Comparison of the Acute Inflammatory Response of Two Commercial Platelet-Rich Plasma Systems in Healthy Rabbit Tendons

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Investigation performed at Stanford University, Palo Alto, California

Background: Numerous studies have shown platelet-rich plasma (PRP) preparations differ with respect to the inclusion of certain blood components, which may affect the host's cellular response.

Hypothesis: This study evaluated the inflammatory effect of Biomet GPS III leukocyte-rich PRP (LR-PRP) versus MTF Cascade leukocyte-poor PRP (LP-PRP) after intratendinous injection in an animal model. The authors anticipated that LR-PRP would incite a greater acute inflammatory response than LP-PRP.

Study Design: Controlled laboratory study.

Methods: A total of 17 skeletally mature New Zealand White rabbits were tested. In all cases, healthy patellar tendons were treated. In the control animals, one patellar tendon was injected with 2 mL autologous whole blood, and the other was injected with 2 mL sterile saline. Seven total tendons were injected with whole blood, and 7 tendons were injected with saline. In the experimental animals, one patellar tendon was injected with 2 mL LR-PRP, and the other was injected with 2 mL LP-PRP. Ten tendons were injected with LR-PRP, and 10 tendons were injected with LP-PRP. Animals were euthanized at 5 or 14 days after injection. Tendons were harvested and stained using hematoxylin and eosin and scored semi-quantitatively for total white blood cells (WBCs), mononuclear cells (macrophages and lymphocytes), polymorphonuclear cells (PMNs), vascularity, fiber structure, and fibrosis.

Results: At 5 days after injection, tendons treated with LR-PRP had significantly greater overall tendon scores (6.3 ± 1.79 vs 1.8 ± 1.64, P = .012), as well as mean scores for fiber structure (1.4 ± 0.22 vs 0.50 ± 0.50, P = .012), denoting disrupted composition, total WBCs (1.1 ± 0.89 vs 0.10 ± 0.22, P = .014), mononuclear cells (macrophages and lymphocytes) (0.80 ± 0.45 vs 0.10 ± 0.22, P = .014), vascularity (1.7 ± 0.27 vs 0.80 ± 0.16, P = .008), and fibrosis (1.0 ± 0.35 vs 0.3 ± 0.45, P = .037) compared with tendons treated with LP-PRP. Otherwise, there were no significant differences in mononuclear cells (P = .590), PMN cells (P = .100), total WBCs (P = .811), vascularity (P = .650), or total tendon score (P = .596) in any of the treatment groups at 14 days.

Conclusion: Compared with leukocyte-poor Cascade PRP, leukocyte-rich GPS III PRP causes a significantly greater acute inflammatory response at 5 days after injection. There is no significant difference in the inflammatory response or cellularity regardless of the injection type at 14 days after intratendinous injection.

Clinical Relevance: Platelet-rich plasma injections are frequently prepared using commercial systems and are administered for clinical treatment of chronic tendinopathy. It is important to characterize the cellular responses elicited by different injection preparations to further understand their effect on tissue healing and aid clinical decision making. Future investigations are necessary to apply these findings to the clinical setting.

Keywords: platelet-rich plasma; inflammation; tendinopathy; injection; leukocytes; rabbits

Over the past two decades, platelet-rich plasma (PRP) has been regarded as a powerful hemostatic and adhesive agent. Recently, PRP has spurred clinical interest as a concentrated source of autologous growth factors (GFs) that may facilitate accelerated healing and regeneration in a variety of tissues. The administration of PRP has been shown to improve recovery from musculoskeletal procedures and injury. However, it has been difficult to achieve consensus regarding its clinical efficacy because the formulation of PRP in these studies varies considerably.

Dohan Ehrenfest et al first identified substantial differences in various platelet concentrates used in the literature. Many basic science studies create PRP using a double-centrifugation laboratory technique, but this is not typical in the clinical setting. More recent investigations have focused on elucidating the differences in platelet
determine leg dominance in alpine skiing. In general, the potential for injured skiers to forget exactly what happened and give erroneous answers has to be mentioned.

CONCLUSION

Based on these findings, female skiers showed a 2-fold higher risk of sustaining an ACL rupture on their nondominant leg. Therefore, leg dominance seems to be a risk factor for noncontact ACL injuries in female recreational skiers.

REFERENCES

and GF concentrations produced by commercial PRP separation systems.11 Attempts to improve the understanding of clinical PRP treatment. A recent study by Castillo et al.2 examined the cellular contents of PRP produced by 3 commercially available separation systems with a specific emphasis on white blood cell (WBC), platelet, GF, and fibrinogen concentrations. Most notably, the authors found significant differences in WBC concentrations of the PRP produced by the 3 separation systems.2 These findings have highlighted the importance of defining the contents of PRP injections to improve the understanding of why PRP may or may not be a useful treatment option. The inclusion of the WBC fraction in PRP preparations may increase GF yield but may also lead to increased inflammation and possibly a delayed healing response. Several recent studies have shown that delivery of concentrated leukocytes as a therapeutic intervention may not optimize the environment for tissue healing or repair.10,29,20 The purpose of this study was to examine the cellular contents of leukocyte-rich PRP (LR-PRP) versus leukocyte-poor PRP (LP-PRP) after intratendinous injection in an animal model using commercially available PRP preparation systems.

**MATERIALS AND METHODS**

**Animal Care and Use**

A total of 22 skeletally mature New Zealand White rabbits weighing an average of 4.4 kg were obtained from a commercial breeder (Myrtle's Rabbitry, Inc, Thompsons Station, TN). Animal care and use before, during, and after procedures complied with the guidelines set forth by the Administrative Panel on Laboratory Animal Care (APLAC).

**Sample Collection**

For blood collection procedures, rabbits were anesthetized using an intramuscular injection of ketamine hydrochloride (35 mg/kg), xylazine (5 mg/kg), and atropine sulfate (0.2 mg/kg). Anesthesia was maintained with inhalation of isoflurane at 1% to 3%. Each ear was cleaned and prepped using Betadine solution. Topical lidocaine jelly (4%) was applied to aid vasodilation. A 22-gauge catheter was placed in the central ear artery after anesthetization, and 37 mL whole blood was collected from all animals. In the control cohort, 1 mL was analyzed for red cell (RBC), WBC, and platelet counts (Abbott Cell-Dyn 3500; Abbott Laboratories, Inc). As injection media was delivered to the remainder 34 mL was discarded. In the experimental cohort, 1 mL was analyzed (above), 27 mL was collected into a 60-mL syringe preloaded with 3 mL ACD-A anticoagulant for creation of LR-PRP, and 9 mL was collected into a 10-mL syringe preloaded with 1 mL sodium citrate for creation of LP-PRP.

**Preparation of Platelet-Rich Plasma**

Multiple commercial systems are currently available for creating PRP with varying concentrations of platelets and leukocytes. In this study, we specifically evaluated 2 commercial systems: LR-PRP (GPS III Mini; Biomet Biologics, Inc, Warsaw, Indiana) and LP-PRP (Cascade; MTF Sports Medicine, Edison, New Jersey) were prepared using the protocols provided by the manufacturers. We will continue to refer to these PRP variations as LR-PRP and LP-PRP, but it should be noted that they may not be possible to draw overarching conclusions regarding leukocyte-poor versus leukocyte-rich PRP based on the use of only 2 commercial systems in the present study. After sample preparation, approximately 1 mL of each PRP was analyzed using species-specific settings for RBC, WBC, and platelet counts (Abbott Cell-Dyn 3500; Abbott Laboratories, Inc).

**Injection Procedure**

Healthy patellar tendons were injected, as there is no well-validated chronic tendinopathy animal model. Because there is no literature consensus on the optimal volume for PRP or whole blood intratendinous injections, a volume of 2 mL was used for all injections to ensure that enough injection media was delivered to the healthy tendon to induce a response. All injections were performed slowly with a 25-gauge needle and administered throughout the patellar tendon with 10 needle passes by a board-certified orthopaedic surgeon to ensure that the entire tendon was exposed to injection media (Figure 1).

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TABLE 1
Number of Tendons Analyzed per Cohort at 5 Days, 14 Days, and in Total

<table>
<thead>
<tr>
<th>Cohort</th>
<th>5 Days</th>
<th>14 Days</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saline</td>
<td>4</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Whole blood</td>
<td>4</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>LR-PRP</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>LP-PRP</td>
<td>5</td>
<td>6</td>
<td>10</td>
</tr>
</tbody>
</table>

*LP, leukocyte poor; LR, leukocyte rich; PRP, platelet-rich plasma.

Eight rabbits (18 tendons) were included in the control cohort. Eight patellar tendons were injected with 2 mL autologous whole blood, and 8 were injected with 2 mL sterile saline. One rabbit (2 tendons) experienced perianesthetic complications resulting in death within 24 hours of the injection procedure and was consequently not included in the analysis. In the 14 experimental rabbits, 14 patellar tendons were injected with 2 mL LR-PRP and 14 were injected with 2 mL LP-PRP. One rabbit (2 tendons) experienced perianesthetic complications resulting in death within 24 hours of the injection procedure and was consequently not included in the analysis. Overall, 10 tendons were included in the LR-PRP cohort (5 at 5 days, 5 at 14 days), and 10 tendons were included in the LP-PRP cohort (5 at 5 days, 5 at 14 days). The remaining 6 tendons (3 LR-PRP, 3 LP-PRP) were excluded from analysis because they were injected with media that did not meet the definition of PRP due to a platelet count below whole blood. This was likely due to clotting in the syringe during blood collection. Table 1 shows the number of tendons included for analysis in each group.

After injection procedures, animals were housed in individual cages without mobility restrictions. Two euthanasia time points were chosen. The first was performed at 5 days after injection to evaluate the acute inflammatory response of the host. The typical life span of the rabbit leukocyte is less than 5 days, so only host response cells would be present in the tendon at this time. The second harvest was performed at 14 days to evaluate chronic inflammation.

Specimen Preparation

Animals were euthanized at 5 or 14 days after the injection procedure using a combination of ketamine hydrochloride (35 mg/kg) and intravenous Beuthanasia-D Special (100 mg/kg) (Schering-Plough Animal Health Corp, Union, New Jersey). After euthanasia, the entire patellar tendon was removed en bloc via transection of the tendon of the quadriceps proximal to the patella and transection of the patellar ligament at its insertion point on the tibial tuberosity. The tendon was then transected into 2-mm sections. The specimens were then fixed in 10% neutral buffered formalin for a minimum of 48 hours before processing. Tissue was then paraffin embedded, cut into 5-μm-thick sections and stained using hematoxylin and eosin (H&E).

Analysis

Two independent, blinded pathologists scored tendon morphologic characteristics and cell infiltration using the semi-quantitative grading scheme outlined in Table 2. This grading scale was modified from the tendon inflammation scoring system published by Kartus et al. Higher scores for individual variables and total tendon score correspond with increased inflammatory response. Tendons were evaluated at 40 and 400 times magnification, and 4 high-powered sections were chosen for evaluation based on identification of a “treatment effect,” which was defined as the presence of needle tracks or local tissue destruction correlating with a needle puncture site. Assessment of mononuclear (macrophage and lymphocyte) and polymorphonuclear (PMN) cell infiltration was chosen to classify the cellular response as chronic or acute, respectively. Vascularity and fiber structure disruption served as markers of the early inflammatory phase, whereas the amount of fibrosis assessed tissue remodeling. Reader scores were averaged for analysis.

Both cell count and semi-quantitative score data distributions were evaluated for normality using the Shapiro-Wilk test. Cell count data were normally distributed and further analyzed using 1-way analysis of variance (ANOVA) with Bonferroni post hoc testing. Semi-quantitative scores were found to have a non-normal distribution. Because the primary research question was whether semi-quantitative scores for LR-PRP- and LP-PRP-treated tendons differed significantly, semi-quantitative scores for tendons treated with LR-PRP and LP-PRP were analyzed using non-parametric independent samples Mann-Whitney U tests with results considered significant at P < .05. Secondary subcomparisons using the same methodology were conducted to compare LR-PRP and LP-PRP with both saline and whole blood-treated control tendons. Correlations of semi-quantitative scores with both leukocyte and platelet counts and platelet/leukocyte ratios were assessed using Spearman correlations.

RESULTS

Preinjection Analysis

Across all treatment categories, the average platelet count (APC) for LP-PRP (2093.5 ± 637.5 K/μL) was significantly greater than the APC for whole blood (285.3 ± 69.2 K/μL, P < .001) and LR-PRP (564.9 ± 129.2 K/μL, P < .001). The mean WBC count for LR-PRP (21.53 ± 9.4 K/μL) was also significantly greater than the mean WBC count for whole blood (2.61 ± 0.78 K/μL, P < .001) and LP-PRP (0.6303 ± 0.475 K/μL, P < .001). The differences in both APC and mean WBC count between whole blood and LP-PRP were not significant (P = .506, P = 1.00, respectively). Mean RBC count was significantly greater in whole blood (5.54 ± 0.6 K/μL) compared with LR-PRP (0.964 ± 1.02 K/μL, P < .001) and LP-PRP (0.079 ± 0.067 K/μL, P < .001). Compared with LP-PRP, the mean RBC count
Variable | Platelet, K/|j/L | RBC, K/|j/L | WBC, K/|j,L |
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vascularity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fiber structure</td>
<td>Dense</td>
<td>Slight</td>
<td>Moderate</td>
<td>Severe</td>
</tr>
<tr>
<td>Fibrosis</td>
<td>None</td>
<td>Mild</td>
<td>Moderate</td>
<td>Severe</td>
</tr>
</tbody>
</table>

**TABLE 3**

Average Values for WBC, Platelet, and RBC Counts Across All Treatment Categories

| Variable | WBC, K/|j,L | Platelet, K/|j,L | RBC, K/|j,L |
|---|---|---|---|---|
| Saline | 2.61 | 285.3 | — | — |
| Whole blood | — | — | 5.54 | — |
| LR-PRP | 21.52 | 2093.5 | 0.96 | — |
| LP-PRP | 0.83 | 584.9 | 0.079 | — |

*LP, leukocyte poor; LR, leukocyte rich; PRP, platelet-rich plasma; RBC, red blood cell; WBC, white blood cell; —, no data.*

**Day 5 Tendon Scoring**

At 5 days after injection, tendons treated with LR-PRP had significantly greater overall tendon scores (0.89 ± 0.10 ± 0.22, P = .014), vascularity (1.7 ± 0.27 ± 0.45, P = .016), and fibrosis (1.0 ± 0.35 ± 0.45, P = .007) compared with tendons treated with LP-PRP. No significant difference was observed in PMN scores (P = .317). Compared with whole blood, tendons treated with LR-PRP had significantly greater vascularity (1.7 ± 0.27 ± 0.45, P = .027), fibrosis (1.0 ± 0.35 ± 0.45, P = .027), and overall tendon scores (6.3 ± 1.79 ± 0.45, P = .014). Differences in WBCs (mononuclear cells, PMNs, and total count) and fiber structure disruption between tendons treated with LR-PRP and those treated with whole blood were not statistically significant (P > .05). Compared with saline, tendons treated with LR-PRP had significantly greater mean scores for fiber structure disruption (1.40 ± 0.29 ± 0.09, P = .007), mononuclear cells (0.80 ± 0.45 ± 0.22, P = .012), and total WBCs (0.5 ± 0.10 ± 0.22, P = .014) vs 0.10 ± 0.22, P = .024). Compared with whole blood-treated tendons, tendons treated with LP-PRP exhibited a significantly lower fiber structure score (0.5 ± 0.29 ± 0.10, P = .039), denoting less disruption of the fiber configuration. The total WBCs in whole blood-treated tendons were significantly greater than those treated with—LP-PRP (0.5 ± 0.10 ± 0.22, P = .024). Compared with saline treatment, LP-PRP-treated tendons exhibited significantly greater vascularity (0.8 ± 0.45 ± 0.22, P = .009) and total tendon scores (1.8 ± 1.64 ± 0.25, P = .022). Tendons treated with whole blood scored significantly higher than saline-treated tendons for fiber structure disruption (1.25 ± 0.29 ± 0.09, P = .014). Scores for total mononuclear cells and PMNs were not significantly different between whole blood and saline treatments (P > .05). Scores for LP-PRP-treated tendons were not significantly different in any other categories when compared with...
Average Tendon Scores for All Parameters at 5 Days After Injectiona

<table>
<thead>
<tr>
<th></th>
<th>PMN Cells</th>
<th>Mononuclear Cells</th>
<th>Total</th>
<th>Vascularity</th>
<th>Fiber Structure</th>
<th>Fibrosis</th>
<th>Total</th>
<th>P Value</th>
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<tr>
<td>LR-PRP</td>
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<td>0.8</td>
<td>1.1</td>
<td>1.7</td>
<td>1.4</td>
<td>1</td>
<td>6.3</td>
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<tr>
<td>LP-PRP</td>
<td>0</td>
<td>0.1</td>
<td>0.1</td>
<td>0.3</td>
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<td>0.3</td>
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<td>.012</td>
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<td>Whole blood</td>
<td>0.25</td>
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<td>.013</td>
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aP values reflect total tendon score compared with LR-PRP. LP, leukocyte poor; LR, leukocyte rich; PMN, PMN, polymorphonuclear; PRP, platelet-rich plasma; WBC, white blood cell; —, no data.

There were no significant differences in mononuclear cells (P = .590), PMNs (P = 1.00), total WBCs (P = .811), vascularity (P = .550), fiber structure (P = .238), or total tendon score (P = .536). LP-PRP-treated tendons did show a slight increase of fibrosis (2.0 ± 0 vs 1.3 ± 0.54, P = .054) compared with LR-PRP, but this was not statistically significant. Tendons treated with LP-PRP had significantly greater fiber structure (1.5 ± 0 vs 0.33 ± 0.29, P = .010) and fibrosis scores (2.0 ± 0 vs 1.0 ± 0.5, P = .010) than did whole blood–treated tendons, denoting disrupted fiber orientation. These trends in fiber (1.5 ± 0 vs 0.67 ± 0.58, P = .010) and fibrosis scores (2.0 ± 0 vs 1.33 ± 0.76, P = .010).
Acute Inflammatory Response of Two Commercial PRP Systems

**TABLE 5**

<table>
<thead>
<tr>
<th>WBCs</th>
<th>PMN Cells</th>
<th>Mononuclear Cells</th>
<th>Total</th>
<th>Vascularity</th>
<th>Fiber Structure</th>
<th>Fibrosis</th>
<th>Total</th>
<th>P Value</th>
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</thead>
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<td>0.7</td>
<td>1.6</td>
<td>1.1</td>
<td>1.3</td>
<td>5.3</td>
<td>...</td>
</tr>
<tr>
<td>LP-PRP</td>
<td>0</td>
<td>0.3</td>
<td>0.6</td>
<td>1.7</td>
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<td>2</td>
<td>6.6</td>
<td>.696</td>
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<tr>
<td>Whole blood</td>
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<td>0.5</td>
<td>1.17</td>
<td>0.33</td>
<td>1</td>
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<tr>
<td>Saline</td>
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<td>1.3</td>
<td>4.2</td>
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*P values reflect total tendon score compared with LR-PRP. LP, leukocyte poor; LR, leukocyte rich; PMN, PMN, polymorphonuclear; PRP, platelet-rich plasma; WBC, white blood cell; —, no data.

P = .051) were also observed when LP-PRP-treated tendons were compared with saline-treated controls. No other significant differences were observed between any of the treatment groups for any of the additional parameters (P > .05). These results are summarized in Table 5 and illustrated in Figure 3. Across treatment groups, total tendon scores did not correlate with WBC count (p = -.225, P = .460) or platelet count (p = .278, P = .358).

**DISCUSSION**

As the literature remains conflicted on the efficacy of PRP treatments, it is imperative to clearly define the contents of PRP formulations and improve our understanding of the roles played by various cellular components. Given that leukocytes release catabolic and inflammatory cytokines, recent investigations have begun to probe the role played by WBCs to better understand the effect they may have on clinical outcomes of PRP application. This study focused on the inflammatory response of healthy rabbit patellar tendons to various blood-derived injection media in attempt to elucidate the effect of administering leukocytes in PRP preparations. We found that LR-PRP created using Biomet GPS III caused a greater acute inflammatory response at 5 days after injection when compared with MTF Cascade LP-PRP, whole blood, and saline injections. However, at 14 days after injection, a significant difference was no longer observed between treatment groups.

Tendons in this study were scored using a semi-quantitative rubric modified from Kartus et al. (Table 2). The WBC scores served to differentiate the cellular response between acute and chronic inflammation; vascularity and fibrosis represented tissue remodeling. Higher scores for individual variables and total tendon score correspond with increased inflammatory response.

At 5 days after injection, we observed greater numbers of total leukocytes and mononuclear cells (macrophages and lymphocytes) in tendons treated with GPS III LR-PRP compared with those treated with Cascade LP-PRP. This hypercellularity suggests acute and accelerated recruitment of inflammatory cells following administration of GPS III LR-PRP, which may be due to the increased concentration of leukocytes, the significantly higher platelet count, the low platelet/WBC ratio, or a combination of these factors. We also observed increased vascularity, fibrosis, and disrupted fiber structure scores in tendons treated with LP-PRP. These findings corroborate those of Lyras et al., who found disrupted tendon structure and increased neovascularization following PRP treatment for both Achilles and patellar tendinopathies, even though the contents of the PRP preparation were not evaluated. Collectively, these results indicate a more pronounced acute inflammatory reaction in tendons treated with GPS III LR-PRP. Conversely, Cascade LP-PRP causes less acute inflammation than do LP-PRP and whole blood but greater than does an injection of saline.

However, at 14 days after injection, we did not observe significant differences between tendons treated with GPS III LR-PRP and those treated with Cascade LP-PRP. These findings suggest that the cellular response essentially equalizes at day 14, with decreasing cellularity in LR-PRP-treated tendons and increasing cellularity from the LP-PRP group. Interestingly, the overall scores from tendons treated with LP-PRP were higher than those treated with LR-PRP at 14 days after injection, although this difference was not statistically significant. This change was primarily due to increased scores for the fibrosis and vascularity subcategories compared with the values at day 5.

The literature is currently divided on the best injection therapy for treatment of tendinopathies; investigators have recently reported successful clinical outcomes in human patients using GPS III LR-PRP, and whole blood. Furthermore, a recent article reviewing patellar tendinopathy injection treatments found reports of improved clinical outcomes after 7 different injection therapies, including dry needling, autologous blood, PRP, and high-volume injections. Our study does not address the clinical effect of PRP therapy or evaluate the effect of PRP using an injury model. However, previous literature findings, coupled with the similar histologic response of tendons to all injection media at 14 days after injection in the present study, suggest that the cellular response may be more dependent on repeated tendon puncture or introduction of significant volume and less dependent on the precise composition of injection media. In fact, statistical analysis in the present study showed there was no correlation between platelet or WBC concentrations and total tendon scores at 14 days after injection.

Recent studies have shown that platelet concentration correlates with anabolic gene expression, growth factors, and...
anabolic cytokine signaling, whereas WBC concentration correlates with catabolic gene expression and catabolic cytokine signaling. These results suggest that increasing the platelet/WBC ratio in PRP may promote anabolism over catabolism and improve clinical outcomes. The results of our study at 5 days after injection support this theory: LR-PRP had a significantly lower platelet/WBC ratio and significantly higher tendon scores, indicating a greater inflammatory response when compared with LP-PRP. The inclusion of the WBC fraction in PRP preparations may have positive antimicrobial and GF-enhancing functions, which contribute to acute hypercellularity and angiogenesis. However, it is also possible that WBCs may increase pain and inflammation, ultimately prolonging tissue recovery and healing. It is unclear whether this early inflammation is ultimately harmful or beneficial for tendon healing. Furthermore, both LR-PRP and LP-PRP appear to have similar effects on the cellularity, fiber orientation, vascularity, and fibrosis of normal tendons at 2 weeks after injection, suggesting that the difference between these injections may not be significant in the long term.

Although the purpose of this study was to compare PRP treatments with and without leukocytes, the commercial kits used also produced PRP with significantly different platelet concentrations. Significant differences in platelet concentrations between various commercially produced PRP media have been previously documented. However, the difference in platelet concentrations between the 2 systems remains a confounding variable and makes broad generalizations between LR-PRP and LP-PRP based solely on leukocytes impossible. When interpreting the results shown in this study, the reader should note that different LR-PRP and LP-PRP commercial systems may not yield similar results.

The clinical ramifications of these findings, particularly with regard to the molecular healing mechanism of chronic tendinopathies, are not addressed by this study or the literature in general. Our study was also limited by the lack of a well-validated chronic tendinopathy model, which mandated that we examine the cellular response of healthy tendons instead of tendinopathy. Finally, we were limited by sample size and minimum blood volume requirements for the commercial PRP separation systems. A larger number of animals may have enabled us to detect more subtle differences at the 14-day time point, whereas lower blood volumes would have permitted the use of a smaller animal model and, subsequently, enabled us to increase our sample sizes. Future investigations are necessary to delineate the effect that LR-PRP and LP-PRP injections have on the early stages of the healing process. Given the lack of a chronic tendinopathy animal model, additional studies should ideally investigate the potential differences in clinical and functional outcomes in human patients treated with LR-PRP or LP-PRP for chronic tendinopathies. In place of histology, ultrasound may prove clinically useful for evaluating structural changes.

CONCLUSION

Intratendinous injection of Biomet LR-PRP causes a greater initial inflammatory response when compared with injections of MTF LP-PRP, whole blood, and saline at 5 days after injection. At 14 days after injection, all tendons showed increased cellularity, regardless of the injection they received. There was no significant difference in total tendon scores between treatments. Future investigations are necessary to apply these findings to the clinical setting.