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Preservation Arthroplasty for Basal Joint Arthritis Using Arthroscopy and Autologous Fat Grafting With Platelet-rich Plasma

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Background: Prior studies have shown that intra-articular injection of autologous fat may be a viable, less invasive approach for the treatment of carpometacarpal (CMC) joint arthritis, compared with trapeziectomy. Small joint arthroscopy has also been found to be a useful tool in evaluation and treatment of arthritis. The authors present a treatment for CMC arthritis combining a minimally invasive approach for arthroscopic debridement with autologous fat grafting and platelet-rich plasma (PRP) injection.

Methods: Patients with Eaton stage II–IV CMC osteoarthritis underwent arthroscopic debridement and injection of autologous fat and PRP into the joint. Pre- and postoperative pain scores, functional outcomes, radiographic improvement in joint subluxation, patient satisfaction, and complications were evaluated.

Results: Forty-eight thumb CMC joint arthroscopies with fat grafting and PRP were performed. No intraoperative or immediate postoperative complications were experienced. No patients required revision surgery. Average preoperative pain scores with activity improved from 8.9 ± 0.9 to 3.3 ± 2.2 ($P < 0.0001$) and at rest improved from 5.0 ± 2.5 to 1.0 ± 1.3 ($P < 0.0001$). M_1M_2 overlap was used to measure radiographic subsidence. This improved from 4.4 ± 2.8 mm preoperatively to 6.8 ± 2.3 mm postoperatively, reflecting a relative improvement of 70% ($P < 0.0042$). High patient satisfaction was noted.

Conclusions: Treatment of the CMC joint using arthroscopic technique combined with autologous fat and PRP is effective in treating pain and joint subluxation. Additional prospective studies are underway for comparison to traditional arthroplasty techniques and to evaluate this technique's potential for other small joint pathology. *(Plast Reconstr Surg Glob Open 2025;13:e6720; doi: 10.1097/GOX.0000000000006720; Published online 24 April 2025.)*

INTRODUCTION

Despite the multitude of operations to treat basilar joint arthritis, a single, superior treatment has yet to be identified.[1,2] Trapeziectomy, while considered the gold standard in surgical management, is an invasive technique with a prolonged recovery, which carries risks for thumb instability, reduced pinch strength, and secondary metacarpal subsidence.[3] For younger, higher-demand patients and those with earlier-stage disease, this "gold-standard" operation is unlikely to provide superior outcomes. Therefore, our authors sought to develop a treatment for basilar joint arthritis that combined a minimally invasive approach while applying new advances in rejuvenative medicine.

Arthroscopy for both diagnostic and therapeutic benefit at the thumb carpometacarpal (CMC) joint is well described.[4] The technique offers a high patient satisfaction and low complication rate, attributed to its maintenance of capsular integrity, lower incidence of nerve irritation, and a faster recovery.[4] Autologous fat grafting, which harnesses to the potential of adipose-derived stem cells, has gained popularity in recent years, and numerous studies have demonstrated regenerative potential,

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positive vasculogenic effects, and chondroprotection via anti-inflammatory properties.[5–8] Current indications for fat grafting in hand surgery include hand rejuvenation, revision nerve decompression, scar and burn management, and thumb CMC joint arthritis.[7] Prior studies have shown that intra-articular injection of autologous fat consistently provides satisfactory results in pain reduction, daily life activities, and hand strength.[9] The addition of platelet-rich plasma (PRP) to autologous fat has similarly demonstrated improvements in pain scores in patients with CMC arthritis.[10] When compared with trapeziectomy, grafting and injection techniques have been shown to provide shorter surgery and recovery times while providing similar functional, quality of life, and patient satisfaction outcomes.[11–13]

Our authors hypothesize that the combination of arthroscopic treatment with intra-articular injection of autologous fat graft and PRP can effectively treat basilar joint arthritis. Here, we present our early case series of patients with Eaton stage II–IV arthritis who experienced failed nonoperative management and underwent arthroscopic treatment of the basilar joint with intra-articular autologous fat and PRP injection.

Takeaways

Question: Can basal joint arthritis be treated by combining a minimally invasive approach and arthroscopic debridement with autologous fat grafting and platelet-rich plasma (PRP) injection?

Findings: Forty-eight thumb carpometacarpal joint arthroscopy with fat grafting and PRP procedures were performed. No intraoperative or immediate postoperative complications were experienced. No patients required revision surgery, and a statistically significant decrease in pain scores was noted. Patient satisfaction survey results demonstrated positive experiences among all patients.

Meaning: Treatment of the carpometacarpal joint using the arthroscopic technique combined with autologous fat and PRP is effective in treating pain and joint subluxation with a high degree of patient satisfaction.

METHODS

A retrospective chart review of all patients who underwent thumb CMC arthroscopy with autologous fat and PRP injection from 2018 to 2022 was performed. Patients with Eaton stage II–IV who experienced failed traditional nonoperative management were included in this study. Patient inclusion was driven by patient preference after a thorough discussion of all surgical treatment options, including more traditional trapeizectomy and arthroplasty techniques. Patients were not excluded based on Eaton stage. Concomitant scaphoid-trapezium-trapezoid (STT) joint arthritis was evaluated on preoperative radiographs and was counseled as a potential prognosticator for incomplete response but was not considered an absolute contraindication.

All procedures were performed by the senior author. Patient demographics, treatment history, functional outcomes, radiographs, patient satisfaction scores, and complications were evaluated. Pain scores and radiographic measures were compared pre- and postoperatively. Pain was assessed on a 1-10 Likert scale, with 10 representing the worst pain. Radiographic measures included M_1M_2 overlap, which was used as a measure of dorsal subluxation. This value was calculated by measuring the distance between the volar tip of thumb metacarpal base and dorsoradial border of the index of the metacarpal base on lateral radiographs.[14] Radiographs were collected by the same 2 technicians, and all measurements were performed in a blinded manner by the same fellowship trained hand surgeon.

Satisfaction surveys were collected postoperatively. A 1-5 Likert scale rated the degree of patient satisfaction with the procedure, postoperative care, pain improvement, functional improvement, likelihood to undergo the procedure again, and likelihood to recommend the procedure to a friend or family member. All patients were followed up for at least 6 months postoperatively. Statistical analysis was performed using *t* test up to this final 6-month follow-up, with *P* values less than 0.05 considered statistically significant. Patient satisfaction, which was collected only postoperatively, was reported descriptively. This study was conducted under institutional review board regulations and conforms to the Declaration of Helsinki.

Surgical Technique

All procedures were performed under a general anesthetic. A well-padded upper arm tourniquet was used on the operative extremity. The 1.9-mm NanoScope system and Nano Sabre Shaver 2.7 mm (Arthrex Naples, FL) were used for all procedures. The 1-R and 1-U portal sites were established, whereas gentle longitudinal manual traction was applied with the extremity on the hand table (Fig. 1). A diagnostic arthroscopy was first performed using gravity irrigation with normal saline. Careful attention was made to note chondral defects, synovitis, and presence of loose bodies. Diagnostic arthroscopy was then transitioned to the STT joint to rule out concomitant disease via the same 1-R and 1-U portals. Arthroscopic debridement was then performed with the arthroscopic shaver. In cases where STT arthritis was identified, this articulation was similarly debrided. In cases where loose bodies were present and resistant to shaver debridement, a grasping device was utilized. (**See figure, Supplemental Digital Content 1**, which displays basal joint arthroscopy. Synovitis, corticosteroid precipitate [A] and loose bodies [B] within the basal joint are visualized. Debridement is performed using the shaver device [C], resulting in a healthier appearing joint [D], **http://links.lww.com/PRSGO/D984**.)

Careful attention was paid to avoid debridement of the articular cartilage. The use of a coblation device was then performed to treat areas of synovitis and attenuated capsuloligamentous structures as indicated.

Although arthroscopy was underway, the harvest of autologous fat and PRP was performed simultaneously. The abdominal, flank, or thigh donor site was selected based on individual adiposity distribution. A tumescent solution of 500-mL normal saline with 20 mL or 1% lidocaine with

Fig. 1. Portals and traction set up. The 1-U and 1-R portals are utilized while the extremity is laid flat on the hand table. Manual distraction is applied to the thumb without need for a traction tower.

epinephrine (1:100,000) was instilled into the subcutaneous tissues by a single stab incision. Manual liposuction was performed with the goal of obtaining about 5–10 mL of fat after processing. The obtained lipoaspirate was then processed by rolling over Telfa sheets and transferred into a 10-mL syringe. The Angel cPRP System (Athrex, Naples, FL) was used to obtain an average of 3–5 mL of concentrated PRP. Using a 3-way stopcock, the PRP and autologous fat were combined.

Once arthroscopic debridement was complete, the irrigation was discontinued, and a dry diagnostic arthroscopy is performed to confirm adequate arthroscopic treatment. The autologous fat and PRP mixture was then injected directly into the CMC joint under arthroscopic visualization. (**See figure, Supplemental Digital Content 2**, which displays basal joint under arthroscopic visualization, **http://links.lww.com/PRSGO/D985**.) The portal sites were closed with a series of simple 5-0 Prolene sutures. The patient was then placed into a well-padded thumb-spica splint dressing.

Postoperatively, patients were seen at 1–2 weeks to ensure proper wound healing. Patients were subsequently able to increase the use of their operative extremity as tolerated once adequate healing was confirmed at the 2-week postoperative visit. At that time, patients were given a removable thumb-spica wrist brace, which they wore until 6 weeks postoperatively. This was progressively weaned to use at nighttime and during activities only, as guided by hand therapy from 2 to 6 weeks postoperatively. Any further use of the brace was determined by patient preference or comfort. Hand therapy was started at 2 weeks postoperatively with a planned 6-week course but with individual variations determined at the patient and therapist's discretion.

Table 1. Patient Demographics and Clinical Characteristics

Patient Demographic and Clinical Characteristics	Value
No. joints treated	48
No. patients	46
Average age (y)	66.8 ± 9.9
Sex	
Male	12 (26.1%)
Female	34 (73.9%)
Laterality	
Right	46 (95.8%)
Left	2 (4.2%)
Prior steroid use	31 (64.5%)
Eaton stage	
II	19 (39.6%)
III	19 (39.6%)
IV	10 (20.8%)
Average follow-up (d)	394.6 ± 241.0

RESULTS

A total of 48 procedures of thumb CMC joint arthroscopy with fat grafting and PRP were performed. Two of the 46 patients underwent bilateral procedures. The average patient age was 66.8 ± 9.9 years with 73.9% female and 26.1% male patients. The majority of cases were performed on the right hand (95.8%). Thirty-one (64.5%) patients had a history of treatment with corticosteroid injection. Eaton stage included 19 patients with stage II disease (379.6%), 19 (39.6%) with stage III disease, and 10 (20.8%) with stage IV disease. The patient demographics and clinical characteristics are summarized in Table 1. No intraoperative or immediate postoperative complications were experienced. No patients required revision surgery, though 2 patients did subsequently undergo the same procedure on the contralateral hand.

Thirty-three (72%) of 46 patients completed full data collection for inclusion. Among these patients, the average preoperative pain score with activity was 8.9 ± 0.9 and improved to 3.3 ± 2.2 ($P < 0.0001$). Improvement was also noted in the pain at rest scores for all patients, where average preoperative score of 5.0 ± 2.5 improved to 1.0 ± 1.3 ($P < 0.0001$). These statistically significant improvements in average pain scores also extended to patients with Eaton stage II–IV disease, as summarized by Table 2.

Lateral radiographs taken pre- and postoperatively demonstrated overall improvements in M_1M_2 overlap measurements. Among all patients, the average M_1M_2 overlap

Table 2. Pre- and Postoperative VAS-pain Scores

	Preoperative VAS-pain (1–5)	Postoperative VAS-pain (1–5)	Percentage Improvement (%)	*P*
		Pain with activity		
All patients	8.9 ± 0.9	3.3 ± 2.2	62.9	<0.0001*
Stage II	8.8 ± 0.9	3.5 ± 2.5	60.2	<0.0001*
Stage III	9.0 ± 0.8	2.9 ± 1.8	67.8	<0.0001*
Stage IV	9.1 ± 1.0	3.5 ± 2.5	62.5	<0.0001*
		Pain at rest		
All patients	5.0 ± 2.5	1.0 ± 1.3	80.0	<0.0001*
Stage II	4.7 ± 2.3	1.4 ± 1.6	70.2	<0.0001*
Stage III	4.8 ± 2.5	0.7 ± 0.8	85.4	<0.0001*
Stage IV	6.0 ± 2.9	1.0 ± 1.6	83.3	<0.0001*

*Statistical significance.

Table 3. Radiographic M_1M_2 Overlap

	Preoperative M_1M_2 Overlap (mm)	Postoperative M_1M_2 Overlap (mm)	Relative Improvement	*P*
All patients	4.4 ± 2.8	6.8 ± 2.3	0.7 ± (1.5)	0.0042*
Stage II	5.2 ± 3.4	7.6 ± 2.3	0.1 ± 1.4	0.84
Stage III	4.0 ± 2.3	6.9 ± 2.0	1.4 ± 1.7	0.0012*
Stage IV	3.6 ± 1.9	5.1 ± 1.9	0.5 ± 0.4	0.0002*

*Statistical significance.

Table 4. Patient Satisfaction Survey Results (1–5 Likert Scale)

	Procedure	Postoperative Course	Pain Improvement	Functional Improvement	Likely to Get Again	Likely to Recommend
All patients	4.6 ± 1.1* (*P* < 0.0001)	4.6 ± 0.7* (*P* < 0.0001)	4.2 ± 1.2* (*P* < 0.0001)	4.3 ± 1.2* (*P* < 0.0001)	4.3 ± 1.3* (*P* < 0.0001)	4.4 ± 1.2* (*P* < 0.0001)
Stage II	4.8 ± 0.6	4.6 ± 0.9	4.1 ± 1.2	4.4 ± 1.2	4.6 ± 0.7	4.6 ± 0.7
Stage III	4.1 ± 1.6	4.5 ± 0.8	3.9 ± 1.6	3.9 ± 1.6	4.0 ± 1.6	4.0 ± 1.6
Stage IV	4.8 ± 0.4	5.0 ± 0	4.8 ± 0.4	4.8 ± 0.4	4.3 ± 1.6	4.5 ± 1.2

*Statistical significance.

measurement of 4.4 ± 2.8 mm had improved to 6.8 ± 2.3 mm, reflecting a relative improvement of 70% ($P < 0.0042$). The relative improvement in M_1M_2 overlap held for all Eaton stages, with 10% in stage II disease ($P = 0.84$), 40% in stage III disease ($P = 0.0012$), and 50% ($P = 0.0002$) in stage IV disease. Although there was improvement across all Eaton stages, only stages III and IV demonstrated statistically significant improvements. M_1M_2 overlap data are summarized in Table 3.

Patient satisfaction survey results demonstrated positive experiences among all patients. The scores for the categories of "procedure," "postoperative course," "pain improvement," "functional improvement," "likelihood to undergo procedure again," and "likelihood to recommend to a friend or family member" were all positive with average scores of 4.6 ± 1.1, 4.6 ± 0.7, 4.2 ± 1.2, 4.3 ± 1.2, 4.3 ± 1.3, and 4.4 ± 1.2, respectively. All average scores demonstrated statistical significance. The patient survey data are further summarized in Table 4.

DISCUSSION

The present study demonstrates efficacy of thumb CMC arthroscopy with fat grafting and PRP injection. Arthroscopy for the basilar joint is well described for both diagnostic and therapeutic benefit. High patient satisfaction rates and low complications for thumb CMC arthroscopy in particular have been reported.[4] Previous studies have demonstrated that arthroscopic findings do not correlate with radiographic findings.[15,16] In many cases, particularly in early disease, benign appearance on plain films will not reveal the clinically relevant pathology within the CMC joint. This study not only highlights the diagnostic and therapeutic potential of basilar joint arthroscopy but also demonstrates synergism in a hybrid approach with the addition of rejuvenative medicine techniques of autologous fat and PRP.

Though continuously evolving, current understanding suggests that fat grafting produces its therapeutic effect through adipose-derived stem cells and their proangiogenic, anti-inflammatory, and regenerative properties.[5] PRP is also known to have anti-inflammatory, cartilage and tissue repair, and pain-relieving effects, which is particularly applicable to the treatment of osteoarthritis.[17] In vitro and animal studies have also demonstrated the effect of tissue regeneration though growth factors and cytokines within PRP.[17] In addition, PRP has been demonstrated to improve survival rates of autologous fat grafting, highlighting a potential synergistic effect of the combination.[17]

The efficacy this hybrid technique of arthroscopy and rejuvenative medicine is demonstrated in the improvements in pain scores, radiographic findings, and patient-reported outcomes in this study. These improvements

were not only statistically significant but clinically significant as well. Prior studies have determined the minimally clinically important difference and substantial clinical benefit for the visual analog scale (VAS) for pain in hand surgery patients.[18] These values were 1.6–1.9 and 2.2–2.6, respectively.[18] In our present study, patient VAS-pain scores were found to exceed both minimally clinically important difference and substantial clinical benefit. Furthermore, pain scores demonstrated greater than significant clinical benefit across Eaton stages, II, III, and IV.

Kemper et al[19] previously described arthroscopic synovectomy with autologous fat grafting for early stages of CMC arthritis (Eaton I-II). The authors found that average pain scores with rest improved from 4.7 to 0.75, whereas pain with activity improved from 8.7 to 2.7 at 2 years postoperatively.[19] These results compare quite similarly to our pain score improvements. We agree with the authors' conclusion that arthroscopic synovectomy combined with autologous fat grafting is a reliable and durable option for early CMC arthritis. However, our present study demonstrates that patients with more advanced stages of disease (Eaton III–IV) can achieve a clinically significant improvement in pain symptoms. Although no definitive claims can be made, we believe added therapeutic benefit of PRP, which has previously been proven to synergistically act with fat,[17] could potentially account for these differences.

Prior studies have demonstrated efficacy of autologous fat grafting alone for basilar joint arthritis. Herold et al[13] demonstrated most pain relief in stage II disease, with statistically significant improvements in stage II and III disease. Haas et al[12] also noted significant pain improvements under stress across Eaton stage I to III disease. These studies do not support the treatment of fat grafting alone for stage IV basal joint arthritis, unlike our present study. Although unclear, we believe the addition of arthroscopy and PRP may play a role in this expanded therapeutic benefit and may make joint preservation a possible option in a broader patient population.

Our case series' clinically significant benefits compare favorably to previously published control groups who underwent trapeziectomy alone.[20] In a study by McCullough et al,[20] patients undergoing trapeziectomy alone had an average score of 6.6 ± 1.6 improved to 2.0 ± 1.4 (69.6%). In our present study, we found that patients similarly had improvements in average pain scores at rest (80.0%) and with activity (62.9%). A similar conclusion is drawn from the study by Erne et al,[11] comparing fat grafting to trapeziectomy for stage III and IV disease. No statistical difference was observed between pain scores in fat grafting and trapeziectomy groups over a 1-year study period.[11]

Winter et al[10] performed a systematic review and meta-analysis of autologous fat and PRP injections for CMC osteoarthritis. In terms of pain, the authors found that autologous fat injections led to an average decrease of 2.4–3 pain scale points, whereas PRP resulted in an average decrease of 2.8–3 pain scale points.[10] Swärd and Wilcke reported on treatment of the thumb CMC, including STT joints with PRP alone.[21] In their case series of 33 patients undergoing 2 intra-articular PRP injections,

Fig. 2. M_1M_2 overlap. Interval improvement in M_1M_2 overlap in preoperative (A) and postoperative (B) lateral radiographs.

the authors were unable to find a therapeutic benefit on patient-reported pain The patients' average pain improvements in our present study demonstrate a more significant decrease in pain of 5.6 with activity and 4.0 at rest. We believe our superior reductions in pain illustrate how arthroscopy, autologous fat, and PRP are complimentary. Ongoing study of our patient population to monitor symptom progression rates will help to better understand which patients may benefit most from this procedure and what exclusion criteria may exist.

In this study, we used M_1M_2 overlap measurement as described by Miura et al[14] to evaluate radiographic improvement. This measure has been found to demonstrate excellent intra- and interobserver reliability while correlating with other methods of quantifying dorsal subluxation of the CMC joint.[14] Mirua et al demonstrated differences in this measurement amongst patients with thumb CMC arthritis (average 4.6 ± 1.2 mm) and those without pathology (2.3 ± 2.3 mm). Their average M_1M_2 overlap value for patients with arthritis compares similarly to our average measurement of 4.4 ± 2.8.[14] Our authors similarly found statistically significant improvement in the postoperative average M_1M_2 overlap value (6.8 ± 2.3) (Fig. 2). Our similar outcomes of improved dorsal subluxation of the joint are noteworthy, as we performed a minimally invasive and joint-sparing approach, whereas Miura et al performed trapeziectomy with abductor pollicis longus tendon for ligament reconstruction.[14] We believe that the ability to effectively treat joint subluxation with arthroscopy results

from the removal of loose bodies and their displacing forces along with capsular and ligamentous tightening with coblation. We assert that despite the minimally invasive approach, this hybrid approach of arthroscopy with biologics is a similarly effective treatment as more invasive techniques for correction of joint subluxation.

Although we believe our early case series demonstrates efficacy and safety, it remains limited due to the study's retrospective nature and lack of a randomized control. We also acknowledge that patient-reported outcomes were not obtained through the use of validated outcome measurement tools. As we continue to offer this procedure to patients, more robust data with greater patient numbers and use of validated patient-reported outcome measurement tools is necessary. We also acknowledge that our M_1M_2 overlap measure of joint subluxation, though previously described and validated, is not a standardized means of quantifying the deformity, nor does it necessarily correlate to clinical symptoms.[14] Additionally, there is inherent limitation to the standardization of this measure. The same technicians were used for all radiograph collection, but no specific protocol to ensure the identical position of the hand and distance from the table was used. Additionally, only 1 surgeon performed all measurements, introducing potential for bias, which could be strengthened with the addition of a second surgeon to perform and compare measurements. Another major limitation is the lack of a control comparison group of traditional trapeziectomy alone. Our patients demonstrate favorable comparison with historical controls in the literature, but ongoing prospective data collection is underway to allow for future direct comparison within our own practice. Finally, cost of the procedure represents a limitation to the technique. Arthroscopy is routinely covered by insurance, but fat grafting is variably covered, and PRP is uniformly not covered. Patients elected to pay out of pocket for these additional elements of the procedure, which may not be feasible for all patients or practices. However, we feel that study of these techniques is essential to help demonstrate their utility and encourage future insurance coverage.

In addition, longitudinal follow-up will help us understand the durability of the technique over time. Though we believe we have demonstrated a potential superior synergistic effect of arthroscopy with autologous fat grafting and PRP, the exact mechanism of action of this synergism and the relative contributions from each component remain unclear. Further study is underway to directly compare different elements of this procedure and determine relative contribution to clinical outcome. Additionally, as basic science research continues to reveal the means by which autologous fat and PRP exert their therapeutic effect, we may begin to apply these regenerative medicine techniques with greater precision.

CONCLUSIONS

Treatment of the basilar joint using the arthroscopic technique combined with autologous fat and PRP is a safe and effective method of treating pain and joint subluxation with a high degree of patient satisfaction. This study highlights the diagnostic and therapeutic utility of thumb CMC arthroscopy and the rejuvenative potential of autologous fat and PRP in basal joint arthritis. Our authors suggest that this preservation arthroplasty technique for the thumb CMC may represent a paradigm shift in the treatment of small joint arthritis. Additional prospective studies are underway to evaluate this treatment's effect in other small joint pathologies in the hand and wrist.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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