## Comparison of Single Versus Serial Platelet-Rich Plasma Injections on Osteochondral Repair in a Rabbit Model

Youichi Yasui<sup>1</sup>, John Frederick Dankert<sup>2</sup>, Ichiro Tonogai, Margaret Goodale, Nathaniel Mercer, Lisa Fortier, John G Kennedy<sup>3</sup>

<sup>1</sup>Teikyo University School of Medicine, <sup>2</sup>NYU Langone Health, <sup>3</sup>New York University

INTRODUCTION: Biological adjuvants such as platelet-rich plasma (PRP) have shown promise in enhancing healing, reducing inflammation, and restoring joint homeostasis after musculoskeletal injuries. PRP contains growth factors and cytokines that promote tissue repair. This study aims to evaluate the effects of single versus serial PRP injections on cartilaginous repair tissue, subchondral bone remodeling, and inflammatory cytokine expression in joint synovium.

METHODS: Forty-eight New Zealand White rabbits were randomized into three groups: single PRP injection (1P, n=18), two PRP injections (2P, n=18), and three PRP injections (3P, n=12). Full-thickness cartilage defects were created on the medial condyles of both knees. PRP was injected into the right knee immediately post-surgery (1P, 2P, 3P), at 2 weeks (2P, 3P), and at 4 weeks (3P). Left knees served as controls. Rabbits were euthanized at 3, 6, and 12 weeks. Cartilage repair was assessed using Goebel macroscopic and modified ICRS histological scores. Subchondral bone remodeling was evaluated via micro-CT, and cytokine levels were quantified using qPCR.

RESULTS: At 3 and 6 weeks, macroscopic evaluation showed improved scores in the 1P and 2P groups compared to controls, though not statistically significant. At 12 weeks, the 3P group had significantly better macroscopic scores than controls (control:  $6.1 \pm 3.3$ ; 1P:  $3.4 \pm 2.7$ ; 2P:  $4.2 \pm 2.9$ ; 3P:  $0.7 \pm 1.5$ ). Histological assessment showed significant improvements in all PRP groups compared to controls at each time point. At 3 weeks, modified ICRS scores were: control:  $2.6 \pm 1.8$ , 1P:  $8.2 \pm 1.5$ , 2P:  $10.7 \pm 2.0$ . At 6 weeks: control:  $3.4 \pm 3.6$ , 1P:  $9.8 \pm 1.5$ , 2P:  $11.6 \pm 1.1$ , 3P:  $10.0 \pm 1.7$ . At 12 weeks: control:  $3.7 \pm 2.8$ , 1P:  $11.4 \pm 1.3$ , 2P:  $12.8 \pm 2.5$ , 3P:  $14.0 \pm 1.6$ . No significant differences were observed among PRP groups. Micro-CT and cytokine expression levels showed no significant differences between groups. DISCUSSION AND CONCLUSION:

Serial PRP injections do not offer significant benefits over a single injection for osteochondral repair. While PRP enhances cartilaginous repair tissue quality, additional injections do not improve macroscopic tissue appearance, subchondral bone healing, or inflammatory cytokine expression levels. A single PRP injection is sufficient with bone marrow stimulation for treating osteochondral lesions. Future studies should focus on long-term outcomes to optimize PRP treatment protocols. This study supports the streamlined use of PRP, providing an effective and efficient approach to improving cartilage repair without the need for multiple injections.

