

Platelet-Rich Plasma



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KEYWORDS

- Platelet-rich plasma • Musculoskeletal • Healing • Regenerative • Sports
- Rehabilitation • Injection

KEY POINTS

- PRP is a regenerative therapy that has gained popularity in musculoskeletal medicine for its potential to augment repair of tissues with low healing ability.
- Basic science and preclinical studies have begun to elucidate the therapeutic roles of platelets, leukocytes, and red blood cells, suggesting greater benefit from leukocyte-poor PRP.
- Clinical studies have investigated PRP for tendon, ligament, muscle, and cartilage repair, yielding limited Level I evidence supporting use for lateral epicondylitis and knee osteoarthritis.
- Patient selection and education and postprocedural rehabilitation are essential to maximize the therapeutic effect of PRP.
- Investigations are needed to determine the ideal PRP composition, while large clinical trials with standardized reporting of formulations used are needed to determine PRP efficacy.

INTRODUCTION

The clinical application of platelet-rich plasma (PRP) and other regenerative therapies in sports, spine, and musculoskeletal medicine has soared in the last decade. Over this period, many factors have converged to fuel this development. Advances in scientific understanding of tendinopathy as a degenerative cellular and connective tissue process; lack of long-term efficacy of steroid injection therapies, which has prompted the need for alternative therapies; advances in musculoskeletal ultrasound (US) to facilitate diagnosis and guide interventions; as well as translation of treatment paradigms from colleagues in oral and veterinary surgery have all contributed to the advancement of this regenerative field.

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This article provides the latest clinically relevant information on the basic science of PRP and practical considerations for its use, evidence for PRP use in musculoskeletal medicine, recommendations for PRP preparation and patient selection, as well as suggested postprocedure rehabilitation and return to sport protocols. The authors will identify the limitations in current knowledge of this regenerative therapy and recommend critical areas for future research.

BASIC SCIENCE AND RATIONALE

Definition of Platelet-Rich Plasma

PRP is a preparation of autologous plasma enriched with a platelet concentration above that normally contained in whole blood.¹ In clinical musculoskeletal medicine, PRP is classically prepared by centrifuging autologous, anticoagulated whole blood to separate its components and concentrate platelets above baseline levels. Typical protocols include either 1 or 2 centrifugation steps to separate whole blood into 3 layers: a top plasma layer, middle leukocyte layer, and bottom red blood cell (RBC) layer, to collect a concentrate of platelets in plasma.² The rationale for use and therapeutic potential of a high concentration of platelets is based on their capacity to supply and release supraphysiologic amounts of essential growth factors and cytokines from their alpha granules to provide a regenerative stimulus that augments healing and promotes repair in tissues with low healing potential.

Early Use of Platelet-Rich Plasma

PRP therapy has gained popularity in regenerative medicine and other specialties since the earliest reports of its clinical use in the 1980s and 1990s, with applications traced to the fields of cardiac, dental, and maxillofacial surgery. In cardiac surgery, PRP was shown to be an effective autologous source for transfusion to address surgical blood loss and hematologic derangements from cardiopulmonary bypass.^{3,4} In dentistry, Anitua⁵ demonstrated application of PRP to tooth extraction sites facilitated bone regeneration in these sockets with compact mature bone that had normal morphology. In maxillofacial surgery, Marx and colleagues⁶ evaluated the effect of PRP on bone maturation rate and bone density in bone graft reconstructions of mandibular continuity defects, demonstrating that addition of PRP to grafts resulted in increased bone formation.

Today in musculoskeletal and sports medicine, PRP therapy has become highly attractive for its potential benefit and influence on repairing injured tissue, treating a wide range of degenerative disorders, and accelerating return to sport, finding its role as an injectable biologic used to augment healing of tendon, ligament, muscle, and cartilage.⁷

Basics of Wound Healing

The utility of PRP in promoting healing is especially significant for tendons, ligaments, and cartilage, the repair processes of which can be particularly slow and poor due to their limited blood supply and slow cell turnover.^{8,9} In general, wound healing can be separated into 3 phases: inflammation, proliferation, and remodeling.¹⁰ The initial inflammation phase is characterized by hemostasis, with platelets establishing clot formation, and the release of growth factors that aid in activating and attracting inflammatory cells like neutrophils and macrophages to the site of injury. The proliferation phase is characterized by the construction of an extracellular matrix associated with granulation, contraction, and epithelialization.^{7,10} Finally, the remodeling phase is associated with production of collagen and scar tissue. The physiologic progression

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