Platelet-rich Plasma (PRP) Injections Coupled with Non-rigorous Exercise to Rehabilitate Patellar Tendinopathy (Jumper’s Knee)

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What is Patellar Tendinopathy?

❖ Commonly referred to as “Jumper’s Knee”
❖ Due to repetitive compressive stresses on the patellar tendon
❖ Leads to structural degeneration of the tendon
  ➢ Painful
  ➢ Loss of mechanical strength

Prevalence of Injury

- Very common in sports that require frequent jumping (volleyball, basketball)
- Study by the Oslo Sports Trauma Research Center showed evidence of patellar tendinopathy in 44.6% ± 6.6% of men’s volleyball players and 31.9% ± 6.8% of men’s basketball players.

Physics of Injury

- Ground reaction forces (GRF) are greater in the landing phase
- Counteracted by eccentric contractions of the quadriceps
- Repetitive jumping and poor landing techniques place compressive stresses on the patellar tendon leading to microtears in the tendon
- Eccentric quadricep strength and ankle dorsiflexion velocity in landing play major roles in susceptibility to patellar tendinopathy.
Biology of Injury

Normal Tendon

Affected Tendon

Goals/Aims

❖ Use Platelet-Rich Plasma injections to increase the speed and efficacy of the healing process
➢ Optimize growth factor concentrations
❖ Identify specific Physical Therapy program to promote healing and prevent future injury through strengthening.
❖ Shorten time spent in recovery and reduce the risk of re-injury to the tendon post-treatment.
Current Treatment & Motivation

❖ Corticosteroids & other steroid hormones:
  ➢ May reduce inflammation, shows no evidence of tendon strength/growth
  ➢ Known to affect the cardiovascular, gastrointestinal, and renal systems

❖ Physical Therapy:
  ➢ Inefficient for recovery time, pain was often only temporarily gone even after 3 month rehabilitation period
Previous Investigations: PRP

- Plasma centrifuged from 150-mL blood sample.
  - Produced 20-mL of plasma
- 6.5 ± 1.5 million platelets were administered per injection
- Plasma was enhanced with CaCl to activate platelets
- Subjects showed significant improvement within 6 months, especially those with long-term patellar tendinopathy.
- Concluded that the process has potential as a treatment for patellar tendinopathy, but more studies must be done to optimize the components of the plasma.

The roles of growth factors in tendon and ligament healing [13]
- TGF-\(\beta\) and PDGF-AA are primary constituents in the healing process

Addition of Hyaluronic Acid to PRP increases TGF-\(\beta\) and PDGF-AA growth factors [15]
- 31.9 ± 4.8 μg/mL (TGF-\(\beta\) Day 5, PRP+HA) vs 24.1 ± 5.2 μg/mL (TGF-\(\beta\) Day 5, PRP)
- 2.69 ± 0.70 μg/mL (PDGF-AA Day 5, PRP+HA) vs 1.48 ± 0.46 μg/mL (PDGF-AA Day 5, PRP)

Study comparing single injection of PRP versus two consecutive injections
- Two consecutive injections showed much higher VISA-P and Tegner scores. [14]
Shortcomings

- Previous PRP research offers reasoning to believe that PRP will improve strength and repair rate; however, there is little tested evidence to prove this.
- Variations of PRP provide confusion of which ones are most effective.
- Release of growth factors from platelets was often mistimed or simply unaccounted for.
Experimental Proposal

- 3 separate groups containing 10 people each:
  - Control: Basic steroid injection + Phys Th.
  - Experimental 1: PRP + Phys Th.
  - Experimental 2: PRP + Hyaluronic Acid + Phys Th.

- There will be check-ups to track the patient’s pain tolerance over a 2-month period.

- Success of the treatment will be based on the results of a Tegner score and a VISA score.
Methodology 1: PRP

Steps for PRP injection:
1. Blood is drawn from patient (~34mL)
2. Blood is centrifuged once and the RBCs are separated
3. The resulting WBC and plasma layer are centrifuged
4. The top ⅔ of the tube are removed (PPP), leaving ~5mL of ready PRP after homogenization
5. PRP is injected into the site. Hyaluronic acid will be injected 10 minutes after the PRP.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4338460/
Methodology 2: Physical therapy

❖ Eccentric Exercises to strengthen the quadriceps and surrounding muscle groups
❖ Exercises utilized will start easy, weight will be augmented as the pain reduces in a patient
❖ The exercises will promote the following:
  ➢ Flexibility in tendon from stretching
  ➢ Tendon tolerance with body weight exercises
  ➢ Eccentric strength in hamstring, quadriceps, and calves
Examples of Exercises

https://www.precisionmovement.coach/rectus-femoris-stretch/


Data & Expected Results

- We will measure improvement based on how tolerable the patient’s tendon becomes over time (VISA/Tegner Score)
- We expect the recovery period to decrease the most with PRP doped with hyaluronic acid as well as demonstrate the largest increase in tendon durability
References