DARADIA eBOOK

REGENERATIVE THERAPY

A Practical eBook for Pain Physicians

PRP • BMAC • SVF • Microfat • Nanofat • Allogeneic Cell Products

Evidence-informed preparation protocols, RPM-based workflow ranges, and condition-wise clinical decision support

Prepared by Daradia: The Pain Clinic for practicing pain physicians and interventional pain fellows

Evidence snapshot updated to May 2026

Prepared as an educational clinical handbook. Not a substitute for local regulation, ethics approval, device instructions, institutional SOPs, or patient-specific medical judgment.

Companion easy-reading webpage: daradia.com/daradia-protocol-regenerative-therapy/

How to Use This eBook

Easy reading companion: Daradia Protocol — Regenerative Therapy | Quick practical reading for OT/OPD workflow.

Clinical positioning

• Use this as a decision-support and teaching document, not as a product manual. Exact centrifuge settings and disposables vary by system; always follow the validated device protocol and report the final injectate composition.

• For most routine pain practices, leukocyte-poor PRP is the most defensible first biologic for knee osteoarthritis and several tendinopathies. BMAC, SVF/fat-derived products, and allogeneic MSC products require stronger counseling because evidence, cost, processing, and regulatory risk are less settled.

• For all cell-based products, record donor/source, manipulation method, sterility controls, cell count/viability where available, and local regulatory status.

Abbreviations

Abbreviation	Meaning
ACP	Autologous conditioned plasma; commonly a low-concentration, leukocyte-poor PRP-like product
ADSC / ASC	Adipose-derived stromal/stem cell
BMA / BMAC	Bone marrow aspirate / bone marrow aspirate concentrate
CET / CFT	Common extensor tendon / common flexor tendon
CSI	Corticosteroid injection
HA	Hyaluronic acid
IA	Intra-articular
LP-PRP / LR-PRP	Leukocyte-poor PRP / leukocyte-rich PRP
MFAT	Microfragmented adipose tissue
MSC / MPC	Mesenchymal stromal/stem cell / mesenchymal precursor cell
OA	Osteoarthritis
PRP	Platelet-rich plasma
SVF	Stromal vascular fraction

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1. Introduction: Regenerative Pain Medicine in 2026

Regenerative pain medicine uses autologous or allogeneic biologic injectates to modulate inflammation, pain, and tissue remodeling. In clinical pain practice, the most commonly used products are platelet-rich plasma (PRP), bone marrow aspirate concentrate (BMAC), adipose-derived products such as stromal vascular fraction (SVF), microfragmented fat/microfat and nanofat, and selected allogeneic mesenchymal stromal/stem cell (MSC) or mesenchymal precursor cell (MPC) products [1].

The therapeutic goal is usually not simple "cartilage regrowth" or "stem-cell replacement." For PRP, the principal mechanism is delivery of platelet-derived growth factors and bioactive mediators. For BMAC and MSC-based products, current thinking emphasizes paracrine and immunomodulatory signaling rather than durable engraftment of cells into cartilage or tendon [1,2].

For the practicing pain physician, the critical question is not "which product is newest?" but "which product has the best evidence for this pain generator, at an acceptable risk, cost, and regulatory profile?" This eBook therefore ranks the best-supported option first for each condition, then lists secondary or investigational options with evidence signals.

What has the best general evidence?

Condition	Best-supported biologic	Practical interpretation	Refs
Knee OA	LP-PRP	Best-supported biologic; strongest routine-use option in mild-moderate OA.	[1,3-6]
Lateral epicondylitis / CET tendinopathy	PRP	Often inferior to steroid early, but superior for longer-term pain/function.	[1,17,18]
Plantar fasciitis	PRP	Longer-term benefit over steroid/placebo in several analyses; avoid repeated steroid near fascia.	[1,18]
Rotator cuff tendinopathy	PRP in selected partial-thickness/tendinopathic lesions	Promising; technique and platelet dose matter. Full-thickness mechanical tears are not "repaired" by injection.	[1,18]
Hip OA / shoulder OA	PRP or HA; no universal winner	Evidence is smaller than knee OA; PRP may be helpful but superiority over HA is inconsistent.	[1]
SIJ pain	Steroid or conventional care first in many cases	PRP evidence is mixed; a rigorous RCT favored steroid over IA PRP at measured time points.	[20]
Lumbar radiculopathy and lumbar facet pain	PRP in selected cases	Recent RCT-only spine review suggests PRP may provide delayed but more durable mid-term benefit than steroid in lumbar radiculopathy and lumbar facet pain.	[2]
Discogenic pain / intradiscal biologics	Investigational	Intradiscal PRP/BMAC/autologous MSC evidence is inconsistent; infection risk, cost, and regulation require caution.	[2]
Cell-based knee OA treatments	Promising but less settled than PRP	BMAC/SVF/MSCs show signals, but results are heterogeneous; allogeneic products remain regulated/investigational in many jurisdictions.	[7-16]

Evidence language used in this eBook

Term	Meaning
Recommended / first biologic option	Consistent RCTs or meta-analyses; favorable risk-cost profile; reasonable for routine practice with consent.
Promising / selected patients	Positive studies exist, but heterogeneity, cost, access, or long-term durability limit routine use.
Investigational / research-preferred	Evidence is preliminary, conflicting, or product is regulated as a drug/biologic in many jurisdictions.
Not routine / avoid as primary treatment	Evidence does not support routine clinical use or the pathology requires mechanical/surgical correction.

2. Classification, Reporting, and Patient Selection

Minimum biologic reporting checklist

- Product name: PRP, ACP, PRGF, PRF, BMAC, MFAT, SVF, nanofat, culture-expanded MSC/MPC, amniotic/umbilical/placental product.
- Autologous or allogeneic source; anatomic source: peripheral blood, iliac crest marrow, adipose tissue, umbilical cord, placenta, Wharton's jelly.
- Processing: single spin/double spin, RPM range, exact RPM used, spin time, device/rotor or kit, anticoagulant, activation method, and final volume.
- Composition when available: platelet concentration, leukocyte count, neutrophil fraction, RBC contamination, nucleated cell count, CD34+ count, colony-forming units, viability, sterility testing.
- Injection target: IA, intratendinous, peritendinous, enthesis, ligament, epidural, facet, SIJ, intradiscal; image guidance used.
- Co-interventions: lavage, dry needling, tenotomy, hydrodissection, HA, local anesthetic, corticosteroid, physical therapy protocol, brace/orthosis.
- Outcome follow-up: baseline VAS/NRS, WOMAC/KOOS/HOOS/SPADI/VISA-A/PRTEE/ODI/NDI, MCID/responder threshold, adverse events.

Who is a good candidate?

Group	Clinical meaning
Best candidates	Localized mechanical pain generator; mild-moderate degenerative disease; failed good rehabilitation and conventional care; realistic expectations; willingness to follow loading restrictions and rehab.
Relative poor responders	Severe end-stage OA with major deformity, bone-on-bone collapse, uncontrolled diabetes, high inflammatory burden, major obesity, active smoker/alcohol excess, severe depression/catastrophizing, poor rehab adherence.
Red flags / defer	Infection, tumor, fracture, inflammatory arthropathy flare needing disease control, anticoagulation not safely managed, pregnancy when safety data are absent, severe immunosuppression, unrealistic "cartilage regeneration" expectations.
When surgery is still needed	Complete unstable ligament rupture, full-thickness retracted tendon tear with major weakness, advanced OA requiring arthroplasty, severe stenosis with progressive neurological deficit, infection, fracture, tumor.

3. Preparation Protocols

Easy reading companion: Daradia Protocol — Regenerative Therapy | Quick practical reading for OT/OPD workflow.

Important technical principle

• In this Daradia eBook, centrifugation steps are expressed as practical RPM ranges. Always follow the kit/device IFU and report the exact RPM/time used, device/system, anticoagulant, final platelet/leukocyte profile, and final volume.

• For intra-articular OA, especially knee OA, the most defensible product is leukocyte-poor PRP with minimal RBC contamination.

• For tendons, leukocyte content is less settled. Some clinicians prefer LR-PRP for chronic tendinopathy to stimulate a controlled inflammatory-healing response, but post-injection flare may be greater. For rotator cuff and peri-neural/spine targets, LP preparations are generally more conservative.

3.1 PRP: core concepts

PRP is prepared from anticoagulated autologous whole blood and centrifuged to concentrate platelets above baseline [1]. The final product may be leukocyte-poor or leukocyte-rich, activated or non-activated, low-dose or high-dose, and single-spin or double-spin.

The clinically relevant product is not just “PRP”; it is a specific platelet dose plus leukocyte/RBC profile. Two PRP products can have opposite biological behavior if one contains neutrophil-rich buffy coat and another is leukocyte-poor plasma.

For OA, avoid high RBC contamination and avoid unnecessary leukocytes. For chronic tendons, a more inflammatory product may be acceptable, but patient counseling must include a flare window.

3.2 LP-PRP preparation: practical double-spin workflow

1. Draw 30-60 mL peripheral venous blood using ACD-A or citrate anticoagulant, usually about 1 part anticoagulant to 8-9 parts blood, unless the commercial kit specifies otherwise.
2. Soft spin: It varies from kit to kit. Common practical range is 1200-1800 RPM for 8-12 minutes to separate RBCs from plasma and platelets. Some closed single-spin/ACP-like kits use about 1500-2500 RPM for 5-10 minutes. Use the kit or device specific recommendations.
3. Under sterile technique, transfer the plasma layer without aspirating the buffy coat. For LP-PRP, deliberately avoid the leukocyte-rich buffy coat and visible RBC layer.
4. Hard spin: common practical range is 3000-3500 RPM for 8-12 minutes to pellet platelets; some commercial systems use approximately 2500-4000 RPM. Use the kit/device specific recommendations.
5. Discard platelet-poor plasma from the top, leaving enough plasma to resuspend the platelet pellet. Final volume commonly ranges 3-8 mL for knee OA and 2-5 mL for smaller targets.
6. Use fresh on the same day. Avoid routine activation unless the indication or device protocol requires it. Document final volume, target, and whether the product was LP-PRP.

3.3 LR-PRP preparation: when and how

- Prepare similarly to PRP, but include the buffy coat during collection after the first spin. This increases leukocyte and neutrophil content.
- LR-PRP may provoke a stronger inflammatory response; this can be rationalized for chronic degenerative tendinopathy but is not ideal for inflamed joints.
- Avoid LR-PRP as the default for knee OA because leukocyte-rich products may increase post-injection pain and synovitis, and LP-PRP has the cleaner evidence profile in OA [4,5].

3.4 Single-spin versus double-spin PRP

RPM range guide (orientation only; follow manufacturer IFU):

Preparation/device context	Common practical RPM range	Typical time	Practical handling note
Single-spin PRP / ACP-like kits	1500-2500 RPM	5-10 min	Office PRP workflow; often lower platelet concentration; usually easier to keep leukocyte-poor if buffy coat is avoided.
Double-spin LP-PRP: soft spin	1200-1800 RPM	8-12 min	Separates RBCs from plasma. For LP-PRP, aspirate plasma without disturbing buffy coat or visible RBC layer.
Double-spin PRP: hard spin	3000-3500 RPM; some kits 2500-4000 RPM	8-12 min	Pellets platelets. Resuspend pellet in intended plasma volume. Include buffy coat for LR-PRP; avoid it for LP-PRP.
BMAC point-of-care systems	2400-3200 RPM; some dedicated systems 2800-3600 RPM or sequential cycles	10-15 min	Use closed/validated BMAC device. Collect buffy/nucleated cell layer; document marrow volume, aliquot technique, final volume, and exact RPM/time.
Microfat / MFAT washing or concentration	1200-3000 RPM if centrifugation is used	2-5 min	Many fat systems use wash/decant/filter without mandatory centrifugation. Do not over-process; document cannula, wash, filter, and final volume.
Nanofat preparation	Often no spin; if clean-up centrifugation is used, 1200-3000 RPM	2-5 min	Usually mechanical emulsification through syringe transfers plus filtration. Record number of transfers and filter size.
Enzymatic SVF	Protocol/device-specific only	Protocol-specific	Use only within applicable regulation/approved research/ethics pathway; do not extrapolate PRP/BMAC RPM settings.

Daradia practical note: For readability in day-to-day practice, this eBook gives RPM ranges for common kit/device workflows. These ranges are practical orientation only. Always follow the IFU or validated SOP of the specific centrifuge, rotor, and disposable kit you are using.

3.5 BMAC preparation

Daradia practical note: Document the aspiration technique, total marrow volume, anticoagulant used, device name, exact RPM/time used, and whether the BMAC system uses a single-cycle or sequential-cycle protocol.

BMAC is an autologous marrow-derived concentrate containing platelets, nucleated cells, hematopoietic cells, endothelial progenitor cells, cytokines, and a low fraction of MSC-like stromal cells [1]. Its effect is probably paracrine and immunomodulatory rather than direct cartilage replacement.

The highest-yield practical principle is multiple small-volume aspirations from different marrow channels. Large-volume aspiration from one position dilutes the sample with peripheral blood.

1. Plan posterior iliac crest aspiration under fluoroscopy or ultrasound according to operator skill and anatomy. Use full sterile barrier precautions.
2. Prepare anticoagulated syringes with heparin or ACD-A according to institutional protocol and device instructions. Avoid clotting inside the aspiration tubing or syringe.
3. Advance an 11-13G Jamshidi or marrow aspiration needle into cancellous marrow. Confirm safe trajectory and avoid the greater sciatic notch.
4. Aspirate 2-5 mL at a time, then rotate or withdraw/reposition the needle. Repeat from multiple channels to obtain 30-120 mL total marrow depending on the processing system.

5. Centrifuge using the BMAC system's validated setting. Common point-of-care BMAC devices use roughly 2400-3200 RPM for 10-15 minutes; some dedicated systems use fixed settings around 2800-3600 RPM or sequential cycles. Collect the buffy coat/nucleated cell layer, typically yielding 3-10 mL concentrate.
6. Inject the same day using image guidance. For knee OA, typical final IA volume is 4-8 mL; combine with PRP only when evidence, consent, and protocol justify it.
7. Document total marrow volume, anticoagulant, sites/aliquots, final BMAC volume, device, and any cell counts available.

3.6 SVF, microfat, MFAT, and nanofat

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Daradia practical note: When fat processing includes centrifugation, document the RPM/time range and exact RPM/time used. When it is purely mechanical, document wash/decant method, number of syringe transfers, filter size, and whether the final product was microfat, MFAT, SVF, or nanofat.

Product	Preparation summary	Key issue	Pain-practice positioning
Enzymatic SVF	Lipoaspirate digested with collagenase/enzymes, centrifuged, washed, filtered, and resuspended.	Higher stromal cell yield than purely mechanical fat processing, but enzyme digestion is more than minimal manipulation in many jurisdictions.	Clinical use should be regulation-led; research/approved settings preferred.
Mechanical SVF / MFAT	Lipoaspirate washed and mechanically fragmented through filters/sieves without enzymes.	Less regulatory complexity than enzymatic SVF in some settings; cell composition variable.	Selected OA/tendinopathy protocols, usually investigational/selected practice.
Microfat	Washed small-particle fat graft, often harvested with small side-port cannula.	Cushioning/scaffold plus stromal niche; requires liposuction skill.	OA or soft-tissue defects; evidence less mature than PRP.
Nanofat	Fat emulsified by repeated syringe passes and filtered to small particles; mature adipocytes are disrupted.	Rich stromal vascular fragments and cytokines, but not a classic “stem-cell injection.”	Skin/scar evidence stronger than OA; joint/tendon use remains early.

General adipose harvest workflow

1. Mark donor site, usually abdomen/flank/thigh. Screen for infection risk and obtain specific consent for liposuction-related complications.
2. Tumescent infiltration is commonly used; composition varies by institution. Avoid injecting local anesthetic into the final biologic target and avoid unvalidated mixtures in the final cell product.
3. Harvest lipoaspirate with a sterile cannula and syringe or closed system. Wash/decant to remove blood, oil, and tumescent fluid.

4. For MFAT/microfat/nanofat, mechanically size-reduce and filter according to a validated kit or institutional SOP. If centrifugation is used for washing/decanting, common practical ranges are 1200-3000 RPM for 2-5 minutes; many closed fat-processing systems use washing, settling, filtration, or emulsification without a mandatory spin. Maintain sterility and closed handling where possible.
5. For enzymatic SVF, enzyme type, concentration, incubation, neutralization, washing, sterility/endotoxin controls, and regulatory permission must be explicitly documented.

3.7 Allogeneic stem-cell and perinatal products

Allogeneic products include culture-expanded bone marrow MSCs, adipose-derived MSCs, umbilical cord MSCs, placental MSCs, Wharton's jelly-derived products, and MPCs. They are attractive because they are off-the-shelf and standardized, but they are also more regulated and product-specific than same-day autologous PRP [1,12-16].

A pain physician should not treat allogeneic "stem cells" as a generic injection category. Each product requires donor screening, GMP manufacturing, cell identity/potency assays, sterility, endotoxin/mycoplasma testing, viability, cryopreservation controls, chain of custody, adverse-event reporting, and clear regulatory authorization.

In knee OA, allogeneic MSC products have encouraging early trials, but the evidence is still heterogeneous. A 2025 dose-focused meta-analysis found significant 12-month WOMAC improvement with intra-articular MSCs and did not show a simple dose-response advantage of very high cell doses [13].

Regulatory caution
• In the United States, FDA consumer information states that regenerative medicine therapies have not been approved for orthopedic conditions such as osteoarthritis, tendonitis, disc disease, tennis elbow, back pain, hip pain, knee pain, neck pain, or shoulder pain [36,37]. Other jurisdictions differ, but the same consent principle applies: clarify approved versus investigational use.
• Avoid marketing language such as "cartilage regeneration guaranteed" or "stem cells will regrow the joint." Use measured language: pain/function improvement, anti-inflammatory modulation, possible tissue remodeling, and uncertain structural effect.

4. Peri-Procedural Practices

Issue	Practical guidance
NSAIDs	Often withheld before and after PRP because platelet activation and inflammatory signaling may be part of the therapeutic effect. Typical practice: avoid 3-7 days before and 1-2 weeks after if medically safe.
Antiplatelets/anticoagulants	Do not stop casually. Balance thrombosis risk with procedural bleeding risk. Follow regional anesthesia/pain anticoagulation guidance for deep targets.
Local anesthetic	Skin wheal and track anesthesia are acceptable. Avoid mixing local anesthetic directly with biologic injectate or flooding the final target; in vitro cytotoxicity is a concern [1].
Corticosteroid	Avoid combining steroid with PRP/BMAC in the same target unless there is a specific rationale; it may counter the desired biologic response.
Antibiotic prophylaxis	Not routine for simple peripheral PRP. Consider institutional protocols for marrow aspiration, liposuction, intradiscal injections, implants,

Issue	Practical guidance
	immunosuppression, or high-risk patients.
Post-procedure loading	Relative rest 2-7 days. Tendon/plantar fascia may need boot/brace/crutches based on pain and site; begin ROM early, strengthening usually after 2-3 weeks [1].
Expected flare	Pain flare for 2-7 days is common, especially LR-PRP and tendons. Use acetaminophen, ice/heat as appropriate, activity modification; avoid routine NSAIDs if possible.
Outcome review	Assess at 6 weeks, 3 months, 6 months, and 12 months where possible. PRP often has delayed benefit compared with steroid.

Red flags after biologic injection

- Increasing severe pain beyond expected flare, fever, chills, erythema, drainage, or progressive swelling: evaluate for infection.
- New neurological deficit after spine or deep pelvic injection: urgent assessment and imaging as indicated.
- Calf swelling, dyspnea, chest pain after reduced mobility or liposuction: evaluate for thromboembolism.
- Severe joint effusion after IA injection: aspirate if infection/crystal flare is possible; send cell count, Gram stain, culture, crystals.

5. Evidence Map by Product

Product	Where evidence is most discussed	Clinical interpretation
LP-PRP	Knee OA, shoulder OA, selected hip OA, rotator cuff tendinopathy, plantar fasciitis, lateral epicondylitis, selected facet/radicular applications.	Best routine biologic in pain practice; low processing burden; strongest safety/cost/evidence balance.
LR-PRP	Chronic tendinopathy where a stronger inflammatory stimulus is desired.	Avoid as default IA OA product; higher flare/synovitis concern.
BMAC	Knee OA and selected cartilage/subchondral/tendon contexts.	Promising but mixed RCT evidence; more invasive; cost and marrow quality matter.
SVF/MFAT/microfat	Knee OA, selected tendon/soft-tissue applications.	Evidence signals exist, but heterogeneity and regulation are major issues.
Nanofat	Emerging OA/tendon use; stronger cosmetic/scar precedent than joint evidence.	Do not oversell as “high MSC injection”; clinical OA evidence remains immature.
Allogeneic MSC/MPC	Knee OA, disc degeneration trials, selected research settings.	Potentially standardized and promising; usually investigational/regulated; product-specific evidence required.
Amniotic/umbilical/exosomes	Orthopedic pain marketing exists.	Use extreme caution; many products are not approved for orthopedic indications in the US and evidence is product-specific.

6. Condition-Wise Playbook

6.1 Knee Osteoarthritis

Best evidence-supported biologic: LP-PRP. Intra-articular PRP has the strongest evidence base among biologics for knee OA, with meta-analyses and consensus guidelines supporting superior mid- to long-term pain and function outcomes compared with HA, corticosteroid, and placebo in many populations [1,3-6].

Preferred patient profile: Kellgren-Lawrence grade I-III, pain not dominated by severe deformity/instability, inflammatory flare controlled, willing to follow exercise and weight management. End-stage grade IV OA may still improve symptomatically but should be counseled as palliative, not regenerative.

Most promising alternatives: BMAC and MSC/SVF products. BMAC is biologically plausible and some RCTs show benefit, but evidence is mixed; a large randomized phase 3 trial did not show superiority of cell therapies over corticosteroid at 1 year [7-13]. Allogeneic MSCs and UC-MSCs have positive early trials but remain product-specific and often investigational [12-16].

Decision point	Practical approach
First-line biologic	LP-PRP, 4-8 mL IA, 1-3 sessions 1-3 weeks apart depending on protocol.
When to consider BMAC	Younger biologically active patient, moderate OA with subchondral pain phenotype, failed PRP/HA, strong consent regarding cost/invasiveness/uncertain superiority.
When to avoid biologic-first approach	Severe varus/valgus deformity, major instability, advanced bone loss, inflammatory arthritis flare, infection, neuropathic-dominant pain, unrealistic expectation of cartilage regrowth.
Combination protocols	PRP plus HA or PRP plus BMAC is used by some clinicians, but should be framed as selected practice rather than universally proven superiority.

6.2 Hip Osteoarthritis

Best evidence-supported biologic: PRP is reasonable, but the evidence is smaller and less decisive than knee OA. Meta-analyses and the ASPN guideline suggest PRP can improve pain/function, but superiority over HA is inconsistent [1].

Technique: image guidance is essential. Use ultrasound-guided anterior capsular recess or fluoroscopy. LP-PRP 3-5 mL is typical. Avoid intra-articular local anesthetic mixed with PRP.

Clinical positioning: Use in mild-moderate hip OA where arthroplasty is not imminent. Severe joint-space loss, femoral head collapse, or major cam/pincer mechanical symptoms may limit response.

6.3 Shoulder Osteoarthritis: Glenohumeral and AC Joint

Best evidence-supported biologic: LP-PRP is promising for glenohumeral OA. Limited RCT evidence suggests longer-term improvement versus corticosteroid and similar results to HA in some comparisons [1].

Glenohumeral technique: ultrasound-guided posterior or rotator interval approach; inject 3-5 mL LP-PRP. For AC joint OA, use smaller volumes, commonly 0.5-1.5 mL, with image guidance.

Clinical caveat: shoulder pain is often mixed: glenohumeral OA, AC OA, rotator cuff tendinopathy, adhesive capsulitis, biceps tendinopathy, and cervical referral. Treating only the joint may fail if the dominant generator is tendon or capsule.

6.4 Ankle OA, Osteochondral Lesions of Talus, Foot/Hand OA, and Other OA

Best evidence-supported biologic: no universal routine option. PRP has evidence signals in ankle OA and osteochondral lesions of the talus, especially as adjunct to microfracture, but evidence is limited and heterogeneous [1,21].

Practical approach: use PRP only after diagnosis is precise and mechanical instability, malalignment, impingement, and inflammatory arthritis are addressed. For ankle OA, 2-4 mL IA PRP under ultrasound/fluoroscopy is typical.

Hand/foot OA: evidence is sparse. Consider PRP selectively for painful thumb CMC or small-joint OA only after counseling that data are weaker than knee OA.

6.5 Sacroiliac Joint OA / SIJ Complex Pain

Best evidence-supported biologic: not established. Earlier smaller studies suggested benefit, but a rigorous double-blind RCT reported greater pain response with IA corticosteroid than IA PRP at 1, 3, and 6 months [20].

Practical positioning: do not market PRP as proven superior for SIJ pain. Consider PRP only in carefully selected chronic SIJ complex pain after diagnostic blocks, failure of rehabilitation, and counseling that evidence is mixed.

Technique: define whether the target is intra-articular SIJ degeneration or posterior SI ligament/enthesis pain. IA SIJ volumes are small; posterior ligamentous PRP targets are biologically different and should not be equated with IA RCTs.

6.6 Facet Joint OA / Zygapophyseal Pain

Best evidence-supported biologic: emerging PRP evidence, strongest in lumbar facet pain and weaker/equivalent in cervical facet pain. A 2026 RCT-only systematic review concluded that lumbar facet PRP surpassed steroids at 6 months, while cervical facet outcomes were similar across groups [2].

Cervical facet RCT: low-concentrate LP-PRP and corticosteroid showed similar cervical facetogenic pain intensity outcomes over 6 months, with some early self-efficacy/procedural-pain advantages in the PRP group [19].

Technique: fluoroscopic IA facet placement; small volume is critical to avoid capsular rupture. Typical volumes: cervical 0.2-0.5 mL/joint; lumbar 0.5-1 mL/joint. Avoid local anesthetic inside the final biologic injectate.

6.7 Lumbar Radiculopathy and Discogenic Pain

Lumbar radiculopathy: PRP epidural/transforaminal strategies remain specialized, but RCTs summarized in 2026 suggest steroids act faster whereas PRP may provide better 3-6 month outcomes in selected lumbar radicular pain [2]. This is not yet a replacement for standard epidural steroid practice in all patients.

Discogenic pain/intradiscal biologics: use caution. Intradiscal PRP evidence is mixed; BMAC and autologous MSC/MPC data are inconsistent, and intradiscal procedures carry infection risk. The 2026 RCT-only review recommends against routine intradiscal PRP/BMAC/autologous MSC use outside carefully selected or research settings [2].

6.8 Supraspinatus and Other Rotator Cuff Tendinopathies

Best evidence-supported biologic: PRP in selected chronic rotator cuff tendinopathy or partial-thickness tear. The ASPN consensus states PRP is likely to provide better analgesia than corticosteroid across intra-articular, subacromial, and intratendinous approaches, and highlights the importance of adequate platelet concentration [1].

Best candidates: chronic tendinopathy, partial-thickness tear, failed exercise-based rehab, no major retraction, no pseudoparalysis, no advanced cuff tear arthropathy.

Not a primary solution: full-thickness retracted tears with mechanical weakness; these require surgical assessment. PRP may reduce pain but cannot reconnect a retracted tendon.

Technique: ultrasound-guided subacromial/peritendinous or intratendinous fenestration approach; 3-5 mL PRP. Avoid high-pressure injection into a tendon substance; use peppering/fenestration only when appropriate.

6.9 Lateral Epicondylitis / Common Extensor Tendinopathy (CET)

Best evidence-supported biologic: PRP. Steroid often gives faster early relief, but PRP has superior long-term pain/function outcomes in meta-analyses [1,17,18].

Clinical protocol: ultrasound-guided CET origin fenestration plus 1.5-3 mL PRP. LR-PRP or LP-PRP may be used depending on local protocol; counsel flare. Avoid repeated steroid in chronic CET because of recurrence and tendon degeneration concerns.

Rehab: relative rest 2-7 days, then progressive stretching/eccentric-concentric loading. Expect meaningful improvement over 6-12 weeks, not 48 hours.

6.10 Medial Epicondylitis / Common Flexor Tendinopathy (CFT)

Best evidence-supported biologic: PRP is promising but less studied than CET. ASPN consensus suggests PRP may provide long-term relief and function compared with surgery/tenotomy in medial epicondylitis, but evidence quality is lower [1].

Technique: ultrasound-guided CFT origin injection, usually 1-2 mL PRP with careful ulnar nerve identification. Avoid aggressive fenestration if the ulnar nerve is unstable/subluxing or if there is neuritis.

6.11 Achilles Tendinopathy

Best evidence-supported biologic: uncertain. PRP evidence for Achilles tendinopathy remains inconsistent and conflicting. Updated RCT meta-analyses have generally not shown robust superiority of PRP over placebo or standard care [1,22].

Practical approach: prioritize load management, eccentric/heavy-slow resistance program, footwear, metabolic factors, and imaging phenotype. PRP can be considered only after failed rehabilitation, with explicit counseling that benefit is less predictable than CET or plantar fasciitis.

Technique: ultrasound-guided peritendinous/intratendinous small-volume injection, usually 2-4 mL. Avoid injection in acute rupture or high-grade tear without surgical evaluation.

6.12 Patellar, Quadriceps, Hamstring, Gluteal, and Adductor Tendinopathies

Tendon group	Evidence-informed recommendation
Patellar tendinopathy	Evidence conflicting; ASPN does not recommend injectable biologics as routine adjunct to conventional therapy. Use only selected refractory cases with strong rehab plan [1].
Quadriceps tendinopathy	Sparse evidence; manage similarly to patellar tendinopathy. PRP may be considered only after load-based rehab failure.
Proximal hamstring tendinopathy	Small RCTs are inconsistent but promising; PRP may show delayed benefit by 6 months. Use US guidance and protect sciatic nerve.
Gluteus medius/minimus tendinopathy	PRP has promising RCT evidence versus corticosteroid with sustained benefit in some studies; ensure diagnosis excludes lumbar radiculopathy/hip OA.
Adductor tendinopathy	Evidence sparse. Consider PRP only in chronic enthesopathy after correcting pelvic/hip biomechanics and excluding pubic symphysis pathology.

6.13 Plantar Fasciitis / Plantar Fasciopathy

Best evidence-supported biologic: PRP. Consensus and meta-analyses support better longer-term pain/function outcomes than placebo or corticosteroid in chronic plantar fasciitis, although steroids may perform similarly or better early [1,18,23].

Technique: ultrasound-guided injection at the medial calcaneal origin and perifascial degenerative zone, usually 2-3 mL PRP. Avoid repeated steroid because of fat-pad atrophy and plantar fascia rupture risk.

Post-procedure: walking boot or reduced loading may be useful for 1-2 weeks in severe cases; then plantar fascia-specific stretching, calf flexibility, intrinsic foot strengthening, and orthoses.

6.14 Ligament Injuries

Best evidence-supported role: adjunct, not replacement for mechanical stability. PRP may support biology in partial ligament injuries or surgical augmentation, but clinical evidence is variable and not strong enough to replace reconstruction/repair for unstable complete ruptures [24,25].

Ankle sprain: evidence is mixed. Acute lateral ankle sprain usually responds to protection, optimal loading, proprioception, and bracing. PRP is not routine first-line.

MCL/UCL partial injury: consider PRP only for persistent pain/laxity in a stable partial tear after appropriate bracing and rehab. Complete rupture, multi-ligament knee injury, or major instability requires orthopedic evaluation.

ACL: PRP cannot restore mechanical continuity in a complete ACL rupture. In ACL reconstruction, PRP augmentation has mixed evidence; use only as surgical adjunct if surgeon protocol supports it [25].

7. Practical Algorithms

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Algorithm A: Choosing the biologic

Step	Action
Step 1	Confirm the pain generator with history, examination, imaging, and diagnostic blocks where appropriate.
Step 2	Classify pathology: inflammatory synovitis, degenerative OA, tendinopathy/enthesis, ligament instability, radiculopathy, facet pain, or discogenic pain.
Step 3	Ask whether a mechanical solution is needed first: arthroplasty, tendon repair, ligament reconstruction, decompression, or stabilization.
Step 4	If biologic is appropriate, choose the product with best evidence: LP-PRP for knee OA; PRP for CET/plantar fascia/selected rotator cuff; selected PRP for lumbar facet/radicular pain; BMAC/cell products only after enhanced consent.
Step 5	Document product composition and target. Avoid vague “stem cell” terminology.
Step 6	Pair injection with rehabilitation and objective outcome tracking.

Algorithm B: Knee OA biologic ladder

- Grade I-II: education, weight management, exercise, analgesic optimization. Consider LP-PRP if persistent pain and patient wants biologic option.
- Grade II-III: LP-PRP is the most reasonable first biologic. Consider 1-3 injections depending on protocol and response.
- Grade III with subchondral phenotype or PRP failure: consider BMAC or selected cell-based therapy only after discussing mixed evidence and cost.
- Grade IV/end-stage: biologic may provide temporary symptom relief but should not delay necessary arthroplasty when disability is severe.

Consent language: concise clinician script

> *"This treatment uses a biologic product intended to reduce pain and improve function by modulating inflammation and tissue healing. It is not guaranteed to regenerate cartilage or tendon, and response varies by diagnosis, disease severity, product quality, and rehabilitation. PRP has the best evidence for knee osteoarthritis and some tendinopathies; BMAC, fat-derived products, and allogeneic cell products have more variable evidence and regulatory considerations. Infection, flare, bleeding, allergic reaction, failure to improve, and need for further procedures are possible."*

Procedure note template

- Diagnosis and target: e.g., right knee OA KL grade II-III; ultrasound-guided suprapatellar recess injection.
- Product: autologous LP-PRP; blood volume; anticoagulant; device/kit; RPM range and exact RPM/time used; final volume; platelet/WBC/RBC data if available.
- Medication management: NSAID/anticoagulant instructions and rationale.
- Guidance and approach: ultrasound/fluoroscopy, needle gauge/length, contrast if used, volume injected, complications.
- Post-procedure plan: relative rest, analgesia, brace/crutches, rehab start date, follow-up outcomes.

Companion easy-reading webpage: daradia.com/daradia-protocol-regenerative-therapy/

8. One-Page Product Selection Table

Condition	Best biologic	Other researched options	Clinical recommendation
Knee OA	LP-PRP	BMAC, allogeneic MSC, SVF/MFAT/nanofat	LP-PRP first; cell/fat options selected/investigational.
Hip OA	PRP or HA	BMAC/cells limited evidence	Use image guidance; counsel less robust evidence than knee.
Shoulder OA	LP-PRP	HA; BMAC limited	Evaluate cuff/capsule/AC joint separately.
Ankle OA/OLT	PRP selected	BMAC adjunct in surgical cartilage protocols	Not routine; mechanical alignment matters.
SIJ pain	No proven biologic-first option	PRP selected only	Steroid outperformed PRP in one rigorous IA RCT.
Lumbar facet pain	PRP selected	BMAC/cells limited	Emerging evidence; lumbar stronger than cervical.
Cervical facet pain	PRP comparable to steroid	None routine	Not clearly superior to steroid.
CET/lateral epicondyle	PRP	BMAC/SVF rare	Long-term benefit vs steroid.
CFT/medial epicondyle	PRP selected	None routine	Protect ulnar nerve.
Rotator cuff tendinopathy	PRP selected	BMAC limited	Do not use as substitute for repair of retracted tear.
Achilles tendinopathy	No strong biologic-first option	PRP selected	Evidence conflicting; rehab first.
Plantar fasciitis	PRP	Prolotherapy less preferred; steroid short-term	PRP better long-term in many analyses.
Ligament partial injury	PRP adjunct selected	BMAC/cells rare	Do not treat unstable complete rupture with injection alone.

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