

TRAUMA · ORTHOPAEDICS · RECOVERY

Regenerative Care

in Trauma and Orthopaedics

Biology, mechanics and the recovery of function

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Preface

A person comes to an orthopaedic consultation because something important has become difficult: walking without pain, working, caring for family or returning to sport. I begin with that interrupted life. The useful question is what is preventing recovery, and which decision can improve the person's capacity to live it.

My work in complex trauma and foot and ankle surgery continually brings me back to the relationship between biology, mechanics and function. Tissue needs a suitable environment in which to heal. A limb needs stability, alignment and an appropriate pattern of loading. The person needs a plan that connects treatment with movement, confidence and everyday activity. These questions belong together.

Regenerative care is one part of that wider clinical reasoning. Platelet-rich plasma, marrow preparations, cell therapies and shockwave treatment raise worthwhile questions about tissue responses and symptom relief. Corticosteroid, hyaluronic acid and hydrogel injections also enter these discussions, although they have different purposes. The name of a treatment should never settle the clinical decision before the diagnosis, the evidence and the patient's goals have been considered.

I distinguish relief of symptoms from regeneration of tissue. A patient may gain a valuable improvement in function without cartilage or tendon regrowth. A laboratory mechanism, however plausible, does not establish a benefit in a consultation room. The strength of a claim should follow the strength of the evidence, and an uncertain intervention should be explained with the same clarity as an established one.

I have written this book for patients who want an informed discussion and for clinicians who want a practical overview. It follows the path from assessment to treatment, rehabilitation and review. Each chapter asks where an intervention may fit, where its limits matter and what should happen next. Current guidance, primary studies and linked references allow the reader to examine the reasoning.

The purpose is a coherent recovery plan. An injection may help a patient participate in rehabilitation; a mechanical problem may require an orthosis, reconstruction or another operation; some patients need further investigation before either. Clinical judgement lies in recognising the relationship between these choices and keeping the person's function at the centre of care.

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About this edition

Revised illustrated edition, 14 October 2026, based on the first complete edition of 10 October 2026. Sources were originally checked on 10 October; core procedural guidance and selected newer evidence were reviewed again on 14 October. This is a referenced narrative guide. It does not report a new clinical trial or a newly performed systematic review or meta-analysis. The selected references support clinical decision-making and are not a complete catalogue of every publication.

Guidance is presented in its relevant context. NICE recommendations inform UK care. AAOS and American College of Rheumatology guidance provide additional perspectives and sometimes differ. The 2026 ACR osteoarthritis recommendations are cited as an approved guideline summary; the full journal manuscript was pending at the evidence check. NICE procedure guidance is cited using its current HealthTech identifier, with the former IPG identifier where useful.

This book provides education and supports consultation. It is not an individual diagnosis, a prescription or a procedural training manual. A clinician must consider the patient's history, examination, medicines, comorbidities and preferences before recommending treatment. Product instructions, local policies and regulatory requirements should be checked for the specific procedure. Treatments discussed in a book are not automatically available or appropriate at a particular clinic.

The author has a professional interest in regenerative care and private orthopaedic practice. This book is associated with his professional website and may support enquiries about clinical services. Readers should consider that context alongside the evidence and alternatives. No patient testimonials or audited practice success rates are presented in the teaching scenarios. Illustrations are original educational schematics and do not depict an injection technique.

The cover and six pictorial illustrations use original AI-generated artwork prepared for the book. Clinical scenes are illustrative; they do not depict actual patients or demonstrate treatment results. Regional artwork provides general orientation rather than a precise anatomical atlas. The diagrams are explanatory schematics, not anatomical imaging or procedural instructions.

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Enquiries concern assessment and treatment planning. The suitability, availability, governance and cost of any proposed procedure should be confirmed during the clinical pathway. Emergency symptoms should be taken to an urgent clinical service rather than sent through a routine practice enquiry.

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01 Regenerative care in modern orthopaedics

What regenerative care means

People seek orthopaedic care because pain, injury or loss of movement has interrupted something they value. For one person this is a comfortable walk; for another it is employment, caring for family or returning to sport. A useful consultation starts with that interrupted life. It does not start with choosing an injection. The purpose of this book is to explain where treatments described as regenerative may fit within a wider plan, what their names mean and how to judge the promises made about them.

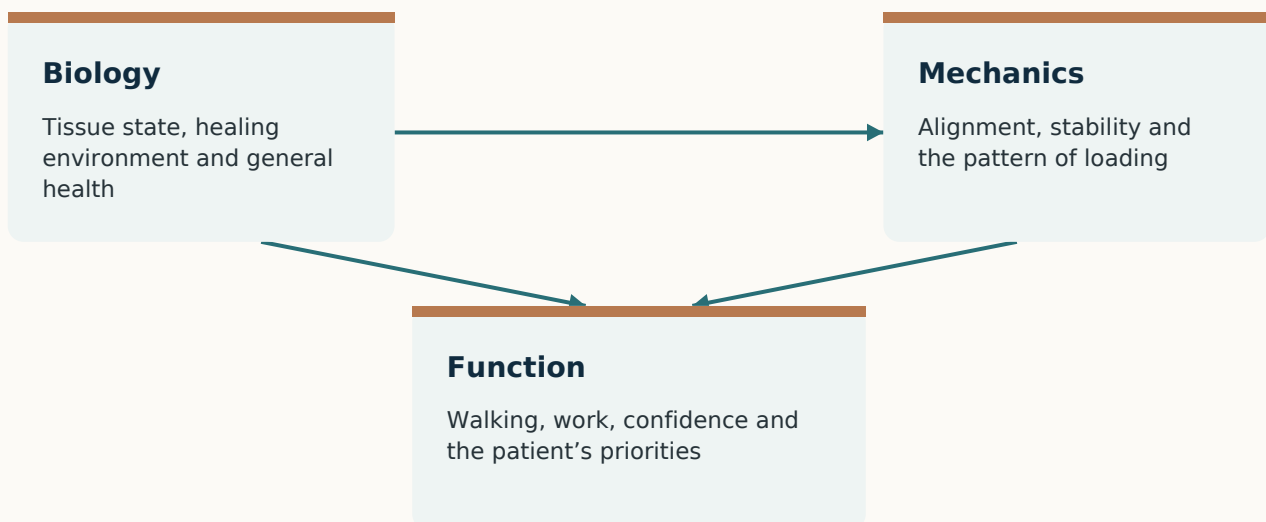


Figure 1 · Biology, mechanics and function belong in the same recovery plan. This is a clinical reasoning framework, not a validated score.

In its strict scientific sense, regeneration means restoring tissue with the structure and function of the original tissue. Repair is broader: a damaged structure may become serviceable through scar formation, remodelling or compensation without becoming identical to its previous state. Symptom treatment may reduce pain while neither repair nor regeneration occurs. These are all legitimate clinical aims, but they must be described accurately. A quieter knee is a valuable outcome; it is not, by itself, evidence that new cartilage has grown.

The phrase regenerative care is often used commercially for a mixed collection of interventions. Platelet-rich plasma, commonly abbreviated to PRP, is prepared from the patient's blood and investigated for effects on tissue signalling and symptoms.

Bone marrow and cell-based interventions involve different products, processing methods and regulatory questions. Extracorporeal shockwave therapy, or ESWT, applies mechanical energy from outside the body. Corticosteroid, hyaluronic acid and injectable hydrogel treatments are discussed alongside these approaches because patients encounter them in the same clinical setting. They should be understood primarily as symptom-directed interventions, not established methods of tissue regeneration.

An orthopaedic pathway with several tools

Orthopaedic practice brings together anatomy, mechanics, biological healing and function. Pain in a foot may arise from a tendon, joint, nerve, stress injury or referred source. A stiff ankle after a complex fracture may involve cartilage damage, deformity, retained implants, scar tissue and altered loading. Calling all of these problems degeneration hides differences that determine treatment. The same injection cannot be expected to solve conditions with different causes.

Education, appropriate activity, rehabilitation and management of relevant health conditions form the foundation of care. For osteoarthritis, NICE recommends therapeutic exercise tailored to the individual and weight management when appropriate. These measures remain relevant when an injection is considered. NICE also advises against intra-articular hyaluronan for osteoarthritis, an important distinction between a commercially available product and a treatment recommended by UK guidance. [1]

Sometimes symptom relief allows a person to participate more comfortably in rehabilitation. Sometimes orthoses, footwear changes or a walking aid reduce a particular mechanical problem. Sometimes a structural condition requires surgery: a displaced fracture, major instability, non-union or severe symptomatic deformity cannot be assumed to improve through an injection. A balanced service keeps these options connected, rather than presenting regenerative treatment as a separate world outside conventional orthopaedics.

The choice also depends on timing. An acute injury may need protection before progressive loading, whereas persistent tendon pain may require a carefully graded loading programme. A person with a rapidly worsening joint or systemic illness needs investigation before elective treatment. Treatment is therefore a pathway with review points, not a fixed staircase in which everyone must purchase successive interventions before reaching a surgical opinion.

Promise, uncertainty and responsible innovation

Biological explanations can be attractive. Platelets contain signalling molecules, cells interact with their environment, and mechanical stimulation can influence tissue behaviour. However, demonstrating an effect in a laboratory does not establish a worthwhile benefit in a person with a painful joint. The product, diagnosis, comparison treatment and outcomes all matter. A treatment that appears helpful for one tendon cannot automatically be advertised as effective for every tendon or joint.

Current NICE guidance on PRP for knee osteoarthritis describes limited-quality efficacy evidence and requires special arrangements for governance, consent and audit or research. This is conditional procedural guidance, not a guarantee of effectiveness or a general recommendation for routine treatment. [2] Cell-based products require particular care with classification and lawful supply; regulatory status depends on the product and its preparation and intended use. The MHRA provides a route for classification advice when a service is uncertain. [3]

Innovation is compatible with caution. A clinician can be interested in an intervention, describe plausible mechanisms and explain why it remains uncertain. What is incompatible with sound care is replacing that uncertainty with an assurance that cartilage, tendons or joints will be renewed. Testimonials and before-and-after stories cannot resolve this question because symptoms can change naturally and because several treatments are commonly used together.

What a patient should expect

A patient should leave the consultation with a clear account of the likely diagnosis, what remains uncertain and how each reasonable option relates to their goals. The clinician should explain the possibility of no meaningful benefit, the risks relevant to that person, the rehabilitation commitment and what will happen if the treatment fails. Choosing to continue conservative care, seek another opinion or decline an elective procedure is a valid outcome.

Improvement should be measured in terms that matter: walking capacity, sleep, confidence on stairs, work participation and a validated measure of pain or function where appropriate. Imaging may answer a specific question, but an impressive image should not replace the patient's experience. The aim of regenerative care in modern orthopaedics is responsible recovery: preserve useful function, support adaptation and offer carefully selected treatment without promising biology that has not been demonstrated.

02 Pain, tissue healing and recovery

Pain and tissue damage are related but different

Pain is the experience that brings most people to a musculoskeletal clinic. It is also a protective signal, a source of distress and sometimes a barrier to movement. It cannot be read directly from an X-ray or measured by counting damaged fibres. The International Association for the Study of Pain recognises pain as a personal sensory and emotional experience influenced by biological, psychological and social factors. Taking those influences seriously respects the reality of pain; it does not suggest that the pain is imagined. [4]



Figure 2 · Tissue responses depend on their environment. Conceptual artwork illustrates signalling within a fibre network; it is not microscopy or evidence of a treatment effect.

Different mechanisms may coexist. Nociceptive pain arises when structures such as a joint capsule or tendon activate protective sensory pathways. Neuropathic pain involves a lesion or disease of the sensory nervous system. In some persistent pain states, altered processing contributes substantially to symptoms, sometimes described as a nociplastic component. These categories help the clinician think, but a label alone does not identify which treatment will help an individual.

The relationship between symptoms and scans is consequently imperfect. A person may have visible osteoarthritis yet manage daily life well; another may experience marked pain with modest structural change. In a joint, pain can originate from synovium, subchondral bone, capsule and surrounding tissues rather than simply from the cartilage surface. A clinician must assess the whole clinical picture before attributing pain to a single finding or proposing that replacing that finding will cure it.

How musculoskeletal tissues recover

After an injury, the body coordinates inflammation, repair and remodelling. These processes overlap rather than following an exact calendar. Early signals recruit cells and organise a response; subsequent tissue formation restores continuity; later remodelling helps the repair adapt to mechanical demands. Recovery can be incomplete, particularly when blood supply, stability, tissue quality or the scale of damage is unfavourable. Repeated loading beyond current capacity can also sustain symptoms without a new major injury.

Bone, tendon, ligament, muscle and cartilage behave differently. Bone can unite after a fracture when biological and mechanical conditions are suitable. A tendon can improve its ability to tolerate load, yet structural changes may persist on ultrasound. A ligament injury may regain serviceable function through healing, muscular control or external support, depending on the injury. Cartilage has limited intrinsic repair capacity. It is misleading to transfer an explanation of fracture healing directly to osteoarthritis or to assume that every tissue can be restored by the same biological stimulus.

Tendinopathy is not always a simple episode of inflammation. Persistent tendon pain may involve changes in matrix organisation, local signalling, sensitivity and how the muscle-tendon unit handles load. The term failed healing is sometimes used, but it can sound as though recovery is impossible. A better explanation for patients is that the tissue's current capacity and the demands placed on it are poorly matched, and that several modifiable influences may affect that relationship.

Mechanical conditions are inseparable from biology. An injection cannot reliably correct a major deformity, stabilise a grossly unstable joint or remove persistent compression of a nerve. Equally, a mechanically sound repair may recover slowly if there are major difficulties with wound healing or general health. In complex trauma, both sides of this relationship must be reviewed before a problem is described as suitable for regenerative treatment.

Why persistent pain needs a wider assessment

Pain can lead to avoidance, loss of fitness, disrupted sleep and anxiety about movement. These changes may reinforce disability even when the original injury has become stable. People also differ in their opportunities for recovery: a physically demanding job, caring responsibilities or lack of access to rehabilitation can influence the outcome. Asking about these factors helps build a practical plan rather than simply documenting a pain score.

NICE recommends a person-centred assessment of chronic pain, including its impact on life and factors that may contribute to it. Chronic primary and secondary pain can coexist, and management should take account of the relevant condition-specific guidance. [5] This is especially useful when a person has a clear orthopaedic diagnosis but the breadth of symptoms exceeds what a local procedure is likely to address.

Diabetes, smoking, nutritional difficulty, vascular disease, inflammatory disease and some medicines may affect risk or recovery. Their significance varies with the condition and treatment. The consultation should identify what can be improved with the patient's wider clinical team. General health advice should remain realistic and respectful; a person's symptoms should not be dismissed because an ideal weight, fitness level or lifestyle has not been achieved.

Recognising progress and danger

Recovery is rarely a smooth line. A manageable fluctuation after unfamiliar activity can occur during rehabilitation, but the patient needs a clear distinction between an expected response and a reason for reassessment. New major weakness, a sudden loss of function, increasing neurological symptoms or pain after fresh trauma can change the diagnosis. Persistent worsening should prompt review rather than an automatic escalation in exercise or another injection.

Sudden severe pain with a swollen joint, fever or feeling unwell requires urgent assessment for possible infection. [6] New calf swelling or pain may require assessment for thrombosis, particularly after reduced mobility or a procedure; associated breathlessness or chest pain needs emergency help. [7] The appropriate response is not to wait for a scheduled review or assume that every deterioration is a treatment flare.

For ordinary progress, the most useful questions are concrete. Can the patient walk farther with less difficulty? Is a previously painful task becoming easier? Is recovery between activity sessions improving? Pain relief, tissue repair and restored capacity are related outcomes, but they are not interchangeable. Understanding these distinctions protects patients from unrealistic promises and helps them recognise worthwhile recovery.

03 Understanding the evidence

The question behind the result

An evidence-based consultation begins with a precise question. For which diagnosis, in which kind of patient, does a particular treatment improve a particular outcome compared with a reasonable alternative? A statement that PRP works or shockwave works is too broad.

Midportion Achilles tendinopathy differs from insertional disease; symptomatic knee osteoarthritis differs from a focal traumatic cartilage defect. Studies should be read in relation to the condition actually being treated.



Figure 3 · Four questions for reading a treatment claim. A plausible mechanism needs a relevant comparison and outcomes that matter to the patient.

The treatment itself also needs definition. Preparations described as PRP may differ in platelet concentration, white-cell content, processing and treatment schedule. Cell-based products are even more diverse. Shockwave equipment and treatment programmes vary. If a publication does not adequately describe what was delivered, its findings may be difficult to reproduce or apply. A shared name does not establish that two clinics are offering equivalent interventions.

The comparison matters just as much. Improvement against no treatment is different from improvement against a credible placebo or an active rehabilitation programme. A study may ask whether an injection adds value to exercise, while another replaces exercise with the injection. These are different decisions. Patients should be told which decision the evidence actually addresses rather than hearing the most favourable result detached from its context.

Reading studies without being misled

A randomised controlled trial allocates participants to groups using a process intended to reduce systematic differences between them. Blinding and a credible comparator can reduce the influence of expectations on reported symptoms. Neither feature makes a trial perfect. Attrition, selective reporting, small samples, short follow-up and changes to the planned analysis can weaken confidence. The methods deserve as much attention as the headline conclusion.

A case series can describe what happened to patients in a service and may identify practical problems or uncommon events. Without a comparison group, however, it cannot reliably separate the treatment effect from natural fluctuation, rehabilitation, other medicines or expectation. A clinician's experience is valuable for careful care, but it does not convert an uncontrolled series into proof of efficacy.

A systematic review identifies and evaluates relevant studies using explicit methods. A meta-analysis may combine their results statistically. Pooling does not remove weaknesses in the original studies. If preparations, diagnoses or comparisons vary substantially, an apparently precise average may describe no particular patient well. A review with a large participant total can still provide uncertain evidence if most trials are biased or clinically inconsistent.

Statistical significance and meaningful improvement are separate questions. A small average difference may be unlikely to occur by chance yet be too small for patients to notice. Confidence intervals describe uncertainty around an estimate, not a personal guarantee. The consultation should translate results into likely effects on pain and function, their probable duration, and how much remains uncertain. Numerical precision should never disguise weak evidence.

Symptom benefit structural change and guidance

Most musculoskeletal trials measure pain or function. These outcomes are important, but they do not prove tissue regeneration. A claim of structural restoration requires suitable structural outcomes, reliable measurement and a design that supports a causal conclusion. Even a change on imaging needs interpretation: it may not translate into better function, and the clinical importance of the finding may be uncertain.

Guidelines consider the body of evidence, its reliability, benefits, harms and sometimes resources. Their conclusions can differ because they ask different questions, use different thresholds or include different studies. NICE procedural guidance for PRP in knee osteoarthritis permits use only with special governance, consent and audit or research arrangements because efficacy evidence is limited in quality. [2] Such guidance should not be described as unrestricted approval of the treatment.

At the time of this edition, the American College of Rheumatology's 2026 osteoarthritis recommendation summary strongly recommends against PRP and stem-cell injections for knee and hip osteoarthritis. Its full supporting manuscript

was pending when the summary was released. [8] Patients should hear that authoritative guidance can be more cautious than commercial advertising and that disagreement requires explanation rather than selective citation of whichever document sounds most supportive.

Absence of convincing benefit is not identical to proof that nobody can improve. It means that the evidence may not justify routine recommendation or confident predictions. Conversely, an uncertain treatment cannot be assumed harmless because benefit is unproven. Effectiveness, safety and lawful supply are separate questions, each requiring adequate scrutiny.

Applying evidence to an individual

Trial participants may differ from a patient in clinic. Age, disease severity, previous surgery, comorbidities and activity demands can affect relevance. A knee study cannot establish an ankle benefit, and results in a narrowly selected sports population may not transfer to a person recovering from complex trauma. When evidence is indirect, that limitation should be made explicit.

Published evidence can guide a discussion but cannot choose the patient's priorities. A person may prefer a modest possibility of temporary symptom relief; another may prefer to avoid an uncertain procedure and focus on rehabilitation. The clinician should give an honest recommendation while preserving the patient's freedom to decline. There should also be a review plan and a threshold for stopping treatment that has not helped.

This book uses evidence to support transparent decisions, not to present a catalogue of guaranteed treatments. Readers should be cautious when a service claims universal success, regrowth without structural evidence or certainty based mainly on testimonials. The most credible account explains who was studied, what was compared, what improved, what did not improve and what remains unknown.

04 Clinical assessment and shared decisions

Establishing the problem

A request for regenerative treatment should trigger a clinical assessment, even when a patient already has an imaging report or a previous diagnosis. The first task is to understand the symptoms and their context. Where is the pain? When did it begin? Was there trauma? What provokes or eases it? Is there swelling, stiffness, instability, locking, numbness or loss of strength? The answers help distinguish a local musculoskeletal problem from a nerve, vascular, inflammatory or systemic condition.



Figure 4 · A consultation connects the patient's priorities with examination and appropriate imaging. Illustrative clinical scene; no actual patient is depicted.

The history should then move from symptoms to their effect. Walking on uneven ground, standing through a shift, climbing stairs or sleeping may be more informative than a single severity score. Previous treatments deserve careful review, including what was actually completed, what helped, what caused difficulty

and whether rehabilitation was feasible. A record that says physiotherapy failed is incomplete if the programme, duration and barriers to participation are unknown.

Relevant medical conditions, medicines, allergies, previous operations and the patient's current clinicians should be documented. In a person with previous complex trauma, operative records and earlier images may clarify the anatomy and sequence of events. The clinician should identify whether the present complaint is new, a progression of an established problem or part of a recovery already being managed elsewhere.

Examination imaging and urgent conditions

Examination tests the working diagnosis. It may include gait, alignment, movement, swelling, local tenderness, tendon function, strength and neurological or circulatory assessment. The adjacent joints matter: hip or spinal disease can produce symptoms perceived elsewhere, and an ankle problem may change knee loading. Findings should be interpreted together, rather than treating one positive manoeuvre as a definitive diagnosis.

Investigation should answer a question that could change management. Weight-bearing radiographs may clarify joint alignment or arthritis; ultrasound can assess selected superficial structures and dynamic movement; MRI or CT can answer more specific soft-tissue or bony questions. Not every patient needs every test. Equally, a scan already obtained should not be ignored when its findings could make an injection inappropriate. The explanation should distinguish a clinically relevant abnormality from an incidental finding.

NICE recognises that typical osteoarthritis can often be diagnosed clinically without routine imaging; atypical features warrant further consideration. [1] A regenerative consultation should therefore avoid two opposite errors: ordering impressive investigations without a useful purpose and treating symptoms without investigating a credible alternative diagnosis.

Potentially serious conditions must be addressed first. An acutely hot, markedly swollen joint with severe pain or systemic illness needs urgent assessment for possible infection. [6] Fresh trauma with inability to use the limb, new neurovascular compromise, a suspected major tendon rupture or progressive neurological loss may also require urgent specialist review. Unexplained persistent swelling, a concerning mass or constitutional symptoms should prompt an appropriate diagnostic pathway. Elective injection is not the next step while a serious cause remains unresolved.

Connecting options to patient priorities

Once the likely diagnosis is established, the consultation should set out reasonable choices. These may include education, supervised rehabilitation, activity modification, a specific support or orthosis, appropriate medication, a procedure, surgery, further investigation or a period of observation. Continuing present care or choosing no intervention should be discussed when reasonable. The choices should not be framed as a competition between a modern injection and outdated conventional treatment.

The patient's priorities help decide which outcomes count. A small increase in walking distance may be valuable to a person with limited mobility, whereas an athlete may need a demanding progression before a return to competition. Recovery time, caring responsibilities, tolerance of risk and confidence in following a rehabilitation plan can all change the preferred option. A clinician should also clarify misconceptions, such as an expectation that a biological injection will straighten a deformed joint.

Shared decision making combines a professional recommendation with the patient's values. NICE recommends recording both the decision and what mattered to the person in reaching it. [9] A useful discussion explains the likely benefit, uncertainty, burdens and relevant harms of each option in language the person can understand. If the evidence is weak, the recommendation may reasonably be to defer the procedure or seek another opinion.

Time and communication support can matter as much as the number of options described. A patient may want a family member present, an interpreter, accessible written information or a second appointment before deciding. An explanation should be checked by inviting the person to describe their understanding, without treating that invitation as a test. Agreement does not establish understanding if the patient has interpreted symptom relief as guaranteed tissue renewal.

Recording a plan and reviewing it

A care plan should identify the diagnosis, present uncertainties, agreed goals, chosen treatment and responsibilities for rehabilitation and follow-up. Baseline measures should relate to the goals: a validated condition-specific questionnaire may sit alongside a practical task such as walking to local shops. The aim is to make change assessable, not to accumulate scores without a purpose.

The patient should know whom to contact, when routine review is expected and which symptoms require earlier help. There should be a clear plan for non-response: reassess the diagnosis, review adherence and barriers, reconsider the evidence, and discuss alternatives. Repetition of an unsuccessful intervention needs a reasoned justification. Good assessment does not end when the treatment decision is made; it creates the framework for judging whether that decision remains appropriate.

05 Corticosteroid injections

Corticosteroid injections have an established place in musculoskeletal care because inflammation can be an important source of pain. They can make an irritable joint or bursa less painful and create an opportunity to restore movement. They belong in a book about regenerative care because patients need to understand the whole range of available treatments. Their purpose is symptom control; they are not a biological method of rebuilding cartilage, tendon or ligament. A sensible consultation explains that distinction before discussing an injection.



Figure 5 · A corticosteroid decision needs a purpose, a risk discussion and a review plan. Relief of symptoms is different from structural repair. [1, 10, 11, 13]

How corticosteroids work

Corticosteroids are medicines related to hormones produced by the adrenal glands. They influence inflammatory signalling and reduce the activity of several pathways that contribute to swelling and pain. Delivering the medicine near the affected structure allows treatment to be directed towards a particular problem, although some medicine can enter the circulation. A local injection is therefore different from a long course of steroid tablets, but it is not entirely free of systemic effects.

The target matters. A joint injection treats the joint space; a bursal injection treats an inflamed fluid-filled sac; an injection around a tendon sheath addresses a different condition again. These are not interchangeable procedures. Pain beside a tendon does not establish that the tendon itself should be injected. In particular, placing corticosteroid within a tendon can damage it. Ultrasound may help identify

relevant anatomy and improve placement, but accurate placement does not make an unsuitable treatment effective.

Some injections also involve local anaesthetic. Immediate numbness from that medicine should be distinguished from the later effect of corticosteroid. A short period of comfort immediately after injection does not prove that the longer-term treatment has worked, and it does not establish that damaged tissue has healed. Patients benefit from knowing which medicines were used and what each was intended to achieve.

When an injection may help

A corticosteroid injection may be considered for a clearly diagnosed painful condition when its likely short-term benefit is worth its risks. Examples include selected episodes of joint inflammation, frozen shoulder, bursitis and certain tendon-sheath disorders. Each has its own evidence and treatment pathway. An injection into a painful joint is not an appropriate way to avoid investigating an unexplained hot, swollen joint, a recent injury or symptoms suggesting infection.

For osteoarthritis, NICE advises considering an intra-articular corticosteroid when other pharmacological treatments are ineffective or unsuitable, or when it can support therapeutic exercise. Patients should be told that relief is short term, usually within a window of approximately two to ten weeks. The recommendation is about managing symptoms, not reversing arthritis. [1]

This makes the intended use of the period of relief important. Someone whose knee pain prevents strengthening exercises may use improved comfort to rebuild confidence and function. Someone with a stiff shoulder may be able to engage more comfortably with a movement programme. The injection and rehabilitation have different jobs. Reducing pain without addressing weakness, loading or occupational demands may leave the underlying difficulty unchanged.

Rapid pain relief can be attractive before an important event or during a difficult flare. That preference is legitimate, but it should be weighed against longer-term considerations. A patient needs a plan for the possibility of no benefit, a brief benefit or recurrence. There is no automatic progression from a steroid injection to PRP, hydrogel or a cell procedure; the next decision depends on the diagnosis and the evidence for that specific option.

Evidence and the problem of repetition

Steroid benefits differ substantially between conditions. A favourable short-term result in frozen shoulder does not establish the same benefit in chronic Achilles tendinopathy. An early improvement also needs to be considered alongside recurrence and later function. In a randomised trial of persistent lateral elbow pain, corticosteroid improved early symptoms but was associated with poorer one-year recovery and more recurrence than placebo injection. This is one reason to resist treating every painful tendon with steroid. [10]

Regular repetition deserves separate scrutiny. A two-year knee osteoarthritis trial compared triamcinolone injections every three months with saline. The steroid group had greater cartilage loss and no significant advantage in pain assessed over the study. This finding argues against an automatic long-term injection schedule. It does not establish that one carefully selected injection causes the same harm, nor does it remove the recognised short-term role of corticosteroid. [11]

Before repeating an injection, the clinician should ask what changed after the previous one. Was the improvement meaningful? Did it last long enough to advance rehabilitation? Were there adverse effects? Is the original diagnosis still convincing? Repeating a procedure because an appointment interval has elapsed is a weaker rationale than repeating it after a documented benefit and a fresh discussion of alternatives.

Risks and individual precautions

Temporary pain or swelling, bruising and flushing may follow a steroid injection. Skin colour change and thinning of the skin or underlying fat can occur, especially at superficial sites. Less common but important risks include infection, allergic reactions and injury to nearby tissues. Tendon weakening or rupture is a particular concern when discussing treatment near tendons. The possible risks should be related to the actual anatomical target rather than delivered as an undifferentiated list. [12]

Diabetes requires a specific plan because blood glucose can rise after injection. EULAR advises discussing this risk and glucose monitoring, particularly over the first to third day. Blood-thinning medicines require an individual bleeding assessment; they are not a reason for patients to stop treatment on their own. Planned joint replacement, previous implants, immunosuppression and recent infection should also be discussed with the treating team. Product instructions and surgical advice may impose additional restrictions. [13]

Medication review should include other steroid exposure, prescribed medicines, non-prescription preparations and relevant allergies. The clinician also needs to know about earlier injections, their location and response. An apparently simple repeat procedure can carry a different risk when the patient's medical situation has changed.

Follow up and a useful result

Aftercare should be written and personalised. It should identify the expected discomfort, activity advice, a contact route and symptoms that require urgent assessment. Increasing pain with a hot swollen joint, fever or feeling generally unwell warrants prompt medical review. New weakness, a sudden loss of function or an unexpected neurological symptom also deserves assessment. An infection cannot reliably be excluded by assuming that a severe reaction is an ordinary injection flare.

Follow-up should measure something the patient values: walking, sleep, dressing, work or an agreed exercise goal. A lower pain score is useful, but it is more informative when accompanied by improved function. If the injection gives no worthwhile benefit, reassessment is more helpful than pursuing repeated injections without a clear reason. Corticosteroid care is most defensible when the diagnosis, short-term goal and subsequent rehabilitation are all explicit.

06 Hyaluronic acid and hydrogel injections

Hyaluronic acid and hydrogel injections are often discussed together because both involve materials placed inside a joint. Their composition, persistence, evidence and precautions can nevertheless be very different. Neither should be described simply as a stem-cell treatment or as a way to regrow cartilage. The relevant questions are whether a particular product improves symptoms for a particular patient, what evidence supports that expectation and what the procedure commits the patient to over time.

Symptom treatment

A defined aim such as short-term pain relief

Biological rationale

A proposed effect on signalling or tissue response

Repair or reconstruction

A structure-specific mechanical or surgical question

Regeneration

Requires evidence that tissue structure and function are restored

Figure 6 · Treatments differ in purpose. Symptom relief, a biological rationale, structural repair and regeneration are distinct claims.

Hyaluronic acid rationale and limitations

Hyaluronic acid is a naturally occurring component of joint fluid and the extracellular environment. It contributes to lubrication and the behaviour of synovial fluid under load. Injectable preparations, often called viscosupplements, vary in molecular characteristics, manufacturing methods and treatment schedules. The intuitive explanation is that they supplement a component of the joint environment. That rationale is biologically plausible, but it does not by itself establish worthwhile clinical benefit.

Patients sometimes interpret lubrication as replacement of the worn joint surface. An injection does not provide a new cartilage layer, correct substantial malalignment or restore a damaged meniscus. A person may report improved

comfort without a demonstrable structural change. Conversely, some patients notice little difference. Discussions should distinguish these possible outcomes and avoid portraying a temporary material in the joint as a mechanical repair.

A named formulation matters because evidence about one preparation may not apply unchanged to another. Different treatment schedules do not become equivalent simply because all contain hyaluronic acid. The consultation should identify the product, its intended indication and its regulatory status. Descriptions such as premium, high strength or advanced do not substitute for comparative evidence.

Why recommendations differ

An influential 2022 review found that the average pain reduction from hyaluronic acid compared with placebo was small and below its threshold for a clinically important difference. It also reported a serious-adverse-event association, although this does not establish that every recorded event was caused by the injection. [14]

In UK osteoarthritis practice, the starting point is clear: NICE recommends against offering intra-articular hyaluronan for osteoarthritis. The American Academy of Orthopaedic Surgeons' 2021 knee guideline also advises against its routine use, while the American College of Rheumatology's 2026 summary conditionally recommends against it in knee, hip and hand osteoarthritis. These recommendations should be visible in patient information, including information for self-paying patients. [1] [15] [8]

International differences reflect the way guideline groups assess small average benefits, study quality, variation between products, safety, cost and patient preferences. A clinician should explain the disagreement without suggesting that unfavourable recommendations arise simply because a health service is reluctant to pay. Private availability does not strengthen efficacy evidence. Equally, a recommendation against routine use is not a judgement about the sincerity of patients who have experienced improvement.

If a clinician considers hyaluronic acid outside the usual recommended pathway, the decision needs a specific rationale and an honest description of uncertainty. Prior experiences, contraindications to alternatives and individual goals can inform the conversation, but they do not prove that the injection will work. The patient should be able to choose continued non-injection care without being told that they are losing an opportunity to preserve cartilage.

Hydrogel is a product-specific decision

Hydrogel is a description of a material containing water within a polymer network, not a single treatment. Some preparations are temporary; others persist. Evidence and instructions for one formulation cannot be applied to all hydrogels or to every joint. A permanent implant requires a different conversation from an injection that is gradually absorbed.

The polyacrylamide hydrogel marketed as Arthrosamid is one example used for symptomatic knee osteoarthritis. Its manufacturer describes it as a permanent, non-degradable implant. This is a device-specific treatment, rather than a biological cell therapy. The product's instructions restrict its use to the knee and identify detailed selection and safety requirements. Its presence should remain part of the patient's medical record for future care. [16]

A randomised study of 239 participants compared this hydrogel with hyaluronic acid and reported non-inferiority for pain at 26 weeks. That design addresses comparison with an active treatment; it does not establish superiority to placebo, exercise or joint replacement. Treatment-related adverse device effects were reported more often with hydrogel than with hyaluronic acid in the trial, although they were described as mild or moderate. [17]

Longer-term findings are encouraging but require careful interpretation. The 2026 extension followed the hydrogel arm of an earlier randomised trial: 91 of 119 original recipients entered extended follow-up and 58 completed five years. The analysis estimated sustained improvement in pain and function, but the extension had no concurrent control group. Fifteen participants withdrew after knee replacement and one after repeat injection, illustrating that further treatment can remain necessary. The manufacturer sponsored the study and participated in design and analysis. These observations support continued investigation of durable symptom relief; they do not establish cartilage regeneration or guarantee five years of benefit for an individual. [18]

Selection, risks and consent

Both the diagnosis and the product determine suitability. Infection, unexplained inflammatory swelling and an uncertain pain source should be addressed before considering an elective joint procedure. Previous injections, arthroscopy, implants, allergies, bleeding risks and future surgical plans all matter. The clinician must check the current instructions for the specific product rather than extrapolating from a different injection.

For Arthrosamid, the manufacturer requires antibiotic prophylaxis before injection and states that corticosteroids, other medicines and biological substances must not be injected alongside it. Its instructions include restrictions concerning infection, severe joint inflammation, other permanent material in the knee and certain recent procedures. The October 2025 instructions also state that safety and effectiveness have not been established in patients with BMI of 35 kg/m² or above. Patients should receive an implant card and tell future surgical or dental teams about the implant so that any need for antibiotic prophylaxis can be assessed. These requirements are specific to this product and do not imply that preventive antibiotics are routinely needed for every musculoskeletal injection. [16]

Hyaluronic acid can cause pain, swelling and sometimes a pronounced inflammatory reaction. Infection remains a serious possibility after any invasive joint procedure. A severe painful swollen joint should therefore be assessed, even when a sterile

inflammatory reaction is suspected. The important distinction cannot be made safely from the label of the injected product alone.

Consent should cover persistence, the limits of long-term evidence, expected follow-up and the practical implications of future surgery. For a permanent material, patients should also understand that the procedure cannot be treated as an easily reversible trial. This does not mean a complication is expected; it means permanence is a material part of the decision.

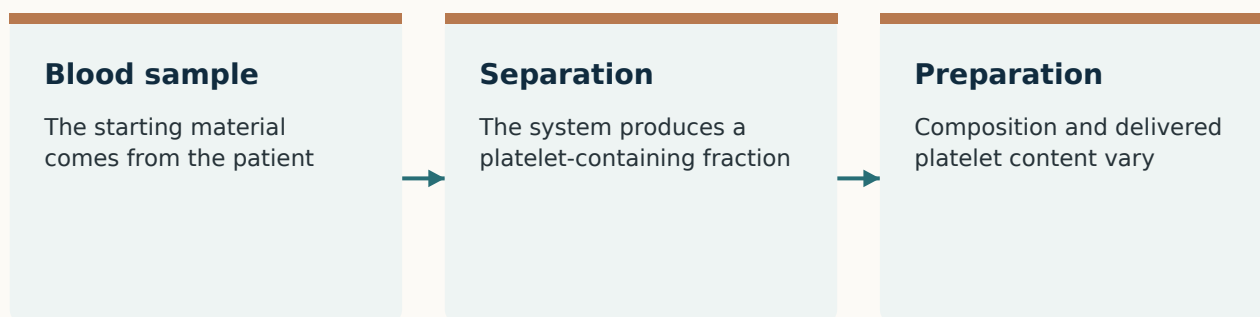
Alternatives and follow up

An injection discussion should begin with what has already been tried and whether it was delivered adequately. Exercise, weight management where relevant, support for daily activities and suitable analgesia remain central to osteoarthritis care. Marked disability despite appropriate treatment may justify discussion of surgery. A hydrogel or hyaluronic acid injection should not be presented as a guaranteed way to postpone or avoid joint replacement.

Baseline pain and function should be recorded alongside a practical goal, such as walking to work or managing stairs. Follow-up should ask whether that goal improved, not merely whether the patient liked the consultation. An ineffective injection calls for reassessment. Repeated purchases without measurable benefit can consume time and money that might be better directed towards rehabilitation, a different diagnosis or surgical assessment.

07 Platelet-rich plasma

Platelet-rich plasma, usually abbreviated to PRP, is made from a sample of the patient's blood. It is among the most widely discussed treatments in regenerative musculoskeletal medicine. The biological rationale is interesting and some clinical studies report benefits, but PRP is not one uniform product and the findings differ by condition. A balanced explanation needs to make room for promising results, important negative trials and recommendations that disagree.



Preparation is a description of a product. It is not proof of benefit or tissue regrowth.

Figure 7 · PRP preparation varies between systems. Simplified product pathway, not a procedural guide. Preparation details matter when interpreting clinical evidence. [2, 20]

What PRP contains and what it may do

Platelets are blood components involved in clotting and in signalling during tissue injury. A processing system separates a blood sample into fractions, allowing a platelet-containing preparation to be collected. Depending on the system and method, the preparation may also contain different amounts of plasma, white cells and red cells. PRP contains signalling molecules; it is not a purified stem-cell product or a replacement for lost cartilage.

Laboratory experiments suggest ways in which platelet-derived signals might affect inflammation and tissue responses. Translating those observations into clinical benefit requires evidence in people. A growth factor can have different effects depending on concentration, surrounding tissues and stage of disease. Providing a mixture of signals does not ensure that they will organise themselves into a new tendon or a healthy joint surface.

Preparation matters. Platelet concentration, total delivered platelet content, white-cell content, handling and the number of injections can differ between studies and clinics. A trial evaluating one method may not establish the performance of another. However, variation should not become an excuse to dismiss every negative study or to claim that a particular commercial kit has overcome uncertainty without a supporting trial. A clinic should be able to describe the preparation it uses and why it is relevant to the diagnosis.

Knee osteoarthritis: an unsettled evidence base

Several studies have reported improved symptoms after PRP for knee osteoarthritis. For example, Patel and colleagues' 2013 placebo-controlled trial in 78 people with bilateral knee osteoarthritis found better symptom outcomes with PRP than saline. It was a smaller study using a different preparation and regimen from later trials. These positive findings belong in the evidence discussion alongside negative results. [19]

Positive placebo-controlled findings continue to appear. A trial published in 2026 enrolled 45 adults with grade 2–3 knee osteoarthritis and compared single-centrifuged PRP, double-centrifuged PRP and saline alongside a common exercise programme. It reported better outcomes in the PRP groups at three and six months, with little consistent difference between preparation methods. Its small sample and short follow-up limit conclusions about durability and tissue regeneration. [77]

The central difficulty is whether improvement exceeds that from a credible comparator and is large enough to matter. People can improve after saline injections, rehabilitation and the supportive context of treatment. A controlled trial helps separate these influences from the specific effect of the preparation.

The RESTORE trial enrolled 288 adults with symptomatic mild-to-moderate radiographic knee osteoarthritis. At twelve months, its PRP regimen did not provide a significant advantage over placebo injection for knee pain or medial tibial cartilage volume. This is an important finding for both symptom and cartilage claims. It does not evaluate every possible PRP formulation, but it prevents a fair account from describing PRP as reliably effective or disease modifying. [20]

Guidance reflects the uncertainty. AAOS's 2021 knee guideline states that PRP may reduce pain and improve function, but grades the recommendation as limited. The ACR's 2026 summary strongly recommends against PRP for knee and hip osteoarthritis. NICE's procedural guidance allows knee PRP only with special arrangements for governance, consent and audit or research because efficacy evidence is limited in quality. These positions cannot be reduced to a single claim that PRP is universally recommended. [15] [8] [2]

In practice, selection should start with the person's symptoms, functional limitation and completed conservative care. Imaging severity may inform the discussion, but no simple age or scan threshold guarantees a response. Advanced mechanical

failure, major deformity or symptoms requiring surgical assessment should not be disguised as problems that an injection will necessarily solve.

Tendons and plantar heel pain

PRP is studied in a range of tendon conditions, but the name of the anatomical structure is not enough to predict effectiveness. Chronic midportion Achilles disease, an acute rupture, insertional Achilles pain and plantar heel pain are different problems. Evidence should be discussed for the exact diagnosis. A favourable result at the elbow cannot be transferred automatically to the Achilles tendon.

In a large randomised trial involving 240 people with chronic midportion Achilles tendinopathy, a single PRP injection did not improve tendon dysfunction at six months compared with a sham procedure. This finding argues against routine PRP promotion for this condition. Rehabilitation remains essential, and an injection should not be presented as a substitute for progressive tendon loading. [21]

For plantar heel pain and for other tendon disorders, some studies report improvement, but differences in diagnosis, comparators, injection preparation and co-interventions complicate interpretation. NICE addresses the plantar fascia separately: its autologous blood and PRP guidance for plantar fasciitis is HTG298, whereas tendon guidance is HTG299. Both require special governance, consent and audit or research because efficacy is uncertain. Procedural guidance is not an endorsement that every patient should be treated. [22] [23]

Comparing PRP with corticosteroid also needs care. Better results than a treatment with short-lived effects do not necessarily establish superiority over well-delivered rehabilitation or placebo. Patients deserve the absolute question: how much extra benefit is reasonably expected from PRP, for this condition, at the time point they care about?

Risks and practical considerations

Using the patient's own blood reduces some concerns associated with donor material, but it does not make the procedure risk free. Blood collection may cause bruising, discomfort or faintness. Processing and injection introduce requirements for reliable identification, appropriate handling and aseptic practice. Local pain, swelling and stiffness may follow treatment; infection, bleeding and injury to nearby structures remain possible.

Relevant blood disorders, active infection, significant illness and medication effects need assessment. Medicines that affect bleeding or platelet function deserve review with the prescribing clinician. Patients should not independently stop aspirin, anticoagulants or essential anti-inflammatory medicines to meet a generic online PRP protocol. The risk of altering necessary treatment may exceed an uncertain gain in PRP activity.

Consent should distinguish hoped-for improvement from established outcomes. It should include non-response, a possible post-procedure flare, the cost of the proposed course and the role of rehabilitation. There should be no suggestion that a more expensive preparation necessarily produces better healing. Nor should a planned series be increased indefinitely because the patient has not responded.

Evaluating the result

A clear starting point makes follow-up more useful. Pain scores, condition-specific questionnaires and a practical activity goal provide complementary information. For a knee, the goal might concern walking or stairs; for a tendon, it might concern returning to a particular load. The patient should know when the response will be reviewed and how rehabilitation will progress.

Symptom improvement should be recorded as symptom improvement. An ultrasound appearance or a change in cartilage measurement is a separate outcome and does not automatically explain the person's recovery. Where uncertainty remains, prospective outcome collection is valuable, but a clinic's before-and-after audit cannot establish causal effectiveness without a comparison group. Good PRP care is defined as much by honest selection and follow-up as by the injection itself.

08 Bone marrow aspirate and cell therapies

Cell-based treatments attract interest because the body contains cells involved in repair. The promise is substantial, but the terminology can obscure major differences between products. Bone marrow aspirate concentrate, mechanically processed adipose tissue, stromal vascular fraction and laboratory-expanded cells are distinct preparations. They should not all be advertised as the same stem-cell injection. Patients need to know exactly what is being collected, processed and delivered, and whether the proposed use has reliable clinical and regulatory support.

Marrow concentrate

A heterogeneous preparation containing many cell types and other components

Manufactured cell product

A separately defined product; processing and intended use affect its regulatory route

Neither label alone establishes a clinical indication, regulatory status or dependable regeneration.

Figure 8 · Marrow concentrate and a manufactured cell product are different categories. The exact product, process and intended use determine the relevant evidence and regulation. [3]

Understanding the preparations

Bone marrow aspirate is collected from marrow-containing bone. Concentrating it produces bone marrow aspirate concentrate, or BMAC, a mixed preparation containing blood and marrow components. A small proportion of its cells may have stromal or progenitor characteristics. BMAC is not a purified population of stem cells, and the number and behaviour of relevant cells vary. Calling it a high-dose stem-cell treatment without appropriate characterisation is misleading.

Adipose-derived preparations involve tissue collected from fat. Mechanical processing, enzymatic isolation of stromal vascular fraction and expansion of cells in a laboratory produce different materials. Donor-derived cells introduce additional

questions about donor screening, manufacturing, immune effects and traceability. A description such as natural or minimally processed does not answer these questions.

The term mesenchymal stromal cell is commonly used in research. Certain cells can display multilineage properties under laboratory conditions, but this does not mean that an injection reliably transforms into organised cartilage inside an arthritic joint. Cells may act through signals, interactions with immune pathways or other effects rather than through permanent replacement of damaged tissue. These proposed mechanisms need to be distinguished from outcomes demonstrated in patients.

Evidence in musculoskeletal disease

Small studies and uncontrolled series sometimes report improved pain after cell procedures. Such findings can justify further research, but they cannot alone establish an advantage over another treatment. Patients who undergo an expensive invasive intervention may simultaneously change activity, receive rehabilitation and experience the natural fluctuation of symptoms. Reliable comparisons are necessary before attributing improvement to the cells.

The multicentre MILES trial randomised 480 people with knee osteoarthritis to study cell-based procedures against corticosteroid injection. The investigated approaches included BMAC, adipose stromal vascular fraction and donor umbilical-cord tissue-derived stromal cells. At one year, none showed superiority over corticosteroid for the primary pain outcomes; MRI osteoarthritis scores did not significantly improve. These findings challenge claims that a more complex cell procedure necessarily provides better results or repairs an arthritic joint. [24]

The ACR's 2026 summary strongly recommends against stem-cell injections for knee and hip osteoarthritis. This recommendation concerns these clinical indications; it should not be confused with the established use of cellular therapies in other branches of medicine. Nor does it determine the future of every cell-based orthopaedic research programme. [8]

Applications during surgery require separate interpretation. A cell-containing material used alongside fixation, bone grafting or a cartilage procedure is not equivalent to a stand-alone injection for general joint pain. Outcome evidence must address the particular indication, accompanying operation and comparator. A biological adjunct does not correct unstable fixation, infection, substantial malalignment or a mechanically failed joint by itself.

Regulation and accountable practice

UK regulation depends on the product, its processing and intended use. Being autologous, prepared on the same day or delivered at the point of care does not automatically exempt a product from regulatory requirements. Substantial manipulation and use for a different essential function are important considerations, but classification requires examination of the actual process and proposed application.

MHRA guidance, updated in September 2026, directs uncertainty about advanced therapy medicinal product classification to its Innovation Office. ATMPs placed on the UK market require marketing authorisation; approved clinical trials and defined routes for unlicensed manufacture have their own requirements. Hospital exemption and the specials route are controlled arrangements, not blanket permission for a private clinic to offer any cell procedure. [3]

A responsible service should be able to explain the applicable regulatory route, manufacturing controls, traceability, clinical governance and arrangements for adverse events. A commercially available collection or processing device does not establish that the resulting treatment is authorised or effective for every proposed use. Equipment status and treatment evidence are separate matters.

Research participation also needs clarity. A registered study should have appropriate approval and a protocol that specifies outcomes and follow-up. Listing a procedure on a trial website does not by itself prove regulatory compliance or therapeutic effectiveness. Patients should understand whether they are receiving established care, an individually justified intervention or an investigational treatment.

Risks burdens and consent

BMAC entails both a collection procedure and a treatment procedure. Pain, bleeding, bruising, infection and injury can occur at the collection site; injection adds its own risks. Adipose harvest introduces further tissue and wound-related burdens. Sedation or anaesthesia, when used, carries additional considerations. The total experience should be explained before the patient agrees, rather than described simply as one joint injection.

Processing creates further risks involving contamination, handling errors and variation in the product. Expanded or donor-derived products require rigorous manufacturing and surveillance. The absence of a serious adverse event in a small study cannot establish rare-event safety or long-term safety. Neither can autologous origin guarantee that an intervention is harmless.

Consent needs to address uncertainty, plausible benefits, alternatives, financial cost and the possibility that later surgery remains necessary. Claims of cartilage regrowth, prevention of joint replacement or permanent repair require direct supporting evidence for the actual treatment. Laboratory images of cells and stories of individual success are not enough. Patients should have time to weigh this information without pressure arising from a claim that delay will forfeit a unique healing opportunity.

Follow up and the place of research

Meaningful follow-up combines symptoms, function, adverse events and relevant structural outcomes. These should be specified before treatment. A person who walks further has gained something important, even if the scan is unchanged; a scan change without a functional benefit needs a different interpretation. Structural observations should not be upgraded into proof that the preparation rebuilt the joint.

For routine care, uncertainty should favour a careful review of established alternatives rather than escalation to more elaborate procedures. Exercise, weight management where appropriate, suitable medicines, orthoses, bracing and surgery each have a place depending on diagnosis. For research, progress requires reproducible products, credible controls, longer follow-up and transparent reporting of negative as well as positive findings. Supporting that work is compatible with declining to promise outcomes that present evidence cannot deliver.

09 Prolotherapy and emerging injections

Prolotherapy and other emerging injections are often promoted through a persuasive idea: stimulate the body's repair response rather than simply suppress symptoms. An appealing idea is a starting hypothesis, however, and patients need to know what has been demonstrated clinically. This chapter separates the rationale for dextrose prolotherapy from the much wider and less established market in peptides, exosomes, ozone and combination products.



Figure 9 · Four questions before considering an emerging injection. Product description, regulatory status and clinical effectiveness are separate matters. [3, 8, 27]

Dextrose prolotherapy the proposal

Dextrose is a form of glucose. Prolotherapy usually refers to injections of a dextrose-containing solution around selected musculoskeletal structures or into a joint. The proposed effect includes changes in local signalling and tissue response. Different concentrations, targets and accompanying procedures have been studied, so the term does not identify one standardised treatment.

Some descriptions imply that a local irritant reliably creates a stronger ligament or restores a worn joint surface. That inference goes beyond what symptom trials establish. A reduction in pain does not prove new mechanically competent collagen, correction of instability or cartilage regeneration. The potential contribution of needling, contextual effects and accompanying rehabilitation also needs consideration.

Perineural dextrose injection and hydrodissection are related topics but should not be treated as interchangeable with ligament or joint prolotherapy. Their targets and proposed mechanisms differ. A trial in a peripheral nerve condition cannot establish effectiveness for chronic knee arthritis. Similarly, a preparation used in research should not be substituted by an improvised mixture because its ingredients seem familiar.

What clinical trials do and do not show

A 2013 randomised trial involving 90 adults with knee osteoarthritis reported greater improvement in symptoms with dextrose prolotherapy than with saline injections or a home exercise programme. A subsequent blinded trial of 76 participants also reported better one-year outcomes with intra-articular dextrose than saline. These studies provide a reason for further investigation; they do not establish universal effectiveness or structural repair. [25] [26]

The size of a trial, its comparator, blinding and the completeness of follow-up matter. An injection compared with minimal advice answers a different question from an injection added to a well-supported rehabilitation programme. Small trials may overestimate effects or miss uncommon harms. Variation in the method makes it difficult to identify a reproducible regimen that can be recommended confidently across settings.

In its 2026 osteoarthritis summary, the ACR conditionally recommends against dextrose prolotherapy for knee and hip disease. Patients should hear that recommendation alongside any favourable trials cited in a consultation. Research interest and a recommendation against routine care can coexist. Describing a treatment as inexpensive also does not establish cost effectiveness, because professional time, repeat visits and unsuccessful treatment contribute to the total cost. [8]

Evidence for tendon, ligament and spinal indications must be assessed separately. A general claim that prolotherapy treats chronic pain is too broad to guide a meaningful decision. The clinician needs a plausible diagnosis, a justified anatomical target and a reason to expect benefit beyond the established alternatives. Unexplained pain, substantial instability or a suspected tear may require further assessment rather than an injection.

Emerging products require greater caution

Exosomes are small extracellular vesicles involved in communication between cells. Their cargo and effects depend on their source and manufacturing. Experimental findings about repair signalling are interesting, but an injectable commercial preparation needs its own evidence about identity, purity, contamination, clinical efficacy and safety. Calling a product cell free does not remove regulatory requirements or make the product inherently safe.

The US Food and Drug Administration has issued warnings about unapproved stem-cell and exosome products and reports of serious adverse events. These

warnings concern US regulation and should not be represented as UK law. They illustrate why an online claim of regenerative activity or a listing on a trial website is not sufficient proof that a product is suitable for clinical use. UK services must establish the relevant UK regulatory position. [27]

Peptide products promoted for tendon or ligament healing raise similar concerns. Animal experiments, early observations and social-media testimonials cannot establish the performance of an injectable medicine in ordinary clinical care. A clinician considering an experimental product should identify its legal status, manufacturing quality and direct evidence for the indication. This book does not provide an injection recipe or recommend purchasing such products online.

Ozone and other chemically active injections also require evidence about the precise route and condition. An intervention near the spine is not comparable to one in a superficial joint, and procedural risk changes with anatomy. The absence of reliable benefit evidence cannot be resolved by combining several unproven products. If a combination has not been properly tested, each additional component can add uncertainty rather than assured synergy.

Selection risks and alternatives

For dextrose prolotherapy, the usual procedural concerns include pain, swelling, bruising, infection and injury to nearby structures. Deep targets and repeated needling introduce additional burdens. Any accompanying anaesthetic or other ingredient has its own contraindications and potential adverse effects. Safety cannot be inferred solely from the everyday use of glucose in food or intravenous care.

The assessment should include previous treatment, medicine use, relevant allergies, infection risk and the patient's ability to undertake rehabilitation. Blood-thinning or other necessary medicines should never be stopped independently to satisfy a protocol. Where the proposed treatment is outside common recommended care, that fact belongs in the consent discussion.

Alternatives should be concrete. For tendon pain, it may mean improving the loading plan and correcting barriers to adherence. For osteoarthritis, it may mean strengthening, weight support where relevant, suitable medicines or a surgical opinion. For true mechanical instability, it may mean bracing or specialist reconstruction assessment. Saying that every conservative treatment has failed is unhelpful unless the actual interventions and their duration are known.

Measuring benefit and resisting escalation

Before treatment, agree what improvement would justify the intervention. The goal may involve walking, work, a sporting activity or use of the hand. Record the starting position and a planned review point. An open-ended course of repeat injections is difficult to justify when there is no documented meaningful response.

Patients who remain in pain may feel that a newer product offers their final opportunity. That situation calls for careful reassessment and support. It should not create pressure to purchase increasingly speculative treatment packages. Failure of a previous injection may reflect the wrong diagnosis, a poorly matched intervention or a need for a different care pathway.

Future trials should evaluate reproducible preparations against credible alternatives and report patient-important outcomes as well as harms. Research can then distinguish promising mechanisms from useful treatments. Until those answers are available, emerging injections are best discussed with precision about uncertainty, rather than grouped under a reassuring label of regeneration.

10 Extracorporeal shockwave therapy

Extracorporeal shockwave therapy, abbreviated to ESWT, applies mechanical pressure waves from outside the body. It does not involve an injected drug or cell preparation. It is used in selected musculoskeletal pathways, particularly for persistent tendon and plantar heel symptoms. The appeal of a non-invasive procedure is understandable, but the evidence varies considerably by condition and method. Patients should understand where ESWT might fit and why it should not be presented as a guaranteed cure.

Focused shockwaves

A distinct physical treatment with a defined focal region

Radial pressure waves

A different physical delivery pattern; often grouped under the same clinic label

Match the diagnosis, device and treatment protocol to the actual evidence. One body region cannot stand in for another.

Figure 10 · Focused shockwaves and radial pressure waves should be distinguished. Physical delivery and diagnosis matter; neither label promises benefit. [28, 29, 30, 31]

The treatment and its proposed effects

Focused shockwave and radial pressure-wave systems generate different physical exposures. They are frequently discussed under the same clinical heading but are not technically identical. Device characteristics, depth, intensity, targeting and treatment schedules differ. Evidence from one method cannot be assumed to validate every device or programme marketed as shockwave treatment.

Proposed effects include changes in pain signalling and cellular responses to mechanical stimulation. Experimental work has examined vascular, inflammatory and tissue-remodelling pathways. These findings provide hypotheses for clinical research. They do not establish that a treated tendon has regenerated or that the

treatment repairs a rupture. A patient can feel better without a proven structural change, and the converse is also possible.

The treatment can be uncomfortable. A clinician should explain what the patient may feel, how tolerance will be monitored and why the chosen method is relevant to the condition. Device settings should be selected by trained professionals within the manufacturer's instructions and the service's clinical pathway. More discomfort or a higher energy setting does not automatically imply a better result.

Achilles tendinopathy distinguish the diagnosis

Midportion and insertional Achilles tendinopathy need separate assessment because the location, loading environment and associated pathology differ. A suspected rupture, substantial tear, infection or alternative cause of pain changes the pathway. ESWT should not be used to bypass that assessment. Examination and selectively chosen imaging can help identify a condition that requires another form of care.

Some trials have reported additional improvement when shockwave or radial pressure-wave treatment is combined with exercise. Other controlled trials have found little or no benefit over sham. A 2026 systematic review of nine randomised trials involving 557 participants found no clinically meaningful overall pain or disability benefit compared with sham treatment for Achilles tendinopathy. Evidence certainty ranged from very low to moderate. This challenges confident claims of routine benefit while leaving the separate questions of diagnosis, treatment protocol and rehabilitation important. [28]

NICE's Achilles guidance reports no major safety concerns but judges efficacy evidence inconsistent and limited. It requires special arrangements for governance, consent and audit or research. The guidance is now labelled HTG426, having previously been IPG571; the transfer of numbering should not be mistaken for a new clinical endorsement. [29]

Progressive rehabilitation remains the foundation of care. A loading programme needs to match the diagnosis, initial tolerance and daily demands. In insertional disease, exercises may need modification to manage compression at the attachment. A patient who cannot manage an exercise programme needs help addressing pain, confidence or practical barriers, not merely an additional passive treatment.

Plantar heel pain and other indications

Persistent plantar heel pain is another common reason for discussing ESWT. Some studies show improvement, but outcomes depend on selection, device and comparison treatment. NICE's guidance for refractory plantar fasciitis reports inconsistent efficacy and requires special governance, consent and audit or research. This is now HTG200, formerly IPG311. It should not be described as a recommendation that shockwave is the best treatment for every painful heel. [30]

The diagnosis deserves attention before an intervention. Plantar heel symptoms may arise from the plantar fascia, but stress injury, nerve problems, fat-pad disease and referred pain can present differently. Morning pain and local tenderness are useful observations, not proof that every case has the same pathology. If the clinical picture is atypical, investigation or a different specialist assessment may be more valuable than escalating treatment.

Other indications have their own guidance. NICE advises that ESWT for calcific shoulder tendinopathy should be used only in research because efficacy evidence is inadequate. A positive result in a heel condition does not override that shoulder recommendation. Equally, low-quality evidence for one tendon does not determine the performance of ESWT in an unrelated condition. [31]

Bone applications and treatment near vulnerable structures require distinct specialist pathways. A device offered for soft-tissue pain should not be assumed suitable for fracture non-union or every deep anatomical target. The clinician must match the indication, device authorisation, training and evidence rather than treating shockwave as a universal regenerative instrument.

Risks screening and consent

Commonly reported effects include treatment discomfort, temporary soreness, skin redness and bruising. Swelling or altered local sensation may occur. Serious harms appear uncommon in the conditions reviewed by NICE, but that observation does not establish safety for every device, exposure or patient group. Screening should follow the current device instructions and the anatomical target.

Relevant considerations include infection, a suspected tumour at the treatment site, significant bleeding risk, pregnancy-related exposure concerns and vulnerable structures in the proposed field. These are reasons for individual assessment, not a universal self-screening checklist. Existing implants, neurological problems and anticoagulant medicines may require additional review. Patients should not discontinue necessary medication without agreement from the prescribing team.

Consent needs to include the possibility of no meaningful improvement, the discomfort and cost of treatment, the intended course and alternatives. A clinician should explain the NICE governance position where applicable and how outcomes will be collected. A prepaid course should not create pressure to continue a procedure that is poorly tolerated or no longer clinically justified.

Rehabilitation and assessment of the result

ESWT should sit within a care plan that specifies activity advice and rehabilitation. Complete prolonged rest may undermine capacity; pushing abruptly through a major flare may also be counterproductive. The appropriate balance depends on the condition and the person's tolerance. Instructions should be individualised and coordinated with the rehabilitation professional.

Follow-up should evaluate change over an agreed period using pain, function and a practical goal. Temporary numbness or an immediate shift in discomfort is not enough to establish a durable response. Tendon function, walking tolerance or return to activity offers a clearer picture. Persistent deterioration, a new injury or a sudden loss of strength warrants reassessment.

An unsuccessful course should trigger a review of diagnosis and treatment priorities. Automatically adding PRP or another injection does not resolve uncertainty, and combinations require their own evidence. Where shockwave is offered under appropriate governance, it should be presented as an optional, uncertain adjunct for a defined condition. The enduring goal is a more capable patient, supported by a coherent plan and an honest account of what the treatment can and cannot establish.

11 Shoulder care

Shoulder care starts with identifying the structure and problem responsible for a person's symptoms. A painful tendon, a stiff joint capsule, arthritis and an acute tendon tear can all make reaching difficult, but they require different decisions. Regenerative care should therefore sit within an orthopaedic pathway that includes diagnosis, rehabilitation, established symptom treatments and surgery when appropriate. An injection should never become the diagnosis simply because it is available. [32]

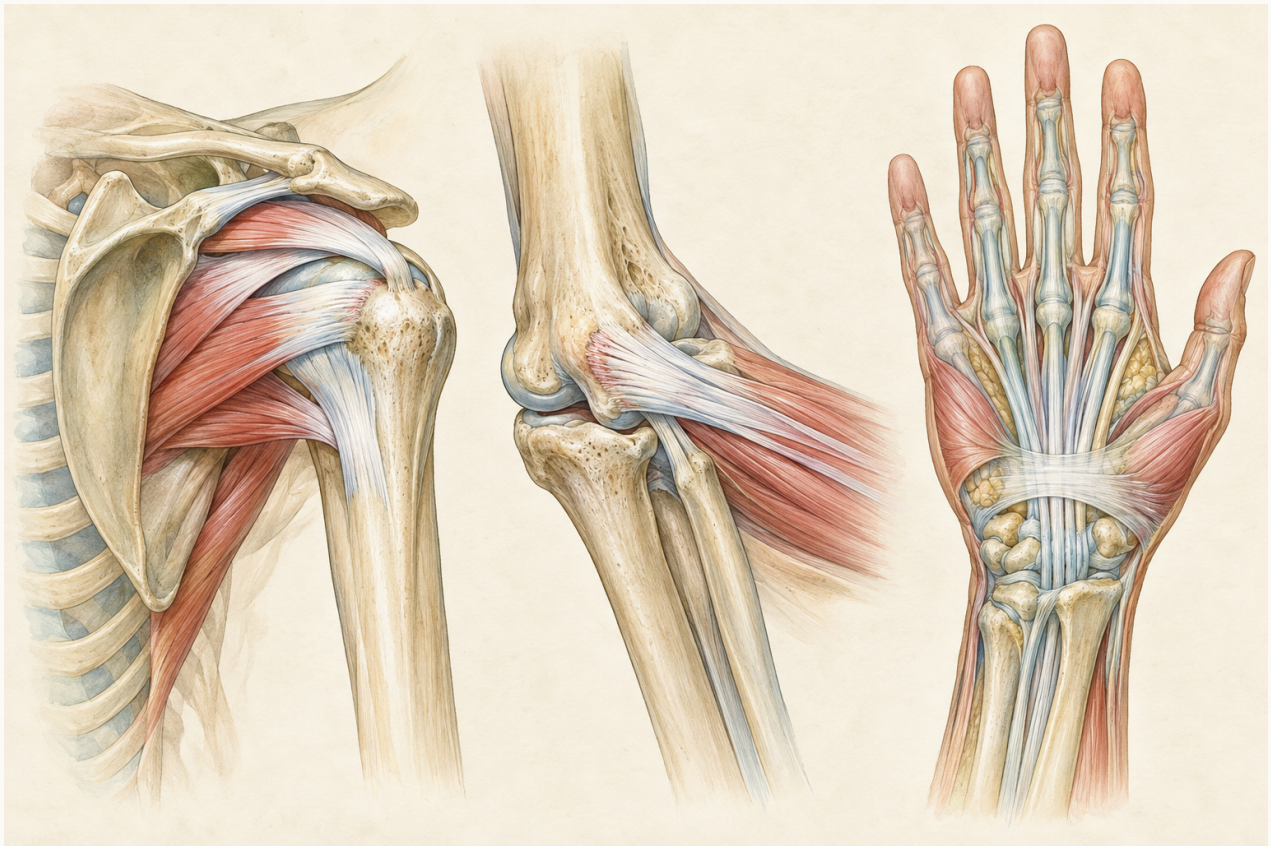


Figure 11 · Artistic overview of the upper limb. Shoulder, elbow and hand presentations require distinct diagnoses and condition-specific treatment evidence; this is not an anatomical or procedural atlas.

Understanding pain weakness and stiffness

The shoulder's ball-and-socket joint depends on the rotator cuff tendons and surrounding muscles for controlled movement. The acromioclavicular joint, at the top of the shoulder, is a separate joint. Pain may arise from either joint, the cuff, the biceps tendon or the tissues around them. Neck problems can also produce symptoms felt around the shoulder. The location of discomfort is useful, but does not establish its cause on its own. [32]

Rotator cuff related pain commonly appears during lifting or overhead activity. Frozen shoulder causes restriction when the patient moves the arm and when the clinician moves it for them. Arthritis can also cause stiffness, while an acute tear may cause new weakness after an injury. Examination therefore compares active and assisted movement, strength, tenderness and neck findings. Ultrasound or MRI may clarify a suspected tear; radiographs are useful when arthritis or a bony injury is suspected. Scans support the clinical assessment rather than replacing it. [33, 34]

An inability to raise the arm after trauma deserves prompt assessment. Severe pain with fever, a hot swollen joint, an obvious deformity or new neurological symptoms also changes the pathway. Such presentations should be assessed before any elective injection is considered. A patient who has undergone previous surgery should bring the operation details and any imaging so that the present problem can be interpreted in context. [32, 33]

Rehabilitation as an active treatment

For many rotator cuff disorders, care begins with education, modification of provoking loads and an exercise programme. The aim is to rebuild useful shoulder capacity: reaching a shelf, dressing, lifting at work or returning to recreation. Temporarily adjusting the weight, height or repetition of a task can make rehabilitation manageable. This is different from avoiding the arm indefinitely. Progress should be planned around the patient's starting ability and response. [33, 35]

The UK GRASP trial is helpful when discussing how much supervised treatment someone needs. In the population studied, a progressive programme delivered over several physiotherapy sessions was not superior over twelve months to a good advice session with a home exercise plan. Both approaches involved rehabilitation. The result does not mean exercise is unnecessary; it supports matching the level of supervision to the person's needs, confidence and ability to carry out the plan. [35]

Patients should know what to practise, how to adjust the programme during a flare and when to request review. A shoulder that becomes progressively weaker, markedly stiffer or differently painful needs reassessment. A written plan is often more useful than a general instruction to "strengthen the shoulder".

Goals should describe activities that matter to the patient so that a change in symptoms can be judged alongside a change in function.

What injections can and cannot do

A corticosteroid injection may be considered for short-term symptom relief in selected rotator cuff presentations, particularly when pain makes rehabilitation difficult. It does not reattach a torn tendon. GRASP found no long-term advantage from subacromial corticosteroid injection over twelve months. The decision should therefore explain the intended purpose, likely limits and alternatives rather than promise durable repair. Repeated injections deserve particular caution when future tendon repair is being considered. [35, 36]

PRP is prepared from the patient's blood, but a plausible biological mechanism does not establish clinical effectiveness. The 2025 AAOS rotator cuff guideline does not support routine PRP for tendinopathy or partial tears, and does not support routine non-operative PRP use for full-thickness tears. These findings should be disclosed clearly. Evidence concerning a product used during surgical repair is a different question and cannot be used to advertise an office injection as an equivalent treatment. [36]

Biological augmentation during surgical repair is a separate question. The 2025 AAOS guideline does not recommend platelet-derived augmentation for improving patient-reported outcomes, but acknowledges limited evidence that liquid PRP used during repair may reduce retear rates. That possible structural benefit should be explained without assuming that it produces better symptoms or that an office injection offers the same result. [36]

Hyaluronic acid, bone marrow concentrate and combinations of biological products should not be presented as established ways to rebuild the shoulder. If an emerging treatment is discussed, the consultation should identify the condition-specific evidence, uncertainty, costs and follow-up arrangements. Ultrasound can help a clinician visualise a target, but accurate placement cannot make an ineffective product effective. Availability and suitability must be confirmed individually. [36, 23]

Frozen shoulder and other specific problems

Frozen shoulder requires a different approach from isolated cuff pain. Education, pain management and appropriately paced movement are central. An intra-articular steroid injection may be discussed, and selected patients are offered hydrodilatation or a surgical intervention. These choices concern pain and capsular restriction; none should be described as restoring cartilage. Forceful exercise that repeatedly provokes substantial pain is not a substitute for a carefully adjusted programme. [34]

UK FROST compared early structured physiotherapy with steroid injection, manipulation under anaesthesia and arthroscopic capsular release. At twelve months, none was clinically superior on the trial's principal comparison, although costs, risks and treatment experiences differed. This supports a discussion of alternatives before progressing to surgery. Persistent symptoms still matter and should trigger review of the diagnosis and the patient's priorities. [37]

Calcific tendinopathy, in which calcium deposits occur within a tendon, is another distinct presentation. Shockwave treatment is sometimes marketed for this condition, but current NICE guidance recommends its use only in research because efficacy evidence is inadequate. A recommendation for another body region should not be transferred to the shoulder. [31]

Safety review and escalation

Before an injection, discuss infection, bleeding, a temporary flare and product-specific risks, together with relevant medicines and medical conditions. Steroid can affect blood glucose and may cause skin or soft-tissue changes. The patient needs written aftercare and a contact route if pain becomes severe or the shoulder becomes hot, swollen or associated with fever. An injection should have a defined review point and an agreed measure of success. [36, 23]

Surgery may be appropriate for selected traumatic tears, persistent disabling cuff disease or advanced arthritis. The decision depends on the diagnosis, tissue quality, function, general health and preferences. Rehabilitation remains important after surgery as well as before it. The practical objective is a better functioning shoulder with a proportionate treatment burden; a promise of regeneration should never delay a needed surgical opinion. [33, 36]

12 Elbow care

Elbow pain can interfere with gripping, lifting and working even when movement remains relatively normal. It is tempting to treat every persistent elbow problem as a damaged tendon needing an injection. A better approach distinguishes tendon overload from arthritis, nerve compression, ligament injury and an inflamed or infected bursa. Treatment then addresses the actual problem and the tasks that maintain it. The label "regenerative" does not remove the need for this diagnostic work. [38, 39]

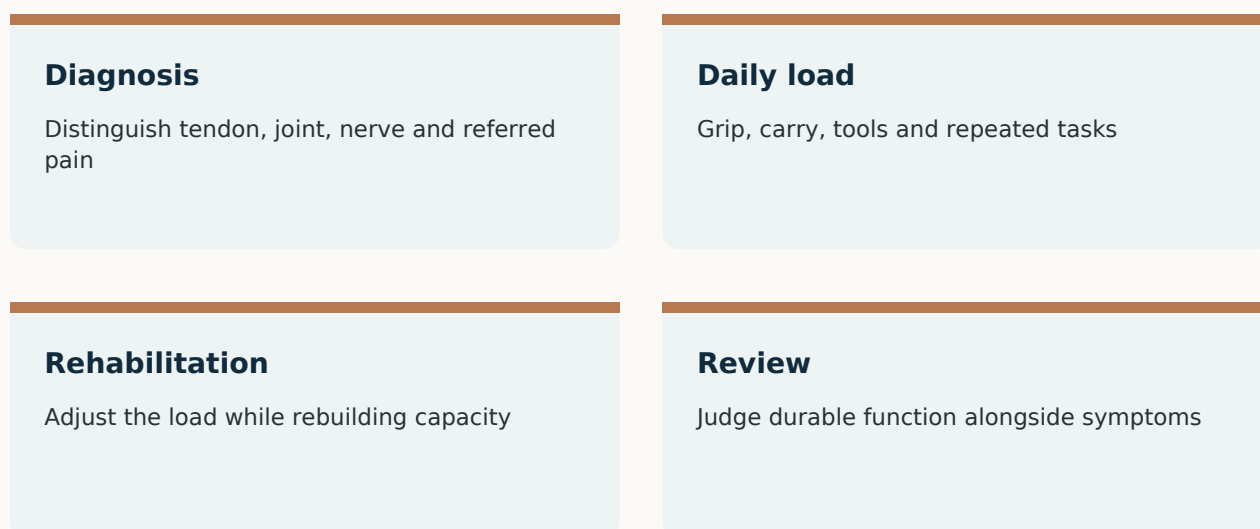


Figure 12 · Elbow care connects the diagnosis with the load placed on the arm and hand. Short-term relief should be reviewed alongside useful and sustained function.

Establishing the diagnosis

Tennis elbow, or lateral epicondylalgia, concerns the tendon attachment on the outer side of the elbow, associated with muscles that extend the wrist and fingers. Golfer's elbow concerns the inner side and the flexor-pronator muscle group. Neither diagnosis requires the patient to play the named sport. Repeated work, recreational loads or a change in activity may be relevant. Tenderness and pain during specific resisted movements help the clinician assess the pattern. [38, 39]

The examination also checks elbow motion, joint swelling, strength, neck symptoms and the nerves supplying the hand. Tingling in the little and ring fingers may suggest ulnar nerve involvement rather than a tendon disorder. A throwing athlete with medial pain may have a ligament problem. Imaging is used selectively: radiographs for a suspected joint or bony disorder, and ultrasound or MRI when the

tendon or ligament findings need clarification. A scan abnormality must fit the symptoms. [39, 40]

An acutely swollen, red and painful elbow, especially with fever, needs assessment for infection or another inflammatory cause. A fall followed by loss of movement or deformity needs assessment for fracture or dislocation. These are not situations for an elective biological injection. A firm diagnosis also helps avoid repeated procedures when the initial label was incorrect. [41]

Changing load without abandoning function

The first practical question is often what the patient has to do every day. Carrying shopping, using tools, typing, lifting a child and racquet sports place different demands on the arm. The plan may adjust gripping force, tool size, wrist position, repetitions or recovery time. An employer or therapist can sometimes help make a temporary modification that preserves participation rather than requiring complete withdrawal from activity. [38, 39]

Rehabilitation commonly includes progressive exercises for the relevant forearm muscles and a planned return to demanding tasks. The starting load needs to be tolerable and progression should be reviewed. A brace may help some patients during selected activities, but it should have a defined purpose and not become a substitute for rebuilding capacity. Medication may be considered for symptoms after reviewing the person's health and other treatments. [38, 39]

Recovery is not judged solely by tenderness over the tendon. Useful measures include whether the patient can carry a kettle, grip a work tool or complete an agreed activity with less difficulty. Recording two or three such tasks at the first appointment makes later decisions clearer. A patient who improves slowly may need a revised rehabilitation plan, while a patient whose symptoms change needs a revised diagnostic assessment.

Corticosteroid PRP and the importance of the comparator

Corticosteroid can produce early relief in tennis elbow, but that short-term response is not the whole story. A placebo-controlled trial found worse longer-term outcomes and more recurrence after steroid injection in chronic lateral epicondylalgia. This makes routine repetition difficult to justify. A patient should not be reassured that another injection is automatically appropriate simply because the first one briefly helped. [10]

PRP studies are often described as favourable because PRP performs better than corticosteroid at a later follow-up. That comparison cannot by itself show that PRP is better than placebo or a sound rehabilitation programme: the steroid comparator may itself have an unfavourable later course. The 2021 Cochrane review found that autologous blood or PRP probably provides little or no clinically important improvement in pain or function compared with placebo for lateral elbow pain. [42]

These findings do not prove that every possible PRP preparation is ineffective in every individual. They do mean that dependable superiority and tendon regeneration have not been established, and routine promotion as a proven treatment is inappropriate. NICE's procedure guidance for autologous blood injections, including PRP, requires special arrangements for governance, consent and audit or research because efficacy is uncertain. Such arrangements are not an endorsement of clinical benefit. [42, 23]

Medial pain ligament injury and emerging procedures

Evidence for lateral elbow pain should not be assumed to apply to golfer's elbow. The nearby ulnar nerve and, in athletes, the ulnar collateral ligament require particular attention. A tendon-focused injection may miss the relevant problem. For a suspected ligament injury, rehabilitation and specialist review should take account of stability, the extent of injury and sporting or occupational demands. Some patients need a surgical discussion. [39, 40]

Biological injections in partial ligament injuries remain a separate, less established question. A small series reporting return to sport cannot show what would have happened with rehabilitation alone. A responsible discussion should avoid promising that PRP can replace reconstruction or prevent surgery. The return decision should be based on recovery of function and stability, not simply the date on which an injection was given. [40, 23]

Dry needling, prolotherapy and other tendon procedures should also be explained by their own evidence rather than grouped together as interchangeable "regeneration". If proposed, the patient should be told whether the procedure is intended to relieve pain, alter a local tissue response or address a defined structural problem. Combining treatments creates an additional evidence question: benefit from either alone does not establish benefit from the combination. [23]

Safety and a planned next decision

All injections involve some risk, including pain, bleeding and infection; the tendon and neighbouring nerves add location-specific considerations. Steroid can also cause local skin or soft-tissue changes. The consultation should review medical history, medicines, allergies, previous injections and any planned surgery. The patient should receive aftercare and a clear route to seek advice for increasing swelling, redness, fever or new nerve symptoms. [23, 39]

A review should ask whether treatment has delivered a worthwhile change in the patient's agreed goals. Repeatedly changing injection products without reassessing load, diagnosis and adherence can prolong an ineffective pathway. Persistent disabling symptoms may justify a specialist opinion about surgical options, but surgery is not required merely because a fixed period has passed. The choice should remain grounded in the problem, the evidence and the patient's needs. [38, 40]

13 Wrist and hand care

The hand contains small joints, tendons and nerves that must work together for precise and powerful tasks. Pain, numbness, weakness and clicking describe different problems. Regenerative care in this region requires particular restraint: small changes in function can matter greatly, and a biological injection cannot be assumed to correct nerve compression or mechanical instability. Clear diagnosis, hand therapy, appropriately selected conventional treatment and timely surgery remain central. [43, 44]

Problem Pain, stiffness, weakness or altered sensation	Structure Small joints, tendons, nerves and prior injury
Treatment Match the intervention to the specific condition	Safety A new neurological or traumatic problem changes the pathway

Figure 13 · The wrist and hand contain different joints, tendons and nerves. A treatment decision should follow the identified clinical problem.

Recognising the pattern and protecting the hand

Carpal tunnel syndrome occurs when the median nerve is compressed at the wrist. Patients may notice tingling or numbness in the thumb, index, middle and part of the ring finger, often troubling them at night. Thumb-base osteoarthritis more often causes pain during pinch and grip. De Quervain's syndrome causes pain around the tendon tunnel on the thumb side of the wrist. Similar locations do not make these conditions interchangeable. [43, 44, 45]

Assessment includes the distribution of altered sensation, strength, tenderness and movement. A history of trauma, inflammatory arthritis or previous surgery may change the investigation. Clinical assessment often establishes carpal tunnel syndrome; selected patients need nerve tests or ultrasound when the diagnosis or severity is uncertain. Persistent numbness, weakness or muscle wasting deserves

timely specialist assessment rather than a succession of injections intended to postpone a decision. [43, 46]

Following a fall, persistent wrist pain may require assessment for a fracture or ligament injury even when the injury initially seemed minor. A cold, pale or poorly perfused hand, new major loss of movement, or a rapidly worsening red swollen area needs urgent assessment. Elective symptom treatment should not begin before a potentially serious injury or infection has been considered. [47]

Carpal tunnel syndrome symptom relief is not decompression

Night splinting and modification of provoking activities may help selected patients with carpal tunnel symptoms. A corticosteroid injection may provide temporary relief, but it does not permanently enlarge the tunnel. The 2024 AAOS guideline states that steroid injection does not provide long-term improvement. Where symptoms are persistent or the nerve is at risk, the discussion should include surgical release rather than present repeated injections as a durable solution. [43, 46]

PRP is sometimes promoted as nerve regeneration. The same AAOS guideline concludes that PRP does not provide long-term benefit in the non-operative treatment of carpal tunnel syndrome. A report of improved symptoms after an injection is insufficient to establish that the nerve has regenerated or that decompression can safely be avoided. A patient considering a biological intervention needs to understand this distinction before paying for it. [46]

Nerve symptoms should be monitored explicitly. Improved pain with continuing numbness is not necessarily an adequate result. The patient and clinician should agree what change would prompt further testing or a surgical referral. This is particularly important when hand function is essential to work, when symptoms are worsening, or when a previous procedure has not resolved the problem. [43]

Thumb base osteoarthritis and practical support

Thumb-base arthritis can make opening containers, turning keys and holding small objects difficult. Treatment should start with the actual tasks the patient wishes to improve. Joint-protection advice, a suitable thumb support and hand therapy may reduce difficulty. An occupational therapist can suggest changes to grips and tools that preserve independence. The purpose is to make daily use more comfortable while retaining useful movement and strength. [44]

Medication and selected steroid injections may be discussed when symptoms remain troublesome, with an explanation that benefit varies and may be temporary. The treatment pathway should progress from measures with relatively low burden to more invasive choices when pain and loss of function justify them. An X-ray helps describe the joint, but the patient's symptoms and activity limitations remain important to the decision. [44, 48]

PRP, hyaluronic acid and marrow-derived products should not be advertised as established thumb-cartilage reconstruction. Small studies do not establish that an injection delays surgery or reverses arthritis. NICE advises against intra-articular hyaluronan for osteoarthritis. If an emerging option is discussed, its evidence should be identified specifically for the thumb rather than borrowed from knee trials. Persistent disabling symptoms may lead to a discussion of appropriate surgical choices. [1, 48]

Tendon tunnel pain and persistent wrist symptoms

De Quervain's syndrome may respond to adjusting provoking activity, a suitable splint or corticosteroid injection; surgery is considered for selected persistent cases. The aim of an injection is to treat the local tendon tunnel problem, not to rebuild the wrist. Discussion should include the possibility of skin colour or soft-tissue changes and the proximity of superficial nerve branches. A different diagnosis should be reconsidered if the expected pattern or response is absent. [45]

Pain on the little-finger side of the wrist, sometimes with clicking or a sense of instability, requires assessment of the joint and stabilising tissues. A ligament or triangular fibrocartilage complex problem is not equivalent to thumb arthritis. Investigation and referral should follow the findings and injury history. Claims that PRP reliably repairs these structures exceed the evidence available for routine practice; an injection should not substitute for assessing stability. [47, 23]

Hand therapy may include tailored supports, movement exercises, graded strengthening and changes to work tasks. The plan should balance protection with the need to retain function. There is no universal post-injection exercise schedule that applies to nerve compression, arthritis and a traumatic wrist injury alike. The written plan should state what the patient can do now and what must be reviewed before progressing. [48, 47]

Safety review and escalation

The hand's confined anatomy makes appropriate expertise and careful assessment especially important. Imaging guidance may be useful for selected targets but does not eliminate infection, bleeding, nerve injury or a treatment flare. Discuss the product, target, alternatives and expected limitations, and give written advice about increasing redness, swelling, fever or new neurological symptoms. Do not ask patients to stop anticoagulants or other essential medicines without an individual medical plan. [23, 46]

Follow-up should assess meaningful activities alongside pain, sensation and strength. A successful plan may be a splint and task adjustment; it may also be surgery when conservative care is insufficient. The measure of good care is preservation and improvement of hand function, with timely treatment of the cause. The availability of a biological product should not determine the pathway.

14 Spine pain

Back pain can be disabling without having a single identifiable structure that needs repair. A safe pathway begins by distinguishing common non-specific pain from sciatica, inflammatory disease, fracture, infection and other important causes. "Disc degeneration" on a scan does not automatically establish the source of symptoms or an indication for an injection. Regenerative products should be judged against a clear diagnosis and meaningful patient outcomes, with particular care because the spine contains vulnerable neurological structures. [49]

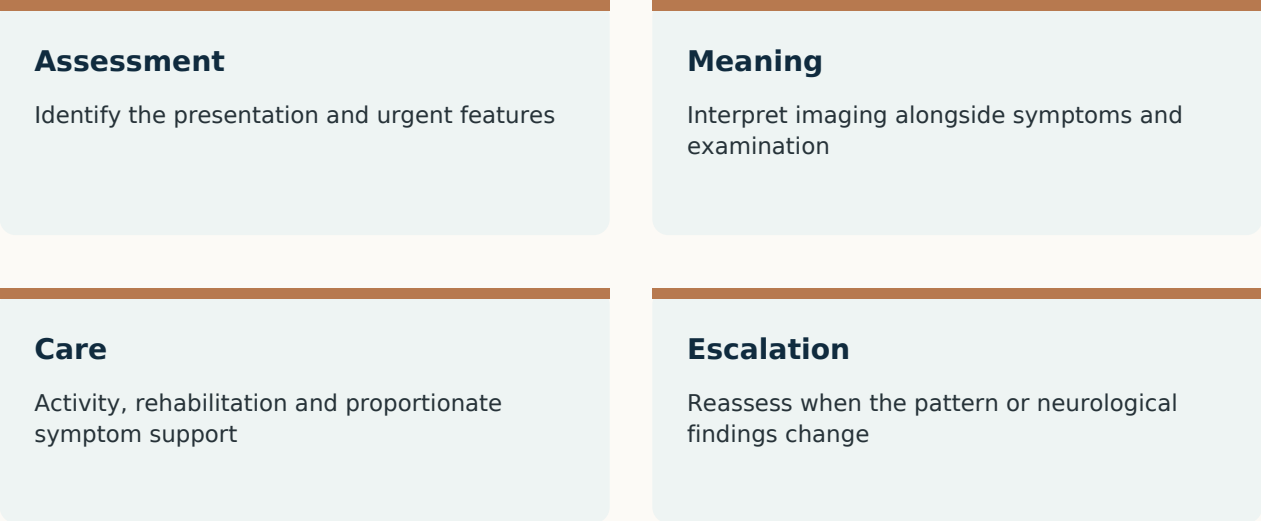


Figure 14 · Back pain care begins with clinical assessment and an appropriate pathway. A scan finding alone does not establish an injection target.

Assessment before treatment

The consultation should establish where pain travels, how it affects walking and sleep, whether symptoms followed an injury, and whether there is weakness or altered sensation. Previous cancer, infection, osteoporosis, immunosuppression and relevant surgery may change the investigation. Examination helps assess neurological function and distinguish symptoms arising from the spine from those arising in the hip or another region. Changes in the pattern deserve fresh assessment rather than automatic continuation of the same treatment. [49]

Sciatica refers to symptoms associated with irritation or compression of a nerve root, often producing pain into the leg. It is different from pain confined to the lower back. This distinction matters because the indications for specialist procedures differ. An injection pathway for acute severe sciatica should not be applied to isolated back pain simply because both occur near the spine. [49, 50]

New bladder or bowel disturbance, numbness around the genitals or anus, or severe or worsening neurological symptoms in both legs may indicate a spinal emergency and require immediate assessment. Fever, systemic illness, significant trauma or a rapidly changing neurological deficit also needs prompt medical attention. Elective biological treatment must not delay this assessment. Written information should make the action required clear rather than list concerning symptoms without explaining what to do. [51, 50]

Making sense of scans and persistent pain

NICE advises against routine imaging in non-specialist settings for low back pain with or without sciatica. Imaging in specialist care is considered when its result is likely to change management. A scan may be essential in the right situation, but ordering one simply to find a target for treatment can create an unhelpful pathway. The clinician should explain why the test is being requested and what decisions its findings may influence. [49]

Terms such as "wear", "bulge" and "degeneration" can sound alarming. They need to be discussed alongside the symptoms, examination and the clinical question. The patient should be able to ask whether an abnormality actually explains the problem and whether treatment would change because of it. A procedure should not be sold on the assumption that a visible change must be reversed before the person can improve.

Persistent pain also affects confidence, sleep, work and participation. A combined physical and psychological programme may be appropriate when there are obstacles to recovery or previous treatment has not helped. Psychological support does not imply that pain is imaginary; it can help patients manage the consequences of real symptoms and regain activity. Goals should include functioning in daily life rather than expecting a scan to become normal. [49]

Rehabilitation and proportionate symptom care

Education, support for self-management and a suitable exercise programme form the foundation of care for many patients. The programme may combine mobility, strengthening and general activity, selected to suit the person's ability and preferences. Work participation can sometimes be maintained with modified duties. Progress is usually easier to assess when the patient has a small number of practical targets rather than a long list of exercises without an agreed purpose. [49, 51]

During a flare, temporary adjustment may be needed, followed by a plan to resume activity. Long periods of bed rest are generally unhelpful for common back pain. Medication decisions require review of expected benefit, side effects, other illnesses and existing medicines; a prescription should have a purpose and a review point. Advice needs to be individual when there are neurological symptoms or a specific structural diagnosis. [51, 50]

Manual treatment, if used, should be part of a package that includes exercise. A patient should understand what they can do between appointments and when the

plan will be reassessed. The same principle applies if a specialist procedure reduces symptoms: improvement creates an opportunity to rebuild function, but does not replace rehabilitation or prove that spinal tissue has regenerated. [49]

Procedures and biological claims

NICE advises against spinal injections for managing low back pain. There are distinct specialist pathways for selected situations: an epidural injection of local anaesthetic and steroid may be considered for acute severe sciatica, and radiofrequency denervation may be considered for appropriately selected chronic localised pain after a positive diagnostic medial branch block. Neither is a general treatment for all back pain, and neither is a regenerative procedure. [49, 52]

PRP injections into discs, facet joints or the sacroiliac region are different interventions and should not be treated as one evidence category. In a placebo-controlled intradiscal trial, PRP did not improve pain or function over control at one year; a serious disc infection occurred in the intervention group. This does not quantify the risk of every spinal procedure, but it demonstrates why a patient's own blood should not be described as risk-free. [53]

A small double-blinded sacroiliac joint trial found greater pain improvement with corticosteroid than PRP at several follow-up points. Together with the wider uncertainty, this does not support a blanket claim that spinal PRP is more durable than conventional care. The result also illustrates why findings for PRP cannot establish that a different marrow-derived or cellular product reconstructs a disc. Each requires its own clinical evidence and specialist scrutiny of the product, indication and governance. [54, 53]

Follow up and specialist escalation

Before any proposed procedure, the patient needs to know its purpose, alternatives, uncertainty and possible complications, including infection, bleeding and neurological injury. They should understand who provides aftercare and how to obtain urgent review if new neurological or systemic symptoms develop. Procedural imaging may help targeting but cannot eliminate these risks or establish that the injected product works. [52, 53]

Specialist referral is appropriate when the diagnosis is uncertain, neurological findings require investigation, or disabling symptoms persist despite a suitable non-operative plan. For sciatica, surgical decompression is considered when non-surgical care has not improved pain or function and imaging matches the symptoms. A professional orthopaedic service should facilitate the right specialist assessment rather than assume that all spinal interventions fall within its treatment offering. The central decision remains which next step is most likely to improve this patient's life. [49]

15 Hip pain

Pain described as "hip pain" may come from the hip joint, the tendons at its outer side, the spine or another structure. Groin pain, lateral tenderness and pain travelling down the leg therefore deserve different assessments. Regenerative care must be condition-specific: evidence for a knee injection cannot be transferred to the hip, and evidence for gluteal tendinopathy cannot establish a treatment for hip arthritis or a labral tear. Diagnosis and rehabilitation remain the starting point. [55, 56]

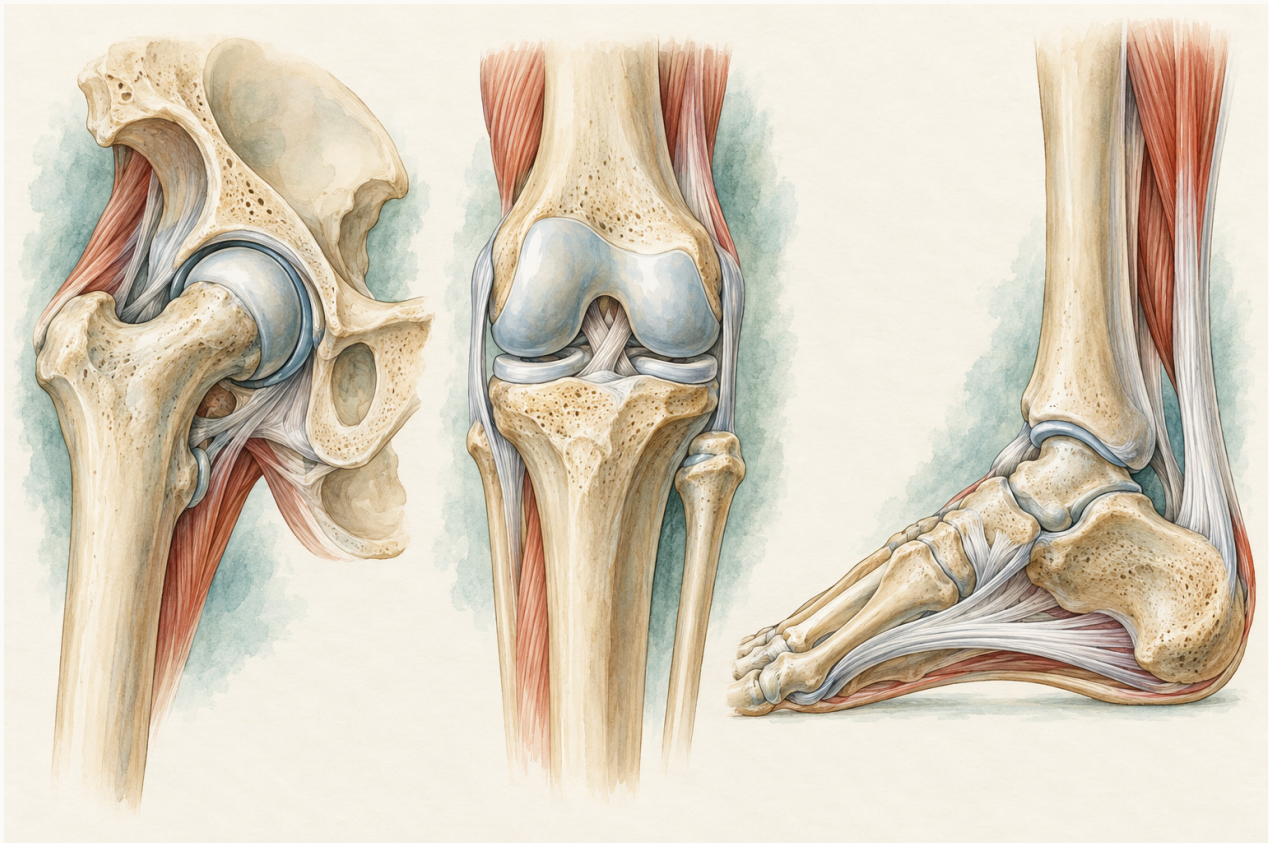


Figure 15 · Artistic overview of lower-limb regions. Hip pain must be distinguished from surrounding tendon, joint and referred symptoms; the artwork is for general orientation.

Distinguishing the joint from the surrounding tissues

The hip is a ball-and-socket joint with an articular cartilage surface and a surrounding rim of tissue called the labrum. Osteoarthritis can cause pain, stiffness and reduced walking tolerance. Femoroacetabular impingement concerns contact associated with the shape of the femoral head-neck region or socket, and may be associated with labral and cartilage problems. A symptom such as clicking does not establish a labral tear on its own. [55, 56]

Assessment considers pain location, movement, strength, walking pattern and relevant spinal findings. Radiographs may help assess arthritis and bony shape. Ultrasound or MRI may be requested for a particular tendon or joint question rather than as routine proof that a biological treatment is needed. Imaging findings should be considered alongside the patient's symptoms and examination; the consultation should explain what information will change the plan. [55, 56]

Sudden inability to bear weight after injury requires assessment for fracture or another significant problem. A severe painful joint with fever or systemic illness needs urgent review. Persistent unexplained symptoms should not be managed indefinitely under a presumed tendinopathy diagnosis. A patient with a hip replacement or previous hip surgery needs a pathway that takes the implant or operation into account. [55]

Osteoarthritis maintaining mobility and independence

Exercise, education and, where appropriate, supported weight management form the basis of hip osteoarthritis care. Strengthening and general activity should suit the person's starting ability. A walking aid may improve confidence and comfort; practical advice can help with stairs, shoes and getting into a car. The goal is improved daily life rather than a promise that damaged cartilage will be restored. [1, 8]

Medication may be considered after checking other illnesses, current medicines and contraindications. A corticosteroid injection can be considered when suitable conventional medication is ineffective or unsuitable, or when short-term relief might support exercise. NICE describes the expected benefit as short-term, generally two to ten weeks. Image guidance is particularly relevant for accessing the deep hip joint, but should be explained as a targeting aid rather than a guarantee of clinical benefit. [1, 57, 8]

Hip symptoms that substantially reduce quality of life despite appropriate non-operative care may justify assessment for joint replacement. Patients should not be required to purchase a sequence of biological injections before having that discussion. Equally, an X-ray alone does not determine when surgery is right: symptoms, function, health and preferences must be considered together. A helpful consultation explains the likely advantages and burdens of each reasonable option. [1, 57]

What biological joint injections establish

Hyaluronic acid is marketed as joint lubrication, but NICE recommends against intra-articular hyaluronan for osteoarthritis. The AAOS hip guideline also recommends against it because it does not improve pain or function better than placebo. A description of what a substance does in a laboratory or in normal joint fluid cannot replace evidence that an injection benefits people with hip arthritis. [1, 57]

PRP research in hip osteoarthritis has produced variable results. Differences in preparation, comparators and patient selection make broad promises inappropriate. The American College of Rheumatology's 2026 recommendation summary strongly recommends against PRP for knee and hip osteoarthritis, with low certainty in the underpinning evidence. The recommendation is relevant to informed consent even when a patient wishes to explore treatment privately. Payment and biological plausibility do not establish effectiveness. [8]

The same summary strongly recommends against stem cell injections for knee and hip osteoarthritis. Marrow concentrate should not be described as a purified stem cell product or as proven cartilage regeneration. A biological procedure has procedural burdens and costs as well as uncertain benefits. If it is proposed, the clinician should explain its exact status and the evidence for the particular product, including what is still unknown. [8]

Lateral hip pain and tendon rehabilitation

Pain over the outer side of the hip may involve the gluteal tendons and surrounding tissues. It is often called greater trochanteric pain syndrome. A tendon-focused programme uses education about provoking loads and progressive exercise rather than treating every presentation as an isolated inflamed bursa. The patient's sleep position, walking demands and prolonged or repeated activities can be discussed as part of a practical plan. [58]

The LEAP trial compared education plus exercise, corticosteroid injection and a wait-and-see approach for gluteal tendinopathy. Education plus exercise performed better than steroid on global improvement at eight and fifty-two weeks. Pain outcomes at one year did not show the same superiority over steroid, which is an important distinction. The trial supports a substantial rehabilitation programme rather than a claim that one injection solves the condition. [58]

An earlier trial found better clinical improvement with PRP than steroid at twelve weeks, but the 2025 HIPPO placebo-controlled trial found no significant PRP advantage for greater trochanteric pain syndrome. These different comparators matter. Neither establishes superiority over a high-quality education and exercise programme, tendon regeneration or guaranteed avoidance of surgery. Patients should hear the positive findings and the negative placebo-controlled evidence together. [59, 60, 58]

Labral problems safety and the next step

For a suspected labral or impingement problem, treatment may include activity adjustment and rehabilitation before selected patients discuss hip preservation surgery. An injection may sometimes contribute to diagnostic or symptom assessment, but it does not remove an impinging bony shape or establish that a labral defect has healed. The clinical question must remain explicit so that temporary pain relief is not confused with correction of the underlying mechanics. [56]

Any proposed injection needs consent for infection, bleeding, a flare and product-specific risks. Steroid-related glucose effects and the timing of a possible future operation should be discussed individually. Written aftercare should explain how to obtain review for worsening pain, fever or a hot swollen joint. Follow-up should measure walking, sleep and agreed daily activities as well as pain. If progress is insufficient, reassess the diagnosis and discuss alternatives instead of automatically adding another product. [57, 23]

16 Knee osteoarthritis

Knee osteoarthritis often leads patients to ask about regenerative treatment. It can affect walking, stairs, sleep, work and confidence. The best consultation acknowledges those difficulties while distinguishing symptom relief from modification of the disease itself. No office injection should be presented as established restoration of the whole arthritic knee. A useful care plan combines education, exercise, symptom treatment and timely consideration of surgery, with decisions based on the patient's priorities. [1]

Source and scope	What it says about PRP
NICE procedural guidance	Special arrangements for governance, consent and audit or research; limited-quality efficacy evidence.
AAOS knee guideline (2021)	Possible improvement in pain and function; recommendation graded limited.
ACR approved summary (2026)	Strongly recommends against PRP for knee and hip osteoarthritis.

Figure 16 · Knee osteoarthritis guidance has different scopes and sometimes different conclusions. Read the full recommendation in its clinical context. [1, 2, 8, 15]

Diagnosis and the limits of imaging

Osteoarthritis affects the joint as a whole, rather than simply representing a quantity of missing cartilage. The history and examination consider pain during activity, stiffness, movement, alignment, swelling and muscle function. In a typical presentation, NICE supports a clinical diagnosis without routine imaging. Atypical symptoms, recent trauma, marked inflammation or an alternative suspected diagnosis may require further investigation. An MRI should not be ordered simply to create an injection target. [1]

Patients may have a degenerative meniscal finding alongside arthritis. A scan description does not automatically mean that the meniscus is the main pain source or needs surgery. NICE advises against arthroscopic lavage or debridement for osteoarthritis. A genuinely locked knee after injury or another specific mechanical problem requires its own assessment and should not be folded into a generic arthritis pathway. [1, 15]

A rapidly swollen hot knee, particularly with fever or systemic illness, needs urgent assessment for infection or another acute cause. Severe symptoms after trauma also require review. Aspirating fluid or performing appropriate investigations may be

necessary before elective treatment is considered. Neither PRP nor steroid should be used to bypass uncertainty about why a joint is acutely swollen. [61]

Exercise and load management as core care

The exercise programme should include useful muscle strengthening and general physical activity, adjusted to the individual's health and ability. The purpose is to improve capacity for tasks such as standing from a chair, walking outdoors and climbing stairs. Some discomfort can occur when exercise begins, and patients need advice on pacing and progression. The plan should be achievable in daily life, with support when pain, fatigue or uncertainty makes adherence difficult. [1, 8]

For people living with overweight or obesity, supported weight management can improve symptoms and function. This should be approached without blame and alongside exercise, nutrition and relevant medical support. A walking aid or selected brace may also be useful when it addresses a specific difficulty. The patient's priorities determine what counts as improvement; completing a longer walk may matter more than a small change in an examination finding. [1, 8]

Appointments should check whether the patient understands the programme, can perform it and has a way to adjust it. A person who has previously "tried physiotherapy" may have received an unsuitable or insufficiently supported plan. Reviewing that experience is more informative than assuming rehabilitation has failed. Before choosing an intervention, record a baseline pain measure and two or three meaningful functional goals.

Medication and corticosteroid injection

NICE recommends a topical non-steroidal anti-inflammatory drug for knee osteoarthritis. Oral medication can be considered where appropriate after assessing gastrointestinal, kidney, cardiovascular and other risks, and reviewing existing medicines. Treatment should use the lowest effective dose for the shortest appropriate period. Medication is intended to support activity and wellbeing; it should not be portrayed as rebuilding cartilage. [1]

A corticosteroid injection can be considered when other pharmacological treatments are ineffective or unsuitable, or when it may help participation in exercise. NICE advises explaining that relief is short-term, generally two to ten weeks. The intended benefit should be explicit: an injection that briefly reduces pain may be useful to a patient with a realistic short-term goal, but it is not a disease cure. [1]

Routine repeated injections warrant caution. A trial of triamcinolone given every three months for two years found greater cartilage loss and no significant pain advantage over saline. That result concerns the studied repeated schedule and should not be presented as proving harm from every individual steroid injection. It does strengthen the case for reviewing response and alternatives rather than placing patients on automatic repeat treatment. [11]

PRP hyaluronic acid and other marketed options

Hyaluronic acid injections should not be offered for osteoarthritis under NICE NG226. This is a treatment recommendation, distinct from whether a product can lawfully be supplied. Private availability does not change the evidence discussion. Claims about lubrication or a "natural" joint substance should not replace an explanation of the guideline and the uncertain value of the proposed procedure. [1]

PRP evidence is conflicting. Some trials report improved symptoms, and the 2021 AAOS knee guideline gives a limited-strength recommendation that PRP may reduce pain and improve function. However, the blinded RESTORE trial found no significant benefit over saline for pain or medial tibial cartilage volume at twelve months in the studied mild-to-moderate knee osteoarthritis population. This is direct evidence against promising cartilage preservation from that regimen. [15, 20]

The 2026 American College of Rheumatology summary strongly recommends against PRP for knee and hip osteoarthritis. Differences between guidelines reflect how evidence and uncertainty are assessed; they do not justify selecting only favourable statements for marketing. A patient should understand that any improvement after PRP may not establish a product-specific effect, that non-response is possible, and that reliable cartilage regeneration or avoidance of joint replacement has not been demonstrated. [8, 20]

Bone marrow concentrate and other cellular treatments require equal care in their description. The ACR summary recommends against stem cell injections for knee and hip osteoarthritis. Injectable hydrogels are a separate technology discussed in Chapter 6; a hydrogel is not a stem cell treatment, and a claim of symptom relief must not become a claim of cartilage restoration. Combining products does not establish a superior or regenerative treatment simply because each has a plausible mechanism. [8]

Review safety and surgical options

Before an injection, review infection risk, medicines, bleeding issues, allergies and relevant medical conditions. Explain a temporary flare, the possibility of non-response and product-specific adverse effects. Patients need instructions for seeking help if a knee becomes increasingly hot, swollen or severely painful, particularly with fever. Planned surgery and recent injections should be discussed with the operating team. [1, 11]

Referral for joint replacement should be considered when symptoms substantially affect quality of life and appropriate non-surgical care is ineffective or unsuitable. NICE advises clinical assessment rather than a rigid numerical score for this decision, and against excluding people from referral solely because of age, sex, smoking, comorbidity or body mass index. Individual operative risk still requires discussion. The patient should receive a balanced pathway, with a clear next decision, rather than an indefinite series of paid injections. [1]

17 Foot and ankle care

Foot and ankle symptoms demand attention to the precise site of pain, walking mechanics, previous injury and the skin, nerves and circulation. Plantar heel pain, Achilles tendinopathy and ankle arthritis have different diagnoses and evidence. Mr Peyman Bakhshayesh's foot and ankle surgery practice provides a context for comprehensive assessment; it does not make every biological procedure suitable or establish that every treatment described here is offered privately. [62]

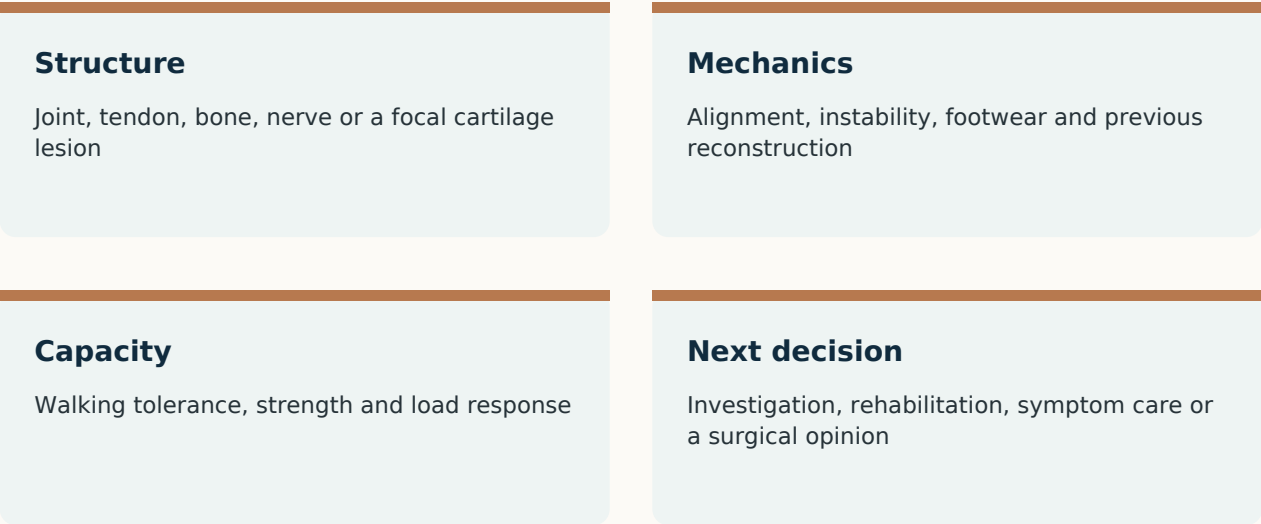


Figure 17 · Foot and ankle care requires a structural and mechanical assessment. Evidence for established ankle arthritis cannot automatically be applied to an isolated osteochondral lesion. [67]

Diagnosis before choosing a technology

Assessment should establish whether pain comes from a joint, tendon, ligament, nerve or bone. It considers footwear, walking demands, previous fractures or surgery, diabetes and relevant inflammatory conditions. Weight-bearing radiographs may help assess alignment and arthritis. Ultrasound, MRI or CT should answer a specific question, such as tendon integrity or a bony problem, rather than simply precede an injection package. [62, 63]

Pain after trauma with inability to bear weight, deformity, a possible tendon rupture or a poorly perfused foot needs prompt assessment. A hot swollen foot or joint, particularly with fever or a wound, requires review before elective injection. Patients with reduced sensation need particular attention because symptoms do not always reflect the severity of tissue damage. [64, 62]

Plantar heel pain

Plantar fasciopathy commonly causes pain under the heel, often prominent with the first steps after rest. Distinguish it from a stress fracture, nerve entrapment, inflammatory disease and other causes. A heel spur on an X-ray is not, by itself, proof of the pain source or a reason for surgery. Examination and the symptom pattern remain important. [65, 63]

Initial care commonly combines education, footwear advice, activity adjustment and exercises addressing the plantar fascia and calf. Supports or selected night splints may be considered. Set goals for standing and walking, then review how the foot responds. An injection should not replace a programme that the patient has not been helped to carry out. [65]

Shockwave therapy has mixed evidence. A 2024 sham-controlled trial found no additional six-month heel-pain benefit from radial shockwave over advice plus customised orthoses. NICE identifies inconsistent efficacy and requires special governance, consent and audit or research arrangements. PRP falls under separate autologous blood guidance, also requiring special arrangements because efficacy evidence is inadequate. These are conditional pathways, not confirmation of a cure. PRP plus shockwave is not an established superior combination. [66, 30, 22]

Corticosteroid may provide temporary relief, but risks including plantar fascia rupture and fat-pad damage require discussion when relevant. Symptom improvement should be followed by a suitable return to load. Persistent symptoms warrant reassessment before further injections or surgery, especially when their location or character changes. [65]

Achilles tendinopathy

Pain in the middle of the Achilles tendon and pain at its heel attachment are distinct presentations. Rehabilitation should recognise that difference. Progressive calf loading, activity adjustment and a planned return to walking, running or sport form the foundation of care. Avoid a generic exercise routine that ignores the symptom site, an associated tear or the response to loading. [64]

The 2021 multicentre JAMA trial found no improvement in tendon dysfunction from a single PRP injection compared with sham in chronic midportion Achilles tendinopathy at six months. This argues against advertising PRP as dependable treatment for that condition or promising tendon regeneration. The population and regimen studied should be stated when explaining the result. [21]

A 2026 systematic review found no clinically meaningful overall pain or disability benefit from shockwave for Achilles tendinopathy, with variable certainty. NICE also describes efficacy as inconsistent and limited, requiring special arrangements. These findings should accompany any discussion of treatment. Shockwave must not displace rehabilitation or be advertised as reliably effective for either tendon subtype. [28, 29]

Steroid injection into the Achilles tendon is generally avoided because of rupture risk. A sudden snap, loss of push-off or suspected rupture needs a separate urgent assessment and treatment pathway. An injection for chronic tendon pain must never become a reason to overlook an acute injury. [64]

Ankle arthritis and structural problems

Ankle arthritis often follows injury, making alignment, previous fixation, stiffness and neighbouring joints important. Non-operative care may include footwear modification, selected supports, physiotherapy and appropriate symptom medication. Steroid may offer short-term relief but cannot reverse the arthritis. Persistent functional loss may justify discussion of joint-preserving surgery, fusion or ankle replacement according to the individual problem. [62, 67]

The AAOS guideline adopted in June 2026 advises against routine intra-articular PRP for symptomatic ankle osteoarthritis, with a moderate-strength recommendation. It strongly recommends against hyaluronic acid alone; it notes possible short-term benefit when hyaluronic acid is combined with corticosteroid, while NICE advises against hyaluronan for osteoarthritis in UK practice. The ankle guideline describes the evidence for intra-articular stem-cell therapy as insufficient and unreliable. These recommendations concern established ankle osteoarthritis and should not be applied automatically to an isolated osteochondral lesion without arthritis. [67, 1] A placebo-controlled trial also found no significant PRP benefit for ankle symptoms and function at twenty-six weeks, with no sustained advantage at later follow-up. [68]

Instability, deformity, a focal cartilage defect and post-traumatic reconstruction are separate questions. A focal lesion is not diffuse ankle arthritis, and a surgical cartilage procedure is not equivalent to a clinic injection. The discussion should identify the structure, realistic alternatives and whether an appropriate specialist referral is needed. A biological injection cannot be assumed to correct instability or a mechanical deformity. [62]

Safety, rehabilitation and the next decision

Before a procedure, assess skin, circulation, sensation, infection risk and medicines as well as the target. Written aftercare should explain permitted activity, rehabilitation and how to seek help for increasing redness, swelling, fever or neurological change. Image guidance helps targeting but does not remove risk or prove efficacy. A suspected infection requires prompt medical review. [22, 29]

Follow-up should review standing tolerance, walking, footwear use and return to meaningful activity. Lack of progress should prompt reassessment of diagnosis, loading and alternatives rather than automatic repetition. A patient considering private care in Huddersfield should receive a clear explanation of suitability, confirmed availability, costs and onward referral arrangements. The objective is better function with justified treatment, without allowing an unproven promise to postpone necessary care.

18 Rehabilitation and return to activity

Rehabilitation is the route back to capacity

Rehabilitation is the process of rebuilding the ability to do meaningful activities. It may involve movement, strength, endurance, balance, confidence and practical adaptation at home or work. An injection or shockwave treatment can be considered within that process for a selected indication, but a procedure does not automatically restore the capacity of a joint, tendon or muscle. A period of reduced pain is useful only if it translates into worthwhile function without inappropriate loading.



Figure 18 · Recovery is expressed in everyday activity. An individual plan should connect symptom management with useful movement and participation. Illustrative artwork, not a treatment result.

The programme should follow the diagnosis. A recently repaired tendon, an arthritic knee and persistent plantar heel pain require different starting points and progressions. After complex trauma, restrictions related to fracture healing, fixation, soft-tissue reconstruction or nerve injury take priority. Generic instructions

downloaded after an injection cannot replace the treating team's plan. The physiotherapist and clinician need enough shared information to understand what is being protected and what can be developed.

For osteoarthritis, tailored therapeutic exercise remains a core treatment in NICE guidance. [1] This principle should not disappear because a patient chooses private care. Practical support can determine whether exercise is achievable: clear demonstrations, written instructions, appropriate supervision and review of barriers may matter more than adding another modality.

Establishing a starting point and progression

A useful starting assessment identifies the patient's present capacity and the tasks they want to regain. Depending on the condition, this may include joint movement, muscle performance, walking tolerance, balance or the ability to complete a daily activity. The therapist should also consider overall fitness and the demands placed on other regions. A person protecting one ankle may have lost conditioning or developed compensatory pain elsewhere.

Progressive loading means increasing demands in a planned way as capacity improves. It does not mean pushing through any level of pain. The acceptable symptom response depends on the diagnosis, stage of recovery and clinical restrictions. Some mild temporary discomfort can accompany appropriate rehabilitation, but increasing swelling, loss of function or persistent deterioration needs review. Patients benefit from a personally agreed rule for adjusting activity and knowing when to contact the team.

Volume, intensity, frequency and task complexity are different ways to change load. Increasing several at once makes it difficult to identify why symptoms worsened. A sensible progression changes demands deliberately and observes the response. For lower-limb problems, a return from level walking to hills, running, jumping and directional change should be staged where those tasks are relevant. For upper-limb problems, repeated reaching, lifting or sustained hand use may require a similar graded approach.

Exercise programmes should be workable. A demanding schedule that cannot fit around employment or caring duties is unlikely to be sustained. A shorter, consistent programme with review may be more useful than an idealised list that the patient rarely completes. When progress stalls, the discussion should examine workload, sleep, equipment, understanding and access to support rather than assuming lack of motivation.

After a procedure and during a flare

Aftercare depends on the intervention and anatomical site. The clinician should provide specific instructions about early activity, wound or injection-site care, medicines and follow-up. Patients should not stop anticoagulants, anti-inflammatory medicines or other prescribed treatments based on generic internet advice. If a change is appropriate, it should be agreed with the clinician responsible for that prescription.

For peripheral joint injections, EULAR advises avoiding overuse during the first day while discouraging immobilisation. [13] That recommendation does not establish one universal timetable for PRP into a tendon, a bone-marrow procedure or a reconstructed limb. Longer restrictions may be necessary for a particular diagnosis or procedure, and the individual plan should explain the reason.

A flare can disrupt confidence. The team should first decide whether the change is compatible with an expected response or needs reassessment. If it is a manageable activity-related fluctuation, a temporary adjustment in load and a gradual return may be appropriate. Repeated cycles of complete rest followed by a sudden return to full activity can make capacity difficult to rebuild. The goal is a sustainable pattern, with modifications that preserve safe movement where possible.

Psychological support may help when fear of reinjury, low mood or persistent pain interferes with recovery. This should complement assessment of physical causes rather than substitute for it. Clear explanations and achievable steps can improve confidence; a promise that the tissue has been regenerated can do the opposite if symptoms recur and the patient concludes that something catastrophic has happened.

Returning to work sport and everyday life

Return decisions should be based on the task and the person's demonstrated ability, alongside tissue-healing and procedural restrictions. Time since treatment is one factor, not the sole criterion. A patient may be ready for desk work yet unable to stand through a long shift or perform repeated heavy lifting. Modified hours, task variation, seated breaks or temporary restrictions can make a return feasible while recovery continues.

Sporting return may require strength, movement control, tolerance of repeated effort and exposure to sport-specific tasks. Competitive deadlines should not replace clinical judgement. A patient whose pain has improved but whose tendon or joint remains poorly prepared for sudden demands still needs a progression. Contact, impact and unpredictable movement can add requirements beyond those tested during ordinary exercise.

Progress should be reviewed against agreed goals and suitable patient-reported measures, with consistent timing where feasible. Success may include better participation despite some residual symptoms. If meaningful progress is absent, the diagnosis, programme and treatment choices should be revisited. Rehabilitation is not a compulsory ritual attached to an injection; it is the part of care that helps convert symptom improvement into a more capable life.

19 Ultrasound equipment and procedural safety

What ultrasound contributes

Ultrasound uses sound waves to produce images of structures beneath the skin. In musculoskeletal practice it can show selected tendons, bursae, fluid collections and joint-related features, and allow assessment during movement. For a procedure, it may help the clinician identify a target and relevant surrounding structures. It does not use ionising radiation. Its usefulness depends on the clinical question, the region being examined and the skill of the operator.



Figure 19 · Illustrative equipment scene. Ultrasound can help visualise a target; the diagnosis, clinical judgement, competence and procedural environment remain essential. The screen is not a diagnostic patient image.

Imaging guidance and treatment efficacy are different issues. A precisely placed injection may still provide little benefit if the diagnosis or treatment choice is unsuitable. Conversely, a well-established procedure may not require ultrasound in every location. The reason for guidance should be explained in terms of anatomy,

accuracy or safety, not presented as a guarantee that the product will work. EULAR notes that imaging guidance may improve accuracy of joint injection. [13]

Ultrasound also has limitations. Some deep structures, bony surfaces and intra-articular problems require other investigations. Image quality can be affected by the patient's anatomy, positioning and equipment. Findings should be considered alongside the history and examination. Where the required structure cannot be assessed confidently, proceeding because a scan has been attempted is not a safe substitute for changing the plan or referring onward.

Competence and a safe clinical environment

The person performing a procedure needs competence in the diagnosis, the imaging method where used, the intervention and the management of complications. Familiarity with a machine does not establish competence for every anatomical site. Training, supervised practice, continuing education and awareness of personal limits support safe care. A clinician should seek help or refer when a case falls beyond those limits. [69]

A suitable environment allows correct patient identification, privacy, comfortable positioning, hand hygiene, clean preparation and safe disposal of sharps and waste. Adequate time is needed to assess the patient, confirm consent, prepare the procedure and discuss aftercare. A busy clinic must not allow the procedure itself to displace those steps. Patients who need support with transfers, communication or anxiety should have this arranged in advance where possible.

Infection prevention covers the whole procedure. Skin preparation, aseptic handling and appropriate preparation of the imaging equipment and field matter. A probe or gel used during an invasive procedure must be managed according to the procedure's requirements and the relevant manufacturer and infection-control guidance. The technical details belong in a local clinical protocol; the patient should be able to expect that a consistent protocol is followed.

Safety checks should confirm the intended patient, side, anatomical site and intervention. They should also review allergies, relevant medicines, current infection concerns and changes since the consultation. If the plan changes on the day, the patient needs an explanation and valid consent for the revised procedure. The possibility of cancelling is part of a safe process when the necessary conditions are not met.

Equipment products and traceability

An ultrasound system, centrifuge, shockwave device or procedure kit should be selected for its intended purpose rather than its marketing appeal. Equipment requires appropriate maintenance, cleaning, safety checks and staff training. The service should understand manufacturer instructions, consumable compatibility and what to do when a device fails. Keeping an attractive machine in the clinic is not evidence that a particular treatment is effective.

NICE recommendations, medicines authorisation, medical-device conformity and provider regulation answer different questions. A device's regulatory status does not establish the clinical effectiveness of every treatment offered with it. Similarly, an approved premises or a clinician's professional registration does not amount to endorsement of all advertised regenerative procedures. Patients should receive a clear account of the status of the actual intervention.

Products prepared from the patient's blood or tissue introduce identity and handling requirements. The service must prevent mix-ups, maintain the integrity of the preparation and document the materials used. Depending on the product and processing, additional regulatory obligations may arise. Services proposing cell-based interventions should obtain appropriate MHRA classification advice when uncertain rather than assuming that a same-day autologous product is automatically outside medicines regulation. [3]

The clinical record should identify the procedure, site, relevant guidance method, products and equipment identifiers required for traceability, and any immediate problem. Lot or batch information may matter if a recall or safety concern occurs. This record connects an individual patient's care to wider product safety; it should be clear enough for another clinician to understand what was delivered.

Preparation for complications and follow up

Even a carefully performed procedure can cause harm. The environment and staff should be prepared for events such as fainting, an allergic reaction, bleeding or an unexpected acute deterioration. There should be a defined route for obtaining additional help or transferring a patient when the service cannot provide the necessary care. The plan should reflect the procedure and patient population, rather than depending on improvisation.

CQC's safe-care requirements include assessment of risk, competent staff, safe equipment and medicines management, and prevention and control of infection. [70] These are service responsibilities. They should be verified for the setting providing care, without assuming that a treatment described in this book is available, authorised or endorsed at a named hospital.

Before leaving, the patient should receive understandable instructions about expected symptoms, restrictions, contact arrangements and warning signs. A procedure is not complete when the equipment is switched off. Safe follow-up, review of problems and a route for reporting device or product concerns help close the loop. Ultrasound and modern equipment can improve aspects of care, but their value depends on thoughtful assessment and a reliable clinical system around them.

20 Patient selection and informed consent

Selection begins with a clinical indication

An appropriate candidate is a person for whom a clearly defined intervention has a reasonable clinical purpose, an acceptable balance of benefit and harm, and a feasible follow-up plan. Eligibility should not be defined simply by willingness to pay or a desire to avoid surgery. The diagnosis, evidence and personal circumstances must support the proposed decision. A treatment may be technically possible yet clinically inappropriate.



Figure 20 · Consent is an informed conversation about the patient's goal, options, trade-offs and clinical plan. A signed form records that discussion rather than replacing it.

The consultation should confirm the likely pain source and whether a local procedure can plausibly address the patient's main difficulty. A person with advanced deformity, major instability or a compressive neurological problem may need a different pathway. Multiple pain mechanisms can coexist, so treatment of one joint or tendon may leave other symptoms unchanged. Explaining this before a procedure is more helpful than attributing an incomplete response to an unexpected failure afterwards.

The previous treatment history should be assessed thoughtfully. Persistent symptoms after a suitable, completed rehabilitation programme differ from symptoms after sporadic exercises that were poorly understood or impossible to fit into daily life. The next step may be a revised programme, a different diagnosis or a

surgical opinion rather than an injection. The term treatment failure should not be used to imply that the patient has exhausted options when the earlier care was incomplete.

Conditions that change or prevent treatment

Current infection, a suspected infected joint or an unresolved serious diagnosis should stop an elective injection pathway. Skin condition at the proposed site, allergies, bleeding risk, immune suppression, diabetes, pregnancy and relevant medicines may influence the decision. The significance depends on the intervention and the individual; a universal list of absolute exclusions can be misleading. Assessment may require liaison with the patient's GP or another specialist.

Anticoagulants and antiplatelet medicines need particular care. The patient should not stop them without an agreed plan because doing so may create a substantial risk unrelated to the injection. EULAR's joint-injection guidance describes a generally low bleeding risk in patients taking antithrombotic treatment unless the individual risk is high; assessment remains necessary. It also advises discussion of transient glucose elevation after intra-articular glucocorticoids with people who have diabetes. [13]

A prosthetic joint, planned surgery, a recent procedure or altered anatomy after reconstruction may require coordination with the responsible surgical team. Products and interventions have their own contraindications and instructions, which must be checked. Clinical selection therefore includes more than a screening form: it requires someone who can interpret the answers and act on them.

Expectations also affect suitability. A patient who believes a procedure will definitely rebuild cartilage needs that misunderstanding resolved before deciding. Persistent uncertainty is not a reason to exclude a person automatically, but the clinician should not proceed on the basis of an expectation the evidence cannot support. Likewise, a promised rapid return to strenuous activity may be incompatible with the required rehabilitation or protective restrictions.

Consent as a continuing conversation

Consent means more than obtaining a signature. The GMC emphasises the exchange of information and the time and support needed for patients to make decisions that are right for them. [71] For regenerative procedures, the discussion should describe what will be done, why it is proposed, the evidence for the indication, the uncertainty and reasonable alternatives. The patient should understand whether the aim is symptom relief, functional improvement or an investigational biological effect.

Risks should be tailored to the procedure and person. These may include temporary pain, bruising, bleeding, infection, an allergic reaction, tissue or nerve injury, and failure to improve. Some interventions have additional concerns, such as a blood draw or donor-site symptoms, steroid-related skin changes or effects on glucose, or

risks associated with an implanted product. A generic statement that injections are safe does not answer the patient's actual decision.

Where reliable frequencies exist, they can help explain risk. When they do not, inventing precise percentages is inappropriate. Common events and rare serious harms both deserve attention when they could influence this patient's choice. The clinician should ask what particularly concerns the patient: even a short interruption of hand function may be especially significant for someone whose livelihood depends on fine manual work.

Uncertainty is itself material information. Limited evidence, inconsistent trial results, possible need for further treatment and the absence of demonstrated structural regrowth should be explained plainly. If a procedure falls under special governance arrangements, those arrangements should be described rather than hidden behind the name of a guideline. Treatment presented as research requires the appropriate approvals and a distinct research-consent process; ordinary clinical consent does not create those approvals.

Supporting and recording the decision

Patients may need accessible information, interpretation, extra time or help communicating preferences. Capacity relates to the particular decision at the particular time; disability or age alone does not establish a lack of capacity. When capacity is in question, the clinician should follow applicable law and professional guidance, support the person's participation and record the assessment and decision appropriately. [71]

The record should capture the patient's goals, the options discussed, relevant risks and uncertainties, questions raised and the agreed plan. Written information can support the conversation but does not prove that the patient understood it. Consent should be revisited if the diagnosis, product, procedure or relevant health circumstances change. The patient remains free to withdraw agreement before an elective intervention.

The outcome may be to proceed, defer, continue rehabilitation, seek another opinion or decline treatment. Each can be a considered decision. Good selection and consent protect the patient from a procedure that does not fit their needs and protect the integrity of regenerative care by making its limitations visible alongside its possibilities.

21 A safe clinical service

Safety is a system around the consultation

A safe regenerative-care service is more than a clinician and a collection of devices. It needs a clear scope of practice, suitable facilities, trained staff, secure records, reliable clinical pathways and arrangements for complications and follow-up. Patients should be able to establish who is providing their care, who has responsibility for decisions and how to obtain help after treatment. A service's identity should be clear even when it operates within another organisation's premises.



Figure 21 · A safe service links the procedure to governance, aftercare and outcome review. This framework supplements the detailed discussion in Chapters 19–21.

The procedures offered should match the clinician's competence and the setting's capability. A service providing outpatient symptom management should not imply that it can manage every complication of complex reconstruction. Referral relationships with physiotherapy, imaging, surgery and other specialties matter because the best outcome may require an option outside the clinic. The ability to recommend a different pathway is a strength of the service, not a failure to provide treatment.

In England, activities and premises must be assessed against applicable CQC registration requirements. A statement that a provider or location is registered should be checked against the actual registration and scope. Professional registration, hospital privileges, product regulation and research approval are separate matters. This book sets out standards of responsible practice; it does not

certify a particular provider, establish registration or imply endorsement by a named hospital or regulator.

Governance protocols and accountability

Clinical governance provides the structure for deciding which procedures may be offered and how they will be reviewed. It should include current evidence assessment, relevant guidance, written eligibility criteria, consent information, product and equipment arrangements, and clear escalation routes. A procedure that requires special governance cannot be treated as ordinary practice simply because several commercial clinics offer it.

Protocols should support judgement rather than substitute for it. They need a review date and an owner, and they should explain when individual circumstances require consultation or referral. New products, changes in preparation or expansion to a different indication should prompt renewed review. An evidence statement written for knee osteoarthritis should not be reused unchanged when a service begins injecting an ankle or tendon.

CQC's good-governance requirements include systems for monitoring and improving quality, risk management, accurate secure records and action on feedback. [72] In practical terms, a service should be able to show that identified problems lead to changes and that those changes are checked. An incident log or audit spreadsheet is not sufficient if nobody reviews it or acts on its findings.

Records should explain the diagnosis, decisions, consent, intervention, aftercare and follow-up. Access should be restricted appropriately while allowing authorised clinicians to obtain information needed for safe care. Communication with the GP and relevant treating teams helps prevent conflicting advice or duplication. Patients should also understand how information is used for care, audit and any separately approved research.

Measuring outcomes honestly

Outcome monitoring should begin before treatment. The service needs a consistent way to record the diagnosis, symptom duration, relevant previous care, intervention and baseline status. Follow-up should assess outcomes at intervals appropriate to the condition and include adverse events and further treatment. Validated patient-reported outcome measures can make comparisons more meaningful; practical goals add information that a questionnaire may miss.

A useful audit distinguishes pain, function and participation from structural outcomes. It also records whether rehabilitation accompanied treatment and whether additional interventions occurred. If a patient improves after an injection and a new exercise programme, the service cannot assign the whole improvement to the injection. Nor can it describe a favourable pain score as evidence of cartilage regeneration.

Missing follow-up needs visibility. Results from the patients who reply may differ from results in those who do not. Reports should give the denominator, follow-up duration and relevant missing data, rather than advertising a success percentage based on a selected group. An audit may help improve a service but usually cannot establish comparative efficacy without a suitable research design.

Case descriptions used publicly require appropriate permission and careful protection of identity. A few striking successes do not represent the range of possible outcomes. Clinical success rates should be reported only from data that were actually collected and analysed. If a service publishes its own results, those results should be clearly labelled, methodologically described and separated from claims derived from controlled studies.

Communication complaints and continuing improvement

Information on a professional homepage should describe services accurately and make the next step clear: assessment and discussion of options. It should distinguish established care, interventions with uncertain evidence and research. Availability should be checked before publication, along with contact details and the setting providing treatment. Broad claims such as guaranteed regeneration, cure without surgery or treatment for every joint should not replace a diagnosis-specific explanation.

Patients need a route for raising concerns that does not depend on knowing which staff member to approach. Complaints may reveal unclear instructions, inaccessible follow-up or problems not captured by a pain score. They should be reviewed alongside incidents, near misses and routine outcomes. Where care has caused harm, the service should respond openly, provide appropriate clinical support and follow applicable candour and reporting duties.

Product or equipment concerns may require reporting through the appropriate manufacturer and regulatory channels as well as local incident systems. Staff should know how to recognise and escalate these concerns. A new safety alert, regulatory change or important trial can require changes to the service before the next scheduled protocol review.

The service should have a defined response when treatment has not helped: a clinical reassessment, discussion of alternative options and a clear decision about further procedures. Patients should not drift into repeated treatment without measurable benefit. Safe regenerative care is accountable care. Its credibility rests on sound diagnosis, honest information, competent delivery, accessible follow-up and willingness to change practice when the evidence or experience demands it.

22 Regenerative care alongside complex trauma and surgery

Restoring a limb requires more than an injection

A limb that has sustained a major injury may have several problems at the same time. Bone alignment and stability, the condition of the soft tissues, blood supply, nerve function, infection and the patient's general health all influence recovery. Pain can arise from any of these structures. It is therefore unsafe to assume that an injection marketed as regenerative addresses the cause of persistent symptoms. A careful reconstruction plan starts by identifying the limiting problem and the treatment that can realistically change it.



Figure 22 · Complex trauma and regenerative care should be connected through biology, mechanics and recovery. Persistent pain after reconstruction may need a structural reassessment.

The place of biological treatment in complex trauma differs from its place in a clinic for uncomplicated tendon pain. Autologous bone grafting, for example, is an established part of selected reconstructive operations. It provides a biological contribution to healing within a surgical plan. That does not establish that an outpatient injection of a cell concentrate can heal an unstable fracture, eradicate infection or substitute for a soft tissue reconstruction. The mechanical environment and the biological environment have to be considered together. [73, 74]

In my approach to regenerative care, the first task is to determine whether the patient needs rehabilitation, an appropriate symptom treatment, specialist investigation or reconstruction. An attractive product should never become the

starting point for that decision. For patients with complex trauma, this also means knowing when to involve colleagues in plastic surgery, infection, vascular surgery, pain medicine and rehabilitation.

Persistent pain after a fracture

Pain after a fracture does not necessarily indicate that the bone has failed to heal. Stiffness, altered gait, muscle weakness, joint damage, sensitivity around a scar and nerve symptoms may persist despite union. Conversely, apparently modest pain can coexist with an important structural problem. Clinical examination and appropriate imaging establish whether union, alignment, the fixation and the neighbouring joints need further attention. A scan must be interpreted alongside symptoms and function rather than used as an isolated explanation for every complaint.

A non-union is not simply a fracture that needs more growth factors. The assessment considers stability, bone loss, the condition of the soft tissues, metabolic and nutritional factors and possible infection. Infection may require a coordinated diagnostic and surgical strategy. Superficial comfort after an injection would not prove that the underlying problem had resolved. Persistent drainage, wound breakdown, new swelling or systemic illness needs a prompt clinical assessment, not a further elective injection. [75, 73]

Patients should bring previous operation reports, imaging and a record of antibiotic treatment where available. Their priorities also matter: safe walking, returning to work, reliable wound healing and avoiding further deterioration may be more relevant than a promise of an early return to sport. Treatment planning should explain the expected stages of recovery and the reasons for any restrictions.

Post traumatic arthritis and tendon symptoms

An injury involving a joint may damage cartilage and change its loading. Malalignment or instability can add to this burden. A treatment that reduces pain does not correct malalignment, restore missing cartilage or stabilise a deficient ligament. Footwear, orthotic support, rehabilitation and activity adaptation may help selected patients, while others need a surgical discussion. The decision depends on the joint, the deformity, the extent of symptoms and the individual's priorities.

Knee evidence cannot automatically be applied to an ankle that has sustained a pilon fracture. Ankle osteoarthritis has its own anatomy, loading environment and treatment evidence. The 2026 AAOS ankle guidance argues against intra-articular PRP and hyaluronic acid alone for symptomatic ankle osteoarthritis. A patient should understand those limits before paying for a treatment described as an alternative to reconstruction. The purpose of a consultation is to weigh appropriate options, including surgery when indicated, rather than postpone a necessary decision through repeated uncertain treatments. [67]

Tendon symptoms following injury or immobilisation may be related to loss of strength, altered loading or a separate tendon disorder. A loading programme

should be adapted to the state of fracture healing and the surgical restrictions. A generic online tendon exercise plan may be unsuitable during a protected phase of recovery. A physiotherapist and the treating surgical team should agree how to advance activity.

Timing and coordination

An injection near the time of planned surgery requires a specific discussion with the operating team. The product, anatomical site, recent procedures, possible infection and the nature of the planned operation matter. Patients should tell the surgeon about every recent injection, including treatment undertaken elsewhere. A general interval printed in a book cannot account for all procedures or individual risks. Current local and specialty guidance should determine the plan.

Symptom relief should not be used as permission to ignore weight-bearing restrictions or return to heavy work before a reconstruction is ready. Analgesia can change the warning signal without changing the load that a healing structure can tolerate. Before treatment, the clinician should agree what activities remain restricted, when they will be reviewed and which symptoms require contact.

For complex trauma, an outcome measure should record more than a pain score. Walking aids, wound status, union where relevant, footwear tolerance, work capacity and independence can all be meaningful. The patient and clinician should decide which outcomes matter at the outset. If improvement is absent or temporary, the next step is reassessment rather than an automatic repeat procedure.

Keeping reconstruction and regenerative care connected

There is a useful place for thoughtful non-operative care before and after surgery. It may help a patient participate in rehabilitation, regain confidence and maintain activity while the structural treatment plan is developed. Its value should be judged by the contribution it makes to that plan. It should not be sold as a way to bypass diagnosis, a multidisciplinary opinion or a necessary operation.

A regenerative care service should therefore have a clear referral route for complex problems. The clinician must be able to explain where the limits of the service lie. Choosing a reconstructive assessment, a rehabilitation programme or no injection can be the most appropriate result of a regenerative consultation. This is consistent with the aim of orthopaedic care: a safer, more useful limb and a treatment plan that the patient understands.

23 Learning from clinical decisions

How to read the examples

The examples in this chapter are hypothetical teaching scenarios. They are not patient records, testimonials or reports of outcomes from my practice. They illustrate the reasoning behind a decision, including a decision not to inject. No numerical improvement or success rate is implied. Real care requires examination, an individual history, relevant investigations and informed consent.



Figure 23 · Use the teaching examples to examine the clinical decision. They are hypothetical situations, not patient records or reports of treatment outcomes.

A case story can make a treatment sound persuasive, especially when it ends with a dramatic recovery. Such a story cannot separate the effect of the procedure from rehabilitation, natural recovery, expectation or other treatment. An instructive example should therefore show why an option was considered and how uncertainty would be managed. It should not stand in for a controlled clinical trial.

A runner with persistent Achilles pain

A recreational runner has several months of midportion Achilles pain. They have tried rest and a collection of stretches but have not followed a structured progressive loading programme. They ask for PRP after reading that growth factors repair tendons. The first clinical task is to confirm the diagnosis, distinguish midportion from insertional symptoms and exclude a rupture or another source of pain.

The initial plan would usually centre on an appropriate loading programme, activity adjustment and clear milestones. Before calling rehabilitation unsuccessful, the clinician would ask what exercises were undertaken, how consistently, at what load and for how long. A sequence of unrelated treatments does not necessarily amount to a completed rehabilitation programme.

PRP should not be presented as the missing step that guarantees tendon repair. A major placebo-controlled trial did not show a benefit for chronic midportion Achilles tendinopathy. If shockwave therapy is discussed after rehabilitation, the patient should understand the mixed evidence, discomfort and financial cost, as well as the governance arrangements that apply. The review would assess function and loading tolerance, not simply whether the patient felt a brief reduction in pain. [21]

If there were a sudden loss of push-off strength, an acute change in symptoms or an abnormal examination, the question would change from an elective injection to an assessment for a structural injury. The treatment plan follows the diagnosis rather than the patient's initial request for a product.

A patient with knee osteoarthritis and limited walking

A patient with symptomatic knee osteoarthritis wants to walk more comfortably and remain independent. They have heard that PRP or stem cells can regrow cartilage. The consultation should first establish how pain and stiffness affect daily life, what exercise and other treatments have been tried and whether another diagnosis is contributing. The discussion should explain that improvement in symptoms and restoration of cartilage are different outcomes.

An individual exercise plan, weight management when appropriate and symptom treatment form the foundation of care. A corticosteroid injection might be considered for short-term relief when otherwise indicated, with a plan to use that period to support activity. PRP is uncertain: some studies report symptomatic improvement, but the RESTORE trial found no significant advantage over saline for its primary pain and cartilage outcomes. Cell-based injections have not established routine disease modification. [1] [20]

The patient should hear about treatment alternatives, possible lack of benefit and the total cost before making a decision. Paying for an injection does not make it more likely to work. If quality of life remains substantially affected despite appropriate non-operative care, a surgical assessment may be more useful than repeatedly purchasing uncertain procedures.

The review would return to the patient's original goal. Can they walk to the shops, manage stairs and sleep more comfortably? A lower pain score accompanied by less activity would need interpretation. A treatment should be assessed within the whole care plan and not by a favourable number alone.

A worker with plantar heel pain

A worker spends long periods on their feet and develops persistent plantar heel pain. They request PRP and shockwave together because they assume two treatments will be better than one. Assessment needs to consider the site and pattern of pain, neurological symptoms, possible stress injury and the effect of footwear and work demands.

A diagnosis of plantar fasciopathy would support education, appropriate exercise and load management, with other measures selected individually. The clinician would agree how work can be adjusted without unnecessary inactivity. If symptoms persist, a discussion of an additional procedure should explain the uncertain benefit and how it would be evaluated. Combining procedures can increase cost and make it harder to identify which treatment helped. It should not be described as a proven superior package without suitable comparative evidence. [30] [22]

The patient needs practical aftercare, a review plan and a contact route for worsening symptoms. It is reasonable to choose one defined change in management and reassess rather than agree to an open-ended series of procedures. A decision to continue rehabilitation is an active treatment choice, not evidence that the patient has been denied care.

A patient with pain after a complex ankle fracture

A patient has persistent ankle pain following fixation of a complex fracture. They are offered a cartilage-restoring injection elsewhere. Before considering any injection, the treating clinician needs to assess union, alignment, the soft tissues, infection risk and joint damage. An unresolved structural or infective problem would take priority.

If post traumatic arthritis is the main diagnosis, the available options should be discussed in the context of the individual's alignment, mobility and goals. The 2026 ankle guideline provides a reason to be particularly cautious about PRP and hyaluronic acid claims in this joint. There may be a role for rehabilitation and support, but severe symptoms may justify a reconstructive opinion. [67]

The useful lesson is that a treatment label does not settle a clinical decision. The best consultation explains why a procedure is appropriate, uncertain or unsuitable, and what will happen next. A patient should leave with a clearer plan even when the outcome is a decision against an injection.

24 The future of regenerative orthopaedics

What meaningful progress would look like

Progress in regenerative orthopaedics should be measured by better lives and more reliable decisions. A treatment would make an important contribution if it improved a meaningful outcome with an acceptable burden and risk, and if the result could be reproduced in the patients for whom it was intended. The word regenerative should eventually describe a demonstrated effect, rather than an ambition attached to a product.

Better questions

Which patient and which clinical problem?

Defined products

Which preparation and reproducible process?

Useful trials

Credible comparisons, patient outcomes and follow-up

Accountability

Transparent reporting and responsible clinical governance

Figure 24 · Progress depends on better questions, defined products, useful comparisons and accountable practice. A new mechanism needs a meaningful clinical result.

For many conditions, the difficult questions remain clinical. Which patients are most likely to benefit? How large is the benefit beyond placebo and good rehabilitation? How long does it last? Does treatment reduce the need for further procedures, and is that a benefit rather than an inappropriate delay? What adverse effects emerge over several years? A persuasive biological mechanism cannot answer these questions on its own.

Research into cells, scaffolds, growth factors and the tissue environment can provide valuable insights. Translation into clinical care requires a reproducible product, a defined indication, appropriate regulation and comparative evidence. The pathway is not completed merely because a substance can be harvested from the

patient's own body or because a laboratory experiment shows a promising response. [3]

Better definitions of products and patients

The term PRP covers products that differ in platelet concentration, white cell content, volume, handling and other characteristics. The term cell therapy is broader still. Studies need to report what was delivered, how it was prepared and what co-interventions were used. Otherwise, two reports using the same treatment name may describe different interventions. A positive result for one formulation does not justify every product sold under the label.

The same precision is needed for diagnoses. Midportion and insertional Achilles tendinopathy are different clinical problems. An osteochondral lesion is not interchangeable with diffuse osteoarthritis. A patient with a mechanically unstable joint may not respond like a patient with uncomplicated symptoms and preserved alignment. Future trials should define these distinctions before recruitment rather than explain away a negative result afterwards.

Claims about personalised treatment need prospective validation. A marker that appears to identify responders in a small retrospective subgroup may not work when applied to a new group of patients. Clinicians should be wary of a claim that a proprietary test predicts benefit if its accuracy, independent validation and practical consequences have not been established.

Trials that answer the right question

A useful trial compares a treatment with a credible alternative and measures outcomes that matter to patients. Where appropriate, a placebo or sham comparison helps separate the specific treatment effect from expectation and the experience of having a procedure. Blinding can be difficult, but that difficulty should be recognised rather than used to dismiss controlled evidence.

Pain, function and structural change need separate reporting. An imaging change may be interesting without making a patient feel or function better. Equally, a patient can gain worthwhile symptom relief without structural regeneration. Both observations can be clinically relevant if they are described honestly. To establish disease modification, researchers need a suitable design and enough follow-up, rather than a reassuring post-treatment scan alone.

Large controlled trials such as RESTORE and MILES show why this distinction matters. Their findings place limits on assumptions about PRP and cell-based injections in knee osteoarthritis. Negative trials contribute to care by identifying treatments that should not be promoted beyond their evidence. New approaches should be judged on their own results rather than on a general belief that biologics must work. [20] [24]

Trials should also describe adherence to rehabilitation, rescue treatment, loss to follow-up and harms. Reporting only the patients who return with a favourable

result can create a misleading impression. The cost to the patient and to the health service is relevant when a small uncertain benefit requires an expensive or invasive procedure.

Responsible use of new tools

Imaging, digital outcome collection and decision support may help clinicians assess progress more consistently. Their usefulness depends on the quality of the information and the way it changes care. A more detailed image does not automatically identify the source of pain. An automated recommendation should remain open to clinical challenge, particularly when symptoms, examination and patient priorities do not fit the model.

A registry can identify patterns, adverse events and questions for future trials. It cannot, by itself, prove that a procedure caused improvement. Registry reports should explain their denominator, completeness of follow-up, case mix and limitations. Patients should know how their information is used and whether it is clinical audit or research. Where research is undertaken, the appropriate approvals and consent are required.

The practical standard for a developing service is restraint with accountability. A new intervention should enter practice through a defined governance process, with a clear consent discussion, monitoring and a plan for stopping or changing use if outcomes are poor. Innovation and patient protection can develop together when uncertainty is made explicit. [71]

A commitment to evidence and recovery

Regenerative care can become more useful by remaining connected to rehabilitation, surgery and the patient's broader health. It should not become a separate commercial pathway that assumes every pain problem needs a biological procedure. The clinician's responsibility is to select the most appropriate next step and explain why.

For patients, the central question is not whether a treatment sounds advanced. It is whether there is a sound reason to expect a worthwhile benefit in their situation, and whether the alternatives and uncertainties have been discussed. For clinicians, the central obligation is to make that reasoning transparent.

My aim in presenting this book is to support informed conversations about recovery. The field will change, and future evidence may strengthen or weaken individual treatments. The approach should remain steady: establish the diagnosis, use effective foundational care, make proportionate decisions and measure the outcome that matters to the patient.

Appendix A · Comparing treatment options

This comparison summarises the discussion in the treatment chapters. The evidence varies by condition, preparation and comparator. A statement about one joint or tendon should not be transferred to another. None of these entries is a personal recommendation.

Treatment	Main purpose	Important limit
Rehabilitation and load management	Improve capacity and day to day function	Requires a suitable diagnosis and individual progression
Corticosteroid injection	Short-term symptom relief in selected conditions	Does not regenerate tissue and repeated use needs review
Hyaluronic acid	Proposed symptom treatment for osteoarthritis	NICE recommends against offering it for osteoarthritis
Polyacrylamide hydrogel	Product-specific symptom treatment studied in knee osteoarthritis	An implantable device with limited comparative and long-term evidence
Platelet rich plasma	Autologous platelet preparation studied for joint and tendon symptoms	Mixed evidence and no dependable proof of cartilage regrowth
Bone marrow aspirate concentrate	Heterogeneous marrow concentrate studied as a biological intervention	Not a purified stem cell product and benefit remains unestablished for routine osteoarthritis care
Cell therapies	Product-specific research or regulated clinical treatment	Processing and intended use determine the regulatory pathway
Dextrose prolotherapy	Proposed symptom treatment through a local tissue response	Uncertain benefit and not a proven reconstruction
Shockwave therapy	Non-invasive procedure studied for selected tendon and heel pain	Condition-specific mixed evidence and relevant NICE arrangements

Read Chapters 5 to 10 for evidence, risks and the distinctions between products. See Chapter 17 for the particularly important limits in ankle arthritis. [1] [2] [3]

Appendix B · Preparing for a consultation

Information to bring

Bring a description of your symptoms and what you most want to improve. Include when the problem began, whether there was an injury, where pain is felt and which activities are difficult. A brief timeline of previous treatment is often more useful than a long list of products. If an injection was given elsewhere, try to bring its date, site, substance and response.

Bring a current medication list, including anticoagulants, antiplatelet medicines, non-prescription products and supplements. Explain any allergies, previous adverse reactions, diabetes, immune suppression, bleeding disorder, infection or planned operation. Bring relevant imaging and previous operation reports if available. Do not arrange an unnecessary scan solely because a procedure is advertised as requiring one.

Questions worth asking

1. What is the diagnosis and what makes it the most likely explanation? 2. What is the treatment intended to improve and what will it leave unresolved? 3. What evidence applies to my joint or tendon and to this specific product? 4. What would an appropriate rehabilitation programme involve? 5. What alternatives are available, including no procedure and surgical assessment? 6. What are the material risks and how do my health and medicines affect them? 7. What governance or regulatory requirements apply to this intervention? 8. What is the total cost, including follow-up and any proposed repeat treatment? 9. When will we review the outcome and what will count as a worthwhile change? 10. Whom should I contact if recovery does not follow the expected course?

A clear explanation should allow time for a decision. You can decline treatment or ask for further information. A signed form should record an informed discussion, not replace one. [71]

A personal goal record

Write down one or two activities that you would like to improve. For example, you might want to walk a particular distance, manage stairs, use a work tool or tolerate a normal shoe. Record what you can do now and what prevents you doing more. Agree an achievable review point with the clinician. A goal that is specific to your life can make a later decision clearer than a general wish to be pain free.

Appendix C · Aftercare and urgent symptoms

Follow the plan for your procedure

Aftercare depends on the treatment, the anatomical site and the diagnosis. Ask for a written plan covering expected discomfort, permitted activity, rehabilitation, medication advice and the next appointment. A generic leaflet cannot set a safe return date for every tendon injury, arthritic joint or reconstructed limb. Keep the clinic's contact details with the instructions.

Never stop prescribed anticoagulants, antiplatelet medicines, aspirin or other important medicines on your own to prepare for treatment. If a change is needed, it should be agreed with the prescribing clinician and the procedural team. Advice about anti-inflammatory medication around PRP varies and should not be turned into a blanket instruction to stop medically necessary treatment. Tell the clinician about any change in your health before proceeding.

A temporary symptom flare may occur after an injection or shockwave therapy. Expected discomfort must still be distinguished from a complication. Worsening severe pain, a hot or increasingly swollen joint, spreading redness, wound discharge or fever needs urgent assessment. Do not assume these findings are a normal response to a biological treatment or wait for the scheduled review. [13]

Seek urgent care when the pattern changes

Get immediate emergency assessment for severe breathing difficulty, facial or throat swelling, collapse or another suspected serious allergic reaction. A newly cold or pale limb, major new weakness, or rapidly worsening loss of sensation also needs urgent assessment. Sudden tendon injury with loss of function requires prompt clinical review rather than further exercise or a repeat injection.

New difficulty passing urine or loss of bladder or bowel control, altered sensation around the saddle area, or rapidly progressive weakness with back or leg symptoms requires emergency assessment. [76] A newly swollen painful calf needs urgent same-day assessment for a possible blood clot. If calf pain or swelling is accompanied by breathlessness or chest pain, call 999 or seek immediate emergency care and do not drive yourself. These symptoms should not be managed through a routine website enquiry. [7]

For emergencies in the UK, call 999 or attend an emergency department. For an urgent problem when the appropriate route is unclear, use NHS 111 or an urgent clinical service. Contact the treating team as instructed, but do not delay urgent assessment because the practice has not replied.

Appendix D · Reviewing the outcome

Record the whole picture

An outcome review should compare the present situation with the baseline. Pain matters, but so do function, activity, sleep, work and treatment burden. The interpretation is different if pain has fallen because you have become less active. Record changes in medicines, rehabilitation, work demands and other procedures alongside the symptom score.

Review field	Baseline	Follow-up
Date and diagnosis	Record at first assessment	Confirm any diagnostic change
Main activity goal	Record the task and current ability	Record ability on the same task
Pain and symptom pattern	Use an agreed consistent measure	Use the same measure and context
Activity and rehabilitation	Record usual activity and plan	Record participation and progression
Medicines and other treatment	Record current treatment	Record changes and rescue treatment
Complications or new symptoms	Record relevant baseline findings	Document adverse events and actions
Next decision	Agree the purpose of treatment	Continue revise refer or stop

Condition-specific questionnaires can add consistency, but they do not replace a conversation. A tendon score, an arthritis score and a general quality of life measure answer different questions. The clinician should choose a relevant instrument, use it consistently and check any licensing requirements. Not every numerical change is a clinically important improvement.

Avoid attributing every improvement to the procedure

A favourable change after treatment is encouraging, but it does not establish why the change occurred. Rehabilitation, expectation, natural fluctuation and other care may all contribute. Individual care should still respond to improvement, while a claim about treatment effectiveness requires suitable comparative evidence. This distinction helps a patient and clinician make practical decisions without overstating what a personal result proves.

If benefit is small, absent or short lived, reassess diagnosis, load, adherence and alternatives before repeating treatment. A repeat procedure should have an explicit rationale, an acceptable risk and a review plan. Escalation to an independent or surgical opinion may be appropriate. An outcome review is useful when it changes the plan, not merely when it creates a favourable statistic.

Appendix E • Glossary

Term	Meaning in this book
Autologous	Obtained from the same person who receives it
Allogeneic	Obtained from another person
ATMP	Advanced therapy medicinal product a regulatory category for specified gene cell or tissue engineered products
BMAC	Bone marrow aspirate concentrate a heterogeneous marrow preparation
Comparator	The treatment placebo or other care used for comparison in a study
Disease modification	A demonstrated alteration of a disease's course rather than symptom relief alone
ESWT	Extracorporeal shockwave therapy a procedure applying acoustic energy from outside the body
Fasciopathy	A disorder of fascia often used for persistent plantar heel pain
Hydrogel	A water-containing polymer material whose properties depend on the specific product
Hyaluronic acid	A molecule present in joint fluid and supplied in some injection products
Intra-articular	Within a joint
Non-inferiority	A trial question asking whether an intervention is not worse than a comparator by a specified margin
Osteoarthritis	A whole-joint disorder involving cartilage and other tissues with variable pain and disability
Placebo	A comparison intended to separate a specific treatment effect from other effects of care
PRP	Platelet rich plasma a platelet-containing preparation made from blood
PROM	Patient reported outcome measure a structured record of symptoms or function
Randomisation	Allocation by chance to reduce selection bias in a comparative study
Regeneration	Restoration of tissue requiring evidence beyond improvement in symptoms
Sham	A procedure designed to resemble treatment without its proposed active element
Special arrangements	Additional governance consent and audit or research requirements under relevant NICE procedure guidance
Tendinopathy	A clinical tendon disorder commonly involving pain and reduced load tolerance
Ultrasound guidance	Real-time imaging used to help locate a target and guide an intervention

Appendix F · A reader's guide to the chapters

For a first discussion about treatment, read Chapters 1, 3, 4 and 20. For a specific procedure, read its chapter in Chapters 5 to 10 and then the chapter about the relevant body region. Patients with heel or ankle symptoms should read Chapter 17 rather than assume that knee evidence applies to the foot and ankle.

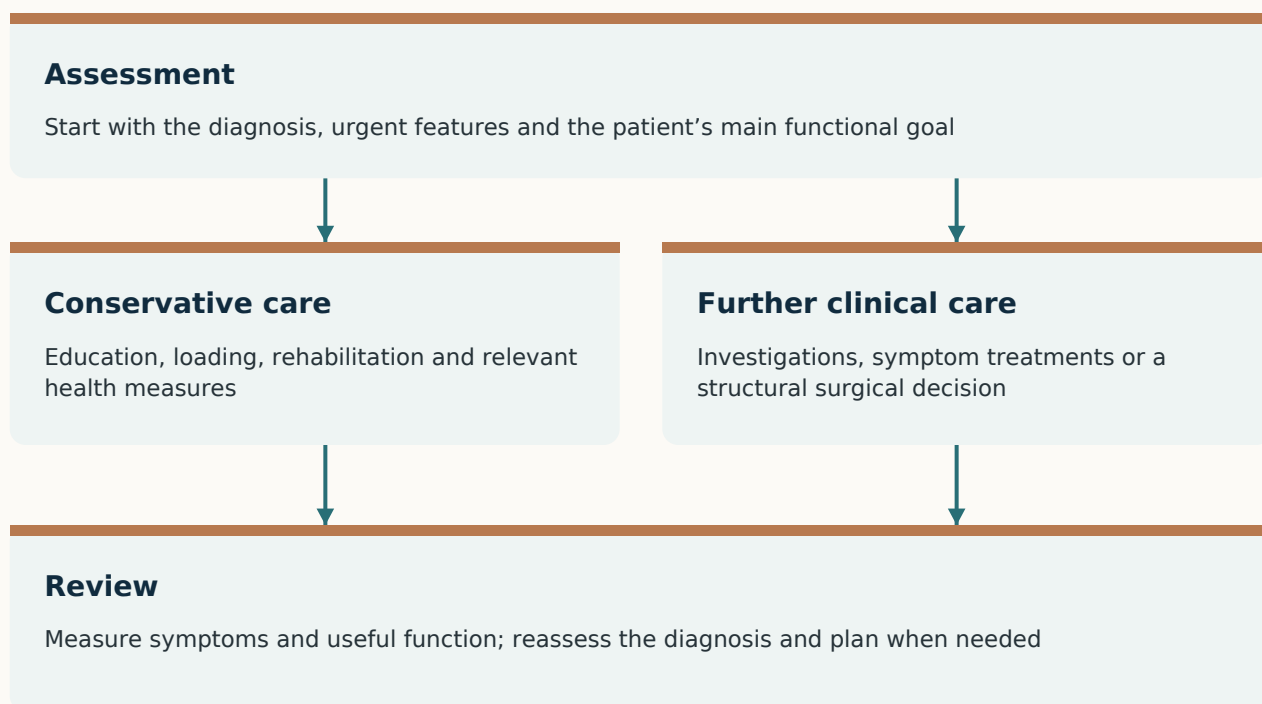


Figure 25 · From assessment to review. The route is determined by the diagnosis, functional goal and response to care; urgent features require their own clinical pathway.

For recovery, read Chapter 18 and the aftercare and outcome appendices. For complex injuries or previous reconstructive surgery, read Chapter 22. Clinicians considering a service can start with Chapters 19 to 21, while the teaching cases in Chapter 23 show how a clinical decision can lead to rehabilitation, further assessment or no injection.

The reference list contains clickable links to official guidance and identifiable publications. It can be used to check the claims and the date of the evidence. An older study may remain useful, but the most recent guideline or well-designed trial may change its interpretation. When advice from different sources conflicts, ask how the disagreement applies to your diagnosis and the specific proposed intervention.

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Sources originally checked on 10 October 2026; core procedural guidance and selected newer evidence reviewed again on 14 October 2026. Links lead to the cited guidance or publication. The new trial in this revision is reference 77; earlier numbering is retained.

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