# Clinical Results of Hip Arthroscopy for Labral Tears: A Comparison Between Intraoperative Platelet-Rich Plasma and Bupivacaine Injection

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**Purpose:** The purpose of this prospective comparative study was to evaluate the effect of intraoperative platelet-rich plasma (PRP) injection on the outcomes of patients undergoing hip arthroscopy for labral treatment. **Methods:** During the period from November 2010 through March 2012, all patients undergoing hip arthroscopy for labral tears were considered for this study. The study group received intra-articular PRP at the end of the operation, and the control group received an intra-articular injection of 0.25% bupivacaine. Selection for the study group was based on the day of the week on which the patient underwent surgery. The protocol included administration of 4 hip-specific patient-reported outcome tools. Patients also reported their pain score on a visual analog scale from 0 to 10. Scores were recorded at the preoperative visit and at 3 months and 2 years postoperatively. **Results:** A minimum of 2 years' follow-up was available for 306 patients. Thirteen patients (4.2%) underwent conversion to total hip arthroplasty and 24 patients (7.8%) underwent revision hip arthroscopy, which left 91 patients in the study group and 180 patients in the control group. The study group had slightly higher pain scores than the control group (3.4 *v* 2.5) 2 years after surgery ($P = .005$). No difference in pain scores was identified at 3 months postoperatively. The 2-year modified Harris Hip Score was slightly lower in the study group (78.6) than in the control group (82.6) ($P = .049$). No significant difference was observed for the Hip Outcome Score—Activities of Daily Living, Hip Outcome Score—Sport-Specific Subscale, or Non-Arthritic Hip Score at any time point. There was no significant difference between groups for conversion to total hip arthroplasty or revision surgery. **Conclusions:** On the basis of the results of this study, intraoperative PRP injection does not appear to improve the clinical results of patients undergoing hip arthroscopy for labral treatment. **Level of Evidence:** Level II, prospective comparative study.

Labral tears and chondral injury in the hip are frequent sources of pain and disability. Arthroscopic chondrolabral treatment and correction of bony deformity have been shown to decrease pain and improve function in multiple studies.[1-3] Although most patients undergoing arthroscopic labral treatment fare well, a subset of patients continue to have pain; these patients may undergo conversion to total hip arthroplasty (THA) or undergo revision arthroscopy.[4] Under-corrected femoroacetabular impingement and dysplasia are risk factors for persistent pain after labral treatment; however, the rate of labral reinjury or incomplete healing is currently unknown.[5,6]

Platelet-rich plasma (PRP) has recently gained significant attention in orthopaedics and sports medicine as a modality to improve the healing environment.[7,8] The growth factors contained in PRP are necessary for tissue repair and healing.[9] The potential for PRP to improve clinical outcomes has generated enthusiasm for its use in multiple applications. To date, PRP has been studied in multiple orthopaedic settings including, but not limited to, rotator cuff repair, Achilles tendon repair, anterior cruciate ligament reconstruction, osteoarthritis of the knee, and elbow lateral epicondylitis.[10-16] The hypothesis that increased concentrations of growth factors contained in platelets may stimulate healing has proved effective in some studies, but many studies have shown

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no difference compared with controls.[10-16] To date, the strongest evidence to support the use of PRP is in the setting of lateral epicondylitis.[17,18]

Successful arthroscopic treatment of hip labral tears and chondral injury is dependent on multiple factors, which likely include the host healing response. Recent reports have documented improved clinical outcomes in patients undergoing labral repair compared with labral debridement.[19,20] The rate of labral repair failure is currently unknown, and evaluation for labral reinjury by magnetic resonance imaging (MRI) is complicated by postsurgical changes. This makes evaluation of various labral repair techniques and adjuncts to treatment difficult to evaluate. Chondral injuries during hip arthroscopy are typically treated with debridement or microfracture. Stabilization and repair of chondral injuries are also difficult to evaluate. Several reports have evaluated the potential of PRP to influence cartilage repair and osteoarthritis.[21,22] Ultrasound-guided hip PRP injections have been shown to be beneficial, although well-designed controlled trials are lacking.[23]

To our knowledge, no study has evaluated the use of PRP in the setting of arthroscopic hip surgery. It stands to reason that the addition of growth factors to an environment that requires chondrolabral healing may improve clinical outcomes. The purpose of this prospective comparative study was to evaluate the effect of PRP on the outcomes of patients undergoing hip arthroscopy for labral treatment. We hypothesized that PRP administration after arthroscopic procedures of the hip could result in improved outcome scores at 3 months and 2 years.

## Methods

### Study Design

During the study period from November 2010 through March 2012, all patients undergoing hip arthroscopy for labral tears were considered for this study. The inclusion criteria were all patients undergoing arthroscopic hip surgery with labral tears during the study period and a minimum of 2 years' follow-up. The exclusion criteria were revision surgery, gluteus medius repairs, labral reconstructions, Workers' Compensation cases, advanced arthritis, and previous hip conditions. Previous hip conditions were defined as avascular necrosis, Perthes disease, connective tissue disorders, pigmented villonodular synovitis, inflammatory arthritis, and synovial chondromatosis. During the study period, patients underwent surgery at 3 hospitals. Selection for the study group was based on the day of the week on which the patient underwent surgery. On 1 of 3 operative days of the week, PRP was administered to all patients at the conclusion of hip arthroscopy. On all other operative days, patients received intra-articular injection of 20 mL of 0.25% bupivacaine at the conclusion of hip arthroscopy. This led to approximately a 2:1 ratio of patients in the control group to patients in the study group. For this reason, the study was designed as a comparative study with randomization by date, considered Level II Evidence. The study group comprised the patients receiving PRP, whereas the control group was made up of patients receiving local anesthetic. No attempt to randomize patients by age, gender, or indication was used. Hip arthroscopy equipment, indications, and procedures were identical among hospitals. Institutional review board approval and patient informed consent were obtained.

### Indications for Surgery

The indications for surgery were severe pain interfering with the activities of daily living and failure to respond to nonoperative treatments for a minimum of 3 months, including physical therapy and anti-inflammatory medications. Physical examination findings of a labral tear, such as a positive anterior impingement sign, were positive in all patients. All patients had preoperative radiographs, as well as preoperative MRI scans, documenting a labral tear.

### Surgical Technique

All surgical procedures were performed by the senior surgeon (B.G.D.) with patients in the supine position. Diagnostic arthroscopy was first performed to check for loose bodies, chondral defects, labral tears, synovitis, ligamentum teres tears, and additional intra-articular pathologies. If needed, cam and pincer lesions were corrected under fluoroscopic guidance, with acetabuloplasty and femoral osteoplasty, respectively. Labral tears were repaired when possible. Otherwise, they were selectively debrided until a stable labrum was achieved. Unstable chondral damage was treated with debridement to a stable border, and in cases with exposed bone, a microfracture was performed with an awl. Patients underwent selective capsular closure and plication based on the potential for hip instability. Patients with refractory lateral-sided hip pain and gluteus medius tendon tears also underwent peritrochanteric endoscopy. Intraoperative data included the presence and size of concomitant labral tears and the presence and location of articular cartilage lesions, ligamentum teres tears, trochanteric bursitis, and gluteus medius tears. Chondral damage data were collected using the Acetabular Labrum Articular Disruption and Outerbridge classifications.[24,25]

### PRP Administration

The study group received a plasma-based PRP solution (Arthrex, Naples, FL) that was administered according to the manufacturer's instructions. This PRP solution contains a platelet concentration 2 to 3 times the level of whole blood and contains minimal to no white blood cells. The PRP injection did not contain

local anesthetic. No activator was used in this study. A peripheral blood sample of 16 mL was withdrawn from the patient into a specific double-barrel syringe. The syringe was placed in a centrifuge for 5 minutes and spun at 1,500 rpm. Then, the white layer containing plasma and platelets was aspirated, creating 4 to 7 mL of PRP extract for injection. The administration was performed after wound closure by a spinal needle that was placed previously under arthroscopic visualization at the capsulotomy site. During the other 2 surgical days, patients undergoing hip arthroscopy were administered 20 mL of 0.25% bupivacaine solution by a similar administration technique.

### Rehabilitation

The goals of rehabilitation were to protect repaired tissue, restore range of motion, prevent muscular inhibition or gait abnormalities, and diminish any pain or inflammation. Patients were placed in a hip brace (DJO Global, Vista, CA) for a minimum of 2 weeks after surgery. Patients were restricted to 20 lb of flat-foot weight-bearing activity for 2 weeks.[26] Patients undergoing microfracture were restricted to 20 lb of partial weight bearing for 6 weeks. The protocol included continuous passive motion for the first 6 weeks. A slow progression to full strength and activity occurred over a 3- to 4-month period.

### Outcome Measures

The protocol included presurgical administration of 4 hip-specific patient-reported outcome (PRO) tools: the modified Harris Hip Score (mHHS),[27] the Non-Arthritic Hip Score,[28] the Hip Outcome Score—Activities of Daily Living, and the Hip Outcome Score—Sport-Specific Subscale.[29] Patients also reported their pain score on a visual analog scale from 0 to 10, where 0 was considered no pain at all and 10 was considered the worst possible pain. Scores were recorded at the preoperative visit and at 3 months and 2 years postoperatively.

### Complications

A record of all patients who underwent conversion to THA or underwent revision surgery was kept during the study period.

### Statistics

A $\chi^2$ analysis was used to compare categorical data such as gender and chondral damage scores between groups. A 2-tailed paired $t$ test was used to assess changes in preoperative and postoperative scores. A 2-tailed independent $t$ test was used to compare scores between the study and control groups. $P < .05$ was considered significant. Statistical analysis was performed with Microsoft Office Excel 2007 (Microsoft, Redmond, WA). A power analysis was performed using a previous study with a mean difference in the mHHS of 9 points and an SD of 16 points.[30] With these values and assuming a power of 0.8 with $P < .05$ considered significant, a 2:1 allocation of patients would require 39 patients in one group and 78 in the other group.

## Results

### Demographic Data

During the study period, 380 patients underwent surgery for labral tears and met the inclusion criteria. A minimum of 2 years' follow-up was available for 306 patients (81%). Thirteen patients (4.2%) underwent conversion to THA and 24 patients (7.8%) underwent revision hip arthroscopy, which left 91 patients in the study group and 180 patients in the control group. Patient demographic data are shown in Table 1. No significant differences between groups were noted for age, gender, or body mass index. Preoperative PRO scores and visual analog scale scores were similar between groups. Chondral injury in the 2 groups is reported in Table 2, and no differences could be identified between groups.

Table 3 shows the types of labral treatment within each group, as well as concomitant procedures performed. No difference in the ratio of labral repair to debridement was identified between groups. The control group underwent more acetabuloplasties than the study group, 137 (76%) versus 55 (60%) ($P = .007$). No differences were noted for femoroplasty, microfracture, or iliopsoas release rates.

No difference in pain scores was identified at 3 months postoperatively. The study group showed significantly higher pain scores than the control group (3.4 *v* 2.5) 2 years after surgery ($P = .005$) (Fig 1). The 2-year mHHS was slightly lower in the study group (78.6) than in the control group (82.6) ($P = .049$). No difference in the 3-month mHHS was observed between groups. No significant difference was observed for the Hip Outcome Score—Activities of Daily Living, Hip

**Table 1.** Demographic Characteristics of Patients

| | Study Group | Control Group | *P* Value |
|---|---|---|---|
| No. of patients | 104 | 202 | |
| Age, yr | 36.0 | 36.5 | .744 |
| Gender, n | | | .306 |
| Male | 31 | 72 | |
| Female | 73 | 130 | |
| BMI, kg/m$^2$ | 24.7 | 25.3 | .288 |
| Preoperative mHHS | 62.8 | 64.1 | .508 |
| Preoperative HOS-ADL | 64.5 | 66.4 | .415 |
| Preoperative HOS-SSS | 41.3 | 43.5 | .477 |
| Preoperative NAHS | 58.0 | 61.3 | .148 |
| Preoperative VAS score | 5.6 | 5.4 | .478 |

NOTE. Data are presented as mean values unless otherwise indicated.

BMI, body mass index; HOS-ADL, Hip Outcome Score—Activities of Daily Living; HOS-SSS, Hip Outcome Score—Sport-Specific Subscale; NAHS, Non-Arthritic Hip Score; VAS, visual analog scale.

**Table 2.** Chondral Injury Between Study and Control Groups for Acetabular Labrum Articular Disruption, Acetabular Outerbridge, and Femoral Outerbridge Classifications

| | Study Group | | Control Group | | *P* |
|---|---|---|---|---|---|
| | n | % | n | % | Value |
| ALAD classification | | | | | .445 |
| 0 | 8 | 8 | 8 | 4 | |
| 1 | 29 | 28 | 62 | 31 | |
| 2 | 40 | 38 | 74 | 37 | |
| 3 | 26 | 25 | 51 | 25 | |
| 4 | 1 | 1 | 7 | 3 | |
| Acetabular Outerbridge classification | | | | | .907 |
| 0 | 6 | 6 | 8 | 4 | |
| 1 | 32 | 31 | 66 | 33 | |
| 2 | 38 | 37 | 72 | 36 | |
| 3 | 17 | 16 | 34 | 17 | |
| 4 | 3 | 3 | 9 | 4 | |
| Femoral Outerbridge classification | | | | | .146 |
| 0 | 74 | 71 | 153 | 76 | |
| 1 | 1 | 1 | 0 | 0 | |
| 2 | 2 | 2 | 9 | 4 | |
| 3 | 7 | 7 | 6 | 3 | |
| 4 | 1 | 1 | 6 | 3 | |

ALAD, acetabular labrum articular disruption.

Outcome Score—Sport-Specific Subscale, or Non-Arthritic Hip Score at any time point. Both groups showed a statistically significant improvement in all 4 PRO scores at 3 months and 2 years ($P < .05$) (Fig 2).

Patients in the study group who underwent labral repair (n = 54) showed higher pain scores (3.3) at 2 years than patients in the control group (2.4) who underwent labral repair (n = 119) and showed no statistically significant differences in PRO scores at 3 months or 2 years (Fig 3). No difference between patients in the study group (n = 37) and control group (n = 61) who underwent labral debridement was observed for pain scores or PRO scores at 3 months or 2 years (Fig 4). Patients undergoing microfracture at the time of surgery were also compared between groups, and no statistically significant differences in pain scores or PRO scores were observed at 3 months or 2 years (Fig 5).

### Complications

A total of 35 patients (11.4%) underwent 37 additional surgical procedures within the 2 groups. Three patients (2.9%) in the study group and 10 patients (5.0%) in the control group underwent conversion to THA during the 2-year follow-up ($P = .40$). Eleven patients (10.6%) in the study group and 13 patients (6.4%) in the control group underwent revision surgery during the 2-year follow-up ($P = .20$). One patient in each group underwent revision surgery and then underwent conversion to THA, for a total of 37 reoperations. The study is underpowered to detect small differences in rates of revision surgery or conversion to THA.

**Table 3.** Labral Treatment and Concomitant Procedures by Group

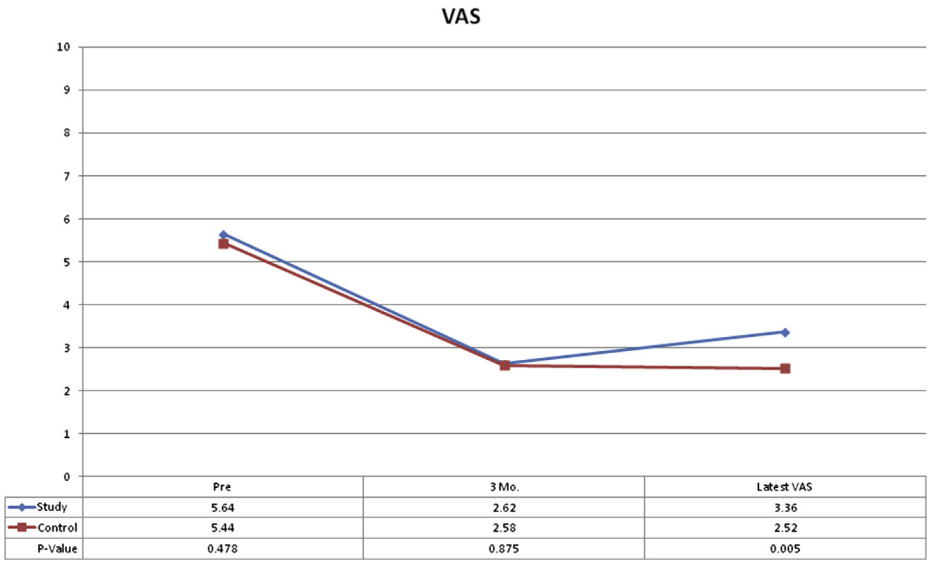
| | Study Group | Control Group | *P* Value |
|---|---|---|---|
| Labral repair | 54 | 119 | .273 |
| Labral debridement | 37 | 61 | .273 |
| Acetabuloplasty | 55 | 137 | .007 |
| Femoroplasty | 60 | 133 | .172 |
| Capsular repair | 44 | 91 | .732 |
| Microfracture | 10 | 28 | .307 |
| Iliopsoas release | 46 | 91 | >.99 |

## Discussion

In this study we were unable to identify a beneficial effect of PRP administration. In fact, contrary to our hypothesis, at 2 years after surgery, the study group had worse pain scores and mHHS values. An etiology for the increased pain scores and lower mHHS values in the study group could not be clearly identified. The control group had a slightly higher rate of acetabuloplasty than the study group, which may indicate more pincer-type morphology in the control group. However, we are unaware of any literature to suggest that acetabuloplasty is associated with a poor prognosis. The use of PRP to improve healing has generated excitement for its use in multiple sports medicine applications.[10-16] Positive results have been shown when applied to lateral epicondylitis, anterior cruciate ligament reconstruction, and Achilles tendon repair.[13,31,32] Conversely, multiple studies have shown little or no effect of PRP on the outcome of rotator cuff repair.[33-36] We were unable to show a beneficial effect of PRP after hip arthroscopy for labral tears.

The general healing response follows a typical pathway, beginning with inflammation and followed by tissue formation and maturation.[8] The process of healing requires a complex interplay of growth factors and signaling cascades. Platelets contain numerous bioactive molecules and growth factors including vascular endothelial growth factor, insulin-like growth factor, fibroblast growth factor, platelet-derived growth factor, transforming growth factor β, and epidermal growth factor that have the potential to augment the healing process.[7] The effect of concentrated platelet injections has been studied extensively in vitro and in vivo. PRP has shown the ability to initiate an inflammatory response in healthy tissue without injury.[37] Leukocytes and red blood cells are also being studied for their effect intra-articularly.[38]

To our knowledge, 3 randomized controlled trials evaluating the effect of PRP on the outcomes of rotator cuff repair have been reported. Randelli et al.[39] compared arthroscopic rotator cuff repair in 26 patients who were treated with PRP and 27 control patients. They observed decreased initial pain scores in the study group but no difference in outcome scores or follow-up MRI healing rates. Castricini et al.[40]

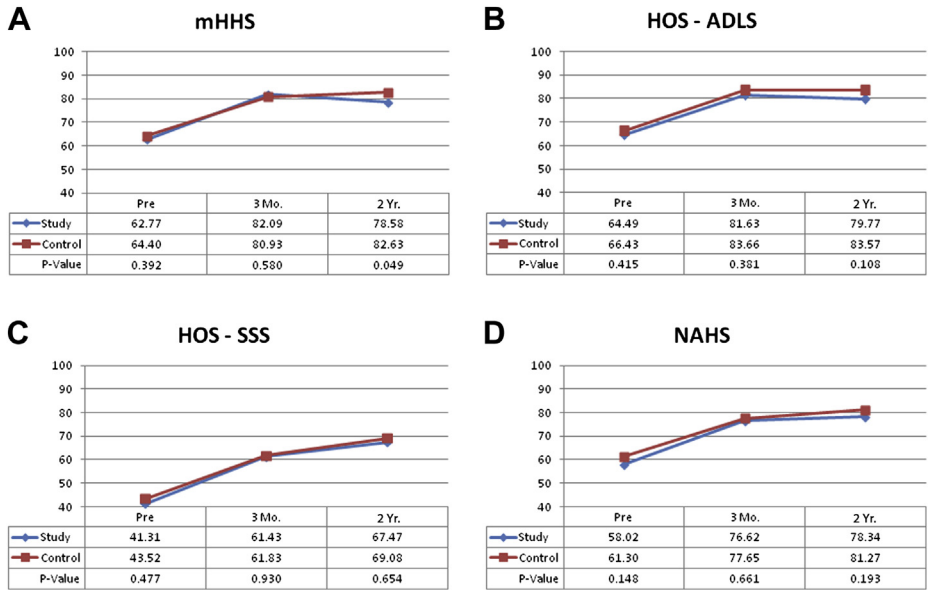



| | Pre | 3 Mo. | Latest VAS |
|---|---|---|---|
| Study | 5.64 | 2.62 | 3.36 |
| Control | 5.44 | 2.58 | 2.52 |
| P-Value | 0.478 | 0.875 | 0.005 |

**Fig 1.** Pain scores measured by visual analog scale (VAS) preoperatively (Pre), 3 months postoperatively, and 2 years postoperatively in study group (blue) and control group (red).

performed a similar study in 88 patients and also showed no difference between the study and control groups at 16 months after surgery using Constant scores and MRI healing rates. Recently, Ruiz-Moneo et al.[10] performed a randomized, double-blind, controlled trial in 69 patients undergoing arthroscopic rotator cuff repair. No differences in University of California, Los Angeles scores and MRI arthrogram healing rates were seen between the groups 1 year after surgery. Although the patients in our study represent a significantly different patient population, both rotator cuff repairs and hip labral repairs require relatively avascular soft-tissue healing to a bony bed. Our study also showed no improvement with PRP at 3 months' and 2 years' follow-up.

The use of PRP for chondral injury has also been evaluated outside of the hip joint. Smyth et al.[21] recently performed a systematic review of basic science evidence for PRP use in chondral injuries. Basic science evidence shows that PRP increases chondrocyte and mesenchymal stem cell proliferation, proteoglycan deposition, and type II collagen deposition. Multiple studies have also evaluated the effect of PRP on cartilage repair with mixed results. In addition, PRP has been studied as an injection for osteoarthritis of the knee and hip with positive early short-term results; however, long-term data are lacking.[22,23] As mentioned earlier, leukocytes and red blood cells are also being studied for their effect intra-articularly.[38] In our study




| A | Pre | 3 Mo. | 2 Yr. |
|---|---|---|---|
| Study | 62.77 | 82.09 | 78.58 |
| Control | 64.40 | 80.93 | 82.63 |
| P-Value | 0.392 | 0.580 | 0.049 |

| B | Pre | 3 Mo. | 2 Yr. |
|---|---|---|---|
| Study | 64.49 | 81.63 | 79.77 |
| Control | 66.43 | 83.66 | 83.57 |
| P-Value | 0.415 | 0.381 | 0.108 |

| C | Pre | 3 Mo. | 2 Yr. |
|---|---|---|---|
| Study | 41.31 | 61.43 | 67.47 |
| Control | 43.52 | 61.83 | 69.08 |
| P-Value | 0.477 | 0.930 | 0.654 |

| D | Pre | 3 Mo. | 2 Yr. |
|---|---|---|---|
| Study | 58.02 | 76.62 | 78.34 |
| Control | 61.30 | 77.65 | 81.27 |
| P-Value | 0.148 | 0.661 | 0.193 |

**Fig 2.** Patient-reported outcome scores preoperatively (Pre), 3 months postoperatively, and 2 years postoperatively in study group (blue) and control group (red). No statistically significant difference was noted in (A) modified Harris Hip Score (mHHS), (B) Hip Outcome Score—Activities of Daily Living (HOS-ADLS), (C) Hip Outcome Score—Sport-Specific Subscale (HOS-SSS), and (D) Non-Arthritic Hip Score (NAHS).

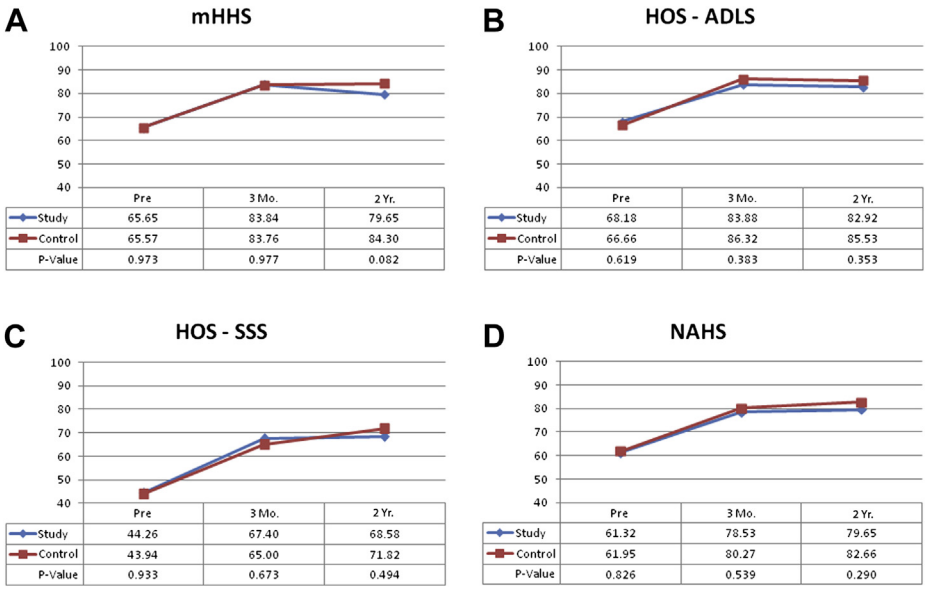



**Fig 3.** Patient-reported outcome scores preoperatively (Pre), 3 months postoperatively, and 2 years postoperatively in patients treated with labral repair in study group (blue) and control group (red). No statistically significant difference was noted in (A) modified Harris Hip Score (mHHS), (B) Hip Outcome Score—Activities of Daily Living (HOS-ADLS), (C) Hip Outcome Score—Sport-Specific Subscale (HOS-SSS), and (D) Non-Arthritic Hip Score (NAHS).

the application of PRP in patients undergoing microfracture at the time of hip arthroscopy did not show a difference in clinical outcome scores at 3 month or 2 years, although the number of patients in this subset was limited. Moreover, most of the patients in this study had some form of chondral injury, and no beneficial effect of PRP could be shown.

The strengths of this study include the large number of patients undergoing surgery for labral treatment and the inclusion of a control group obtained during the same period. To our knowledge, this study represents the first investigation of PRP administration at the time of hip arthroscopy for labral treatment.

## Limitations

This study has many limitations. First, the randomization method was not performed according to standards for Level I Evidence. We relied on random sampling by operating room schedule to determine which patients received PRP, making this a Level II study; nonetheless, the study and control groups showed no differences in demographic data, labral repair rates, concomitant procedures, or Tönnis grades. Second, we used PRO scores, pain scales, and revision rates as outcome measures. Ideally, we could include an objective measure of labral healing such as MRI. Although MRI has been shown to be effective before

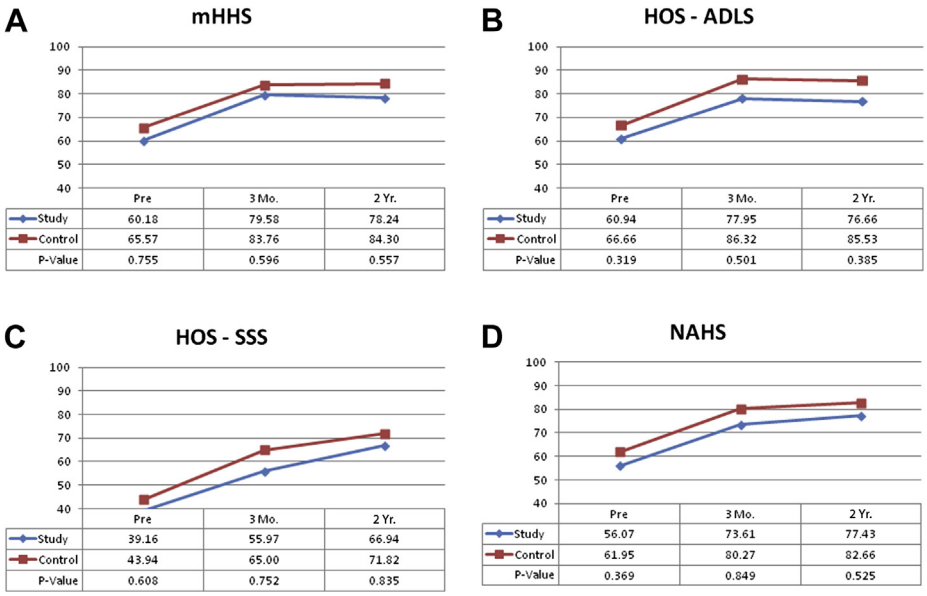



**Fig 4.** Patient-reported outcome scores preoperatively (Pre), 3 months postoperatively, and 2 years postoperatively in patients treated with labral debridement in study group (blue) and control group (red). No statistically significant difference was noted in (A) modified Harris Hip Score (mHHS), (B) Hip Outcome Score—Activities of Daily Living (HOS-ADLS), (C) Hip Outcome Score—Sport-Specific Subscale (HOS- SSS), and (D) Non-Arthritic Hip Score (NAHS).

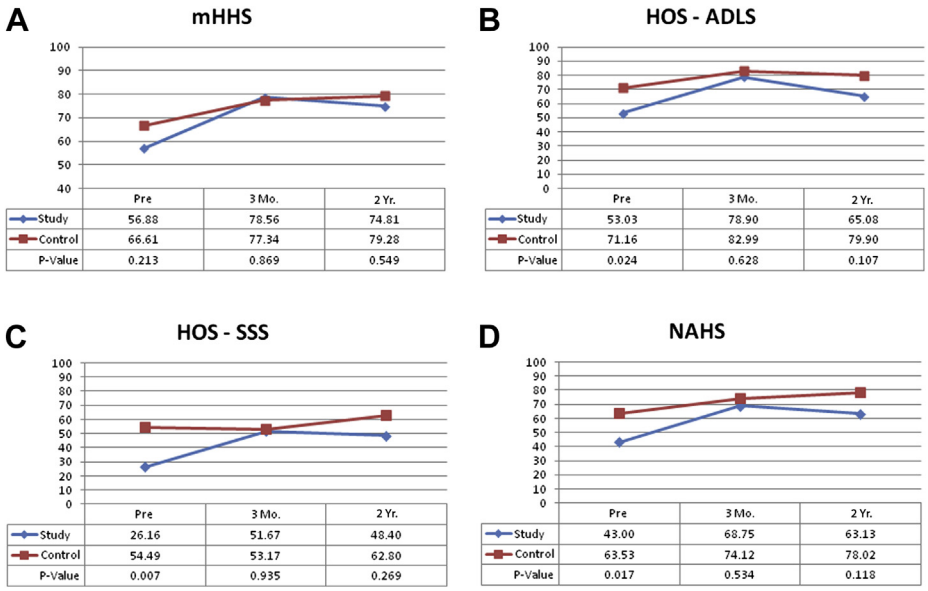



**Fig 5.** Patient-reported outcome scores preoperatively (Pre), 3 months postoperatively, and 2 years postoperatively in patients treated with microfracture in study group (blue) and control group (red). No statistically significant difference was noted in (A) modified Harris Hip Score (mHHS), (B) Hip Outcome Score—Activities of Daily Living (HOS-ADLS), (C) Hip Outcome Score—Sport-Specific Subscale (HOS-SSS), and (D) Non-Arthritic Hip Score (NAHS).

revision hip arthroscopy, in our experience postsurgical change makes an estimation of labral healing difficult.[41] Obtaining postoperative MRI arthrograms in the number of patients included in this study would also lead to significant costs. Third, only 1 type of PRP preparation was investigated in this study. It is clear that PRP preparations vary considerably by system and by individual patient. We did not attempt to study the concentration of platelets delivered in each patient. However, the method used did allow us to investigate a large number of patients without increased costs of laboratory analysis. Fourth, the first time point evaluated in this study was 3 months. If PRP has a short-term effect before 3 months, we would not have captured these data. Fifth, the study was performed at 3 different hospitals. The equipment and technique are nearly identical among hospitals; however, this has the potential to introduce variability among centers. Sixth, the study included a heterogeneous group of patients with surgery being performed for symptomatic labral tears. Some patients had femoroacetabular impingement, and others had borderline dysplasia. The control group had more acetabuloplasties performed than the study group, and as such, the study group may have had more patients without pincer impingement. It is unclear how this might affect the results but yields the question of whether the groups are similar. In some patients the labrum was detached before refixation, and others underwent acetabuloplasty without detachment. The study did, however, include a large group of patients, which likely minimizes potential bias. Seventh, the study did not include patients with advanced arthritis. Whether PRP could improve results in patients with arthrosis is unclear. Eighth, we do not have detailed physical examination findings on all patients preoperatively and postoperatively. If PRP has any effect on motion or other examination findings, it would not be captured in this analysis. Ninth, the study is underpowered to detect small differences in rates of revision surgery and conversion to THA. Although we were unable to detect a difference between groups, this may be subject to type II error. Finally, the application of PRP in this study included an intra-articular injection at the capsulotomy site at the termination of the procedure. This undoubtedly allows PRP to exit the capsule and leak out of the intra-articular region. Whether improved results could be seen with direct application of the PRP to the labral repair site or microfracture site may be the subject of future investigation. The effect of PRP may be different if it is delivered postoperatively, after capsular healing; this may be the subject of future research.

## Conclusions

On the basis of the results of this study, intraoperative PRP injection does not appear to improve the clinical results of patients undergoing hip arthroscopy for labral treatment.

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Kevin F. Dunne, B.S., contributed to data collection and management.

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