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Original Article

Can platelet-rich plasma therapy save patients with ulnar collateral ligament tears from surgery?

Yuki Kato [a], Shin Yamada [a, *], Jover Chavez [b]

[a] Department of Sports Medicine, Kameda Medical Center, Japan
[b] Global Care Medical Center of Canlubang, Laguna, Philippines

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ABSTRACT

Introduction: Platelet-rich plasma (PRP) has been shown to be effective in treating partial tears of the ulnar collateral ligament (UCL) of the elbow in overhead throwing athletes, but it is still unknown whether it has a role in complete tears. The aim of this study was to assess the effectiveness of PRP in treating complete as well as partial UCL tears. We hypothesized that trephination of the injured UCL followed by injection with PRP can promote healing of both partial and complete tears.

Methods: Thirty-four baseball players with partial or complete UCL tears confirmed by magnetic resonance imaging (MRI) were included in the study. They were all recalcitrant to more than two months of rest and physical therapy. Under ultrasound guidance, trephination of the UCL was performed using an 18-gauge needle, followed by PRP injection. Visual analog scale (VAS) scores, Disabilities of the Arm, Shoulder, and Hand (DASH) sports module scores, and sonographic ulnohumeral joint space measurements with valgus stress were all obtained prior to the procedure and six months after.

Results: Twenty-six of 30 athletes were able to return to sport with pre-injury level of play within six months after the procedure, at an average time of 12.4 weeks (range: 10–18). Four subjects needed surgical treatment for persistent UCL insufficiency. The average follow-up was 54.2 weeks (range: 26–148). The average VAS and DASH scores improved from 53.5 to 17.2 ($p < 0.0001$) and from 81.7 to 24.2 ($p < 0.0001$), respectively. The average ulnohumeral joint space opening with valgus stress decreased from 3.81 mm to 3.45 mm ($p = 0.018$). Subgroup analysis by injury location revealed that the average VAS score improved from 48.2 to 8.6 ($p < 0.0001$) and from 64.0 to 34.5 ($p = 0.0023$) in proximal and distal tears, respectively. The average DASH score improved from 83.8 to 17.8 ($p = 0.0001$) and from 77.5 to 36.7 ($p < 0.0001$) in proximal and distal tears, respectively. The average ulnohumeral joint space opening with valgus stress decreased from 3.64 to 3.21 mm ($p = 0.003$) and from 4.14 to 3.92 mm ($p = 0.0023$) in proximal and distal tears, respectively. There was one case with a proximal tear that needed surgical management for failure of treatment, while there were three cases needing surgery in those with distal tears.

Conclusion: Ultrasound-guided PRP injection following trephination can be an effective treatment option for both partial and complete UCL tears of the elbow, especially proximal tears. The use of this technique for complete UCL tears may allow more athletes to avoid surgery and enable them to return to play faster.

1. Introduction

Platelet-rich plasma (PRP) therapy has recently become a popular element of regenerative medicine due to its potential to augment the healing process and thus accelerate recovery times. It has gained ground in the field of sports medicine and is effective in treating conditions such as lateral epicondylitis, chronic patellar tendinitis, and Achilles tendinitis [1–7]. PRP has also been shown to successfully treat partial tears of the ulnar collateral ligament (UCL)

Abbreviations: PRP, platelet-rich plasma; UCL, ulnar collateral ligament; VAS, visual analog scale; DASH, Disabilities of the Arm, Shoulder, and Hand; MRI, magnetic resonance imaging.

* Corresponding author. Department of Sports Medicine, Kameda Medical Center, 929 Higashi-cho, Kamogawa City, Chiba Prefecture 2968602 Japan. Fax: +81-4-7099-11.
E-mail address: shin23yamada@gmail.com (S. Yamada).

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of the elbow [8], which commonly occur in overhead, high-velocity throwing athletes such as baseball players [9]. In cases of complete tears, ligament reconstruction remains the standard of treatment, especially for high-performance athletes. However, despite being the prevalent practice worldwide for such cases, UCL reconstruction is reported to have high revision rates as well as delayed return to sport, sometimes lasting more than one year [10], both of which are catastrophic for an athlete.

Some institutions have started deviating from this norm by using PRP therapy even for complete UCL tears in attempts to avoid surgical reconstruction. Podesta and colleagues reported successful PRP therapy for 34 cases with complete UCL tears [8], while Dines and colleagues reported the same for their group of 44 cases [11]. Similarly, our institution uses PRP to treat both partial and complete UCL tears.

2. Methods

Thirty male athletes (5 professional and 25 amateur baseball players) with partial or complete UCL tears confirmed by magnetic resonance imaging (MRI) were followed up. All UCL injuries involved the patients' dominant arms. According to the MRI findings, nine patients had grade 1 UCL injury; 13 had grade 2; and eight had grade 3. They were all recalcitrant to more than two months of rest and physical therapy. The average age was 19.5 ± 2.9 years (range, 16–27). Patients were excluded if they had previous injury to the elbow and resulting complications, and if they previously underwent any elbow surgery.

Under ultrasound guidance, trephination of the UCL was performed using an 18-gauge needle, followed by PRP injection, which our institution routinely performs under the permission of the Ministry of Health, Labor, and Welfare (Cell processing facility number: FC3150890, class 3 PRP therapy plan number: PC3151033). In all cases, the PRP was prepared using the Autologous Conditioned Plasma (ACP™) Double Syringe system (Arthrex, Florida, USA), which yields leukocyte poor (LP)-PRP [12].

The visual analog scale (VAS) scores, Disabilities of the Arm, Shoulder, and Hand (DASH) sports module scores, and sonographic ulnohumeral joint space measurement with valgus stress were all determined prior to the procedure and six months after. They all followed the same rehabilitation protocol that emphasized regaining range of motion at week 2 post-procedure, resisted concentric exercises at week 3, UCL stress testing at week 5, strengthening and controlled overhead throwing at weeks 8–10, sport-specific training at weeks 10–12, and return to sport at weeks 12–14.

3. Results

Twenty-six of the 30 athletes were able to return to sport with pre-injury level of play within six months from the procedure at an average time of 12.4 weeks (range: 10–18), while four subjects needed surgical treatment for persistent UCL insufficiency. Of these 4 patients, 3 had grade 2 injuries and one had a grade 3 injury. The average follow-up was 54.2 weeks (range: 26–148). The average VAS and DASH scores improved from 53.5 to 17.2 ($p < 0.0001$) and from 81.7 to 24.2 ($p < 0.0001$), respectively. The average ulnohumeral joint space opening with valgus stress decreased from 3.81 mm to 3.45 mm ($p = 0.018$) (Fig. 1).

Subgroup analysis was done by injury location based on MRI findings. In 20 patients who had tears in the proximal portion of the UCL, the average VAS score improved from 48.2 to 8.6 ($p < 0.0001$). Their average DASH sports module score also improved from 83.8 to 17.8 ($p < 0.0001$). The average ulnohumeral joint space opening with valgus stress decreased from 3.64 to 3.21 mm ($p = 0.003$). In this group, there was one case with grade 2 UCL injury that needed surgical reconstruction for failure of conservative treatment (Fig. 2).

On the other hand, in the subgroup ten patients had tears in the distal portion of the UCL, the average VAS score improved from 64.0 to 34.5 ($p = 0.0023$). The average DASH sports module score also improved from 77.5 to 36.9 ($p = 0.0045$). The average ulnohumeral joint space opening with valgus stress decreased from 4.14 to 3.92 mm ($p = 0.56$). In this group, three cases needed surgical reconstruction for failure of conservative treatment. Of these 3 patients, 2 had grade 2 injuries and one had a grade 3 injury (Fig. 3).

4. Discussion

Considering that the benefit or harm of white blood cells in PRP treatments is concentration-dependent [12], the current study used a system that yields LP-PRP, which is synonymous to pure platelet-rich plasma (P-PRP) [13]. The authors opted against the use of leukocyte rich (LR)-PRP since it induces both anabolic and catabolic effects. These effects can lead to the degradation of tendon, ligament, muscle, and chondrocytes [14], which will adversely affect the outcomes of the study. The results justify the use of LP-PRP, leading to 30 of 34 patients (88%) avoiding surgical

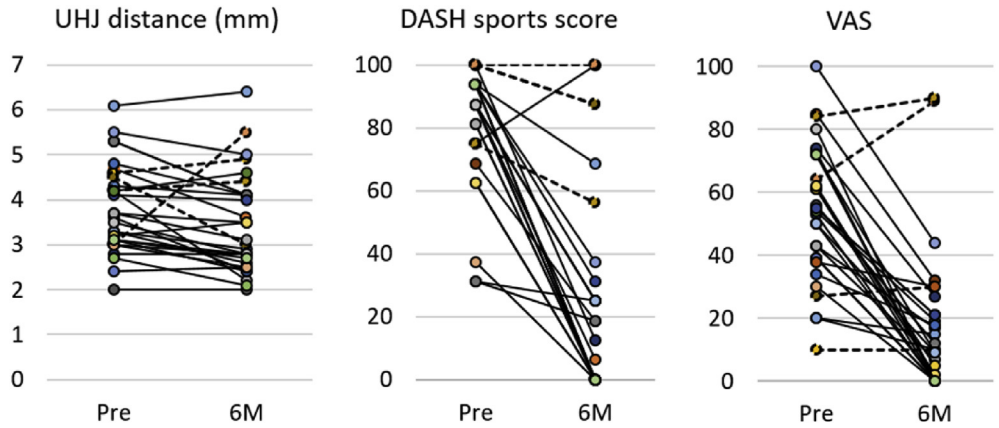

Fig. 1. All subjects (n = 30): comparison of ulnohumeral joint (UHJ) distance, DASH sports score, and VAS score at baseline and 6 months post-PRP. Dotted lines show the four patients who needed additional surgery after PRP injection. UHJ, ulnohumeral joint; DASH, Disabilities of the Arm, Shoulder, and Hand; VAS, visual analog scale; PRP, platelet-rich plasma.

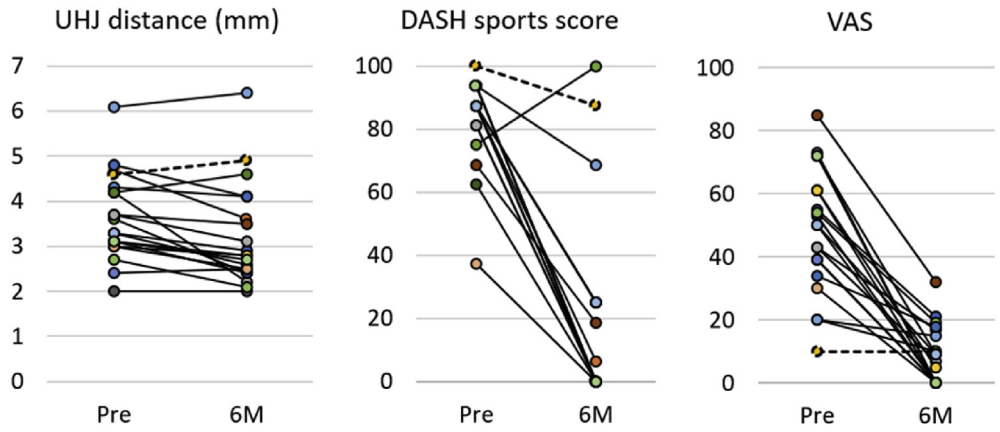

Fig. 2. Proximal UCL tear (n = 20): comparison of ulnohumeral joint (UHJ) distance, DASH Sports score, and VAS scale at baseline and 6 months post-PRP. A dotted line shows one patient who needed additional surgery after PRP injection. UCL, ulnar collateral ligament; UHJ, ulnohumeral joint; DASH, Disabilities of the Arm, Shoulder, and Hand; VAS, visual analog scale; PRP, platelet-rich plasma.

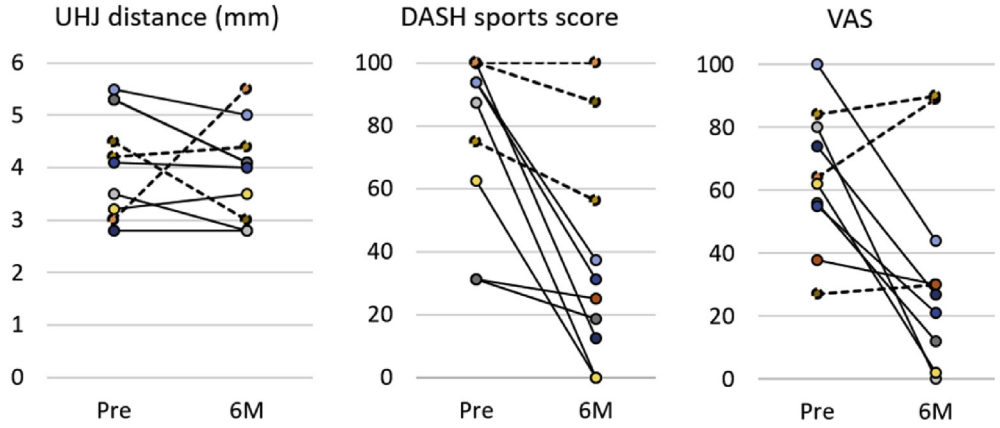

Fig. 3. Distal UCL tear (n = 10): comparison of ulnohumeral joint (UHJ) distance, DASH Sports score, and VAS score Figure at baseline and 6 months post-PRP. Dotted lines show the three patients who needed additional surgery after PRP injection. UCL, ulnar collateral ligament; UHJ, ulnohumeral joint; DASH, Disabilities of the Arm, Shoulder, and Hand; VAS, visual analog scale; PRP, platelet-rich plasma.

reconstruction and returning to play at an average time of 12.4 weeks.

In the four cases that required surgery for failure of conservative management, it should be noted that three of these (75%) had distally-located UCL ruptures, suggesting that LR-PRP therapy may be more effective for proximally-located tears. This difference in effect may be attributed to the close anatomical relationship of the proximal portion of the UCL with the overlying common flexor origin, both of which attach to the medial epicondyle of the humerus [15]. The common flexor tendon attachment to the medial epicondyle has been shown to be directly continuous with the proximal portion of the UCL, resulting in a single enthesis with no boundary between the two structures forming it [16]. This implies that an intact common flexor mass may somehow curtail any instability caused by a proximally-located UCL injury, which is consistent with the average ulnohumeral joint space measurements both prior to and six months after treatment. Further, it has been suggested that there is vascular proliferation near the bony interface of this enthesis with some vessels potentially able to communicate with those in the bone marrow [16]. This provides a more conducive condition for healing, either naturally or in an augmented state like that provided by PRP and local trephination. In contrast, the distal portion of the UCL lacks these protective features since it solely attaches to the sublime tubercle of the ulna.

The study has some limitations, one of which is its small population. A larger population would increase the power of the study and may better measure the response to treatment. The study is also limited by its lack of a control group, making blinded randomized controlled trials desirable and necessary in the future. Another limitation of the study is its use of a two-step, coupled procedure in treatment, making it more difficult to determine which step the efficacy actually should be attributed to. It is therefore necessary for future studies to determine whether the efficacy of treatment can be attributed to PRP alone, trephination alone, or both.

5. Conclusions

These encouraging results suggest that PRP has a therapeutic role even in complete tears of the UCL. While surgical reconstruction remains the standard of treatment, PRP therapy coupled with trephination of the UCL can save an athlete from season-ending surgery and extended time from play. It is a viable and safe option that can be performed in the clinic under ultrasound guidance. While this is particularly applicable for proximally-located tears, expectations should be managed for distally-located tears.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.reth.2019.02.004.

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