INTRODUCTION

Proximal interphalangeal joint (PIPJ) cartilage injury with resultant osteoarthritic degenerative changes is commonly managed with arthrodesis or arthroplasty. Their drawbacks, namely loss of range of motion (ROM) and implant-related complications, have led surgeons to explore other methods of cartilaginous reconstruction, especially for young patients where neither is attractive. Often discussed, free vascularized toe joint transfer is limited by severe extension lags, flexion contractures, and sacrifice of the toe joints. One potential avenue is the use of autologous cartilage transplant for joint resurfacing. The use of autologous perichondrium arthroplasty (PA) was popularized in the 1970s by Skoog and Johansson. The idea stems from the potential to grow and develop new hyaline cartilage following transplant into the joint space. PA eventually fell out of favor because of high revision rates, which is in contrast to recent orthopedic surgery literature publications showing promising outcomes and few failures. Indications include posttraumatic osteoarthritic changes with or without stiffness and deviation, rheumatoid arthritis, and congenital joint malformation and/or ankylosis. Relative contraindications include posttraumatic arthritis, preoperative ROM less than 20 degrees, and age over 40. In this article, we present a PA technique that has been applied successfully for PIPJ reconstruction within our institution.

SURGICAL TECHNIQUE AND POSTOPERATIVE MANAGEMENT

First Stage

In the main operating room, under general anesthesia and tourniquet control, the PIPJ is exposed through a lateral incision. The collateral ligaments are obliquely incised to create flaps. The volar plate is released distally and, along with the checkrein and collateral ligaments, is elevated off the proximal and middle phalanges. The joint is shotgunned to expose the arthritic bony surfaces (Fig. 1). The cartilage from both joint surfaces is denuded. The articular surfaces are contoured using a rongeur to produce a convex proximal phalanx head and concave middle phalanx base, ensuring congruity and stability (anteroposterior and lateral) of the joint surfaces via reduction maneuvers and intraoperative fluoroscopy.

Concurrently, perichondrium is harvested from the sixth rib by a second surgical team (Fig. 2). After making a transverse incision, the subcutaneous fat is divided, along with any remaining pectoralis major muscle fibers. A rectangular perichondrial graft is templated over the rib, basing the lateral most aspect at the costochondral junction. The graft is elevated off the underlying cartilage from lateral to medial with careful attention to avoid injury to the internal mammary perforators medially. The graft is divided as medially as possible, resulting in a 6 × 2 cm long perichondrial graft.

The perichondrial graft is cut to match the size of the proximal phalanx head. A 0.035 K wire is then used...
to create bone tunnels in an AP direction through the head of the proximal phalanx, 1–2 mm from the joint surface. It is key to position the graft chondrogenic layer (ie, side in contact with the cartilage) facing the joint (ie, flip the graft orientation after harvest). The graft, along with a 2 × 2 cm 0.5 mm silicone sheet (to prevent adhesion between the grafts), is then parachuted down over the proximal phalanx head and secured with 5-0 PDS suture through the bone tunnels. The polydioxanone (PSD) is secured following this sequence: silicone sheet, periochondrium, bone tunnel, perichondrium, and silicone sheet. The knot is on the lateral aspect of the bone. If both joint surfaces are being resurfaced, the same step (minus the silicone sheet) is repeated to parachute the perichondrium graft onto the base of the middle phalanx. With the silicone sheet in place, the joint is

**Takeaways**

**Question:** How can we maximize range of motion while avoiding implant-related complications in patients with posttraumatic arthritis of the small joints of the hand?

**Findings:** In this article, we revisit reconstruction of small joints of the hand using autologous perichondrium to resurface the articular surfaces in patients with posttraumatic osteoarthritic changes. A brief review of the literature with surgical technique description is presented.

**Meaning:** In patients with posttraumatic osteoarthritic changes of the small joints of the hand, perichondrial arthroplasty (PA) allows for a functional, pain-free joint that avoids both the immobility of arthrodesis and the long-term complications associated with implants.

**Fig. 1.** Stage 1: PIPJ preparation.
reduced, and the collateral ligaments are repaired using PDS. The skin is closed and dressed with a nonadherent dressing. A volar splint in the position of safety is used for 1 week postoperatively. Antibiotics are given prophylactically to prevent surgical-site infection. Active range of motion (aROM) exercises begin at 1 week. (See Video [online], which displays preoperative X-rays and ROM, intraoperative photographs, and postoperative X-rays and ROM of a patient having undergone PA.)

Second Stage
The second stage is performed at least 3 months later. It is our practice to perform this stage under local anesthesia with a digital block (10 ml lidocaine 1% ± epinephrine). The joint space is accessed through the original incision. The shotgun approach to the joint is not necessary as the silicone sheet can be readily identified within the joint space and removed using toothed forceps. The joint space is thoroughly irrigated with normal saline. Attempt at repairing the collateral ligaments is made, acknowledging that the surrounding scar may make reapproximation impossible. The skin is closed, and the finger is dressed with gauzes and a compressive dressing, such as a Coban wrap. No splint is required and aROM can begin immediately.

DISCUSSION
Painless stable joints are traditionally achieved through alloplastic arthroplasty and arthrodesis, but promising outcomes have been reported through autologous reconstruction with PA. Recovery of full aROM\textsuperscript{1,4,6,8,9} and near complete pain resolution has been described.\textsuperscript{1,4,6-9} A 41-year-long follow-up has documented Disability of the Arm, Shoulder and Hand scores of 8.7 for PIPJ and 2 for metacarpophalangeal joint (MCPJ), which speaks to the longevity of PA.\textsuperscript{1} A retrospective study of 163 joints in 124 patients demonstrated a longer revision-free joint survival for both MCPJ and PIPJ following PA, compared with two-component alloplastic arthroplasty, although it was a non-significant trend.\textsuperscript{6} PIPJs resurfaced with perichondrium required fewer revisions and had an increased 10-year survival and median time to revision.\textsuperscript{6} However, PA is technically demanding when it comes to obtaining the right curvature of the resurfaced phalanx. This, along with the lack of funding from third-party industry, might explain why it has not been widely adopted by hand surgeons. From our experience, PA is superior in patients with stiffness, as it allows them to significantly improve ROM. Patients must have adequate subchondral bone stock and be agreeable to a second surgical site. They must understand the two-stage nature of the procedure and extended course of postoperative hand therapy required to achieve excellent outcomes. Complications include pneumothorax, joint deviation, stiffness, neurovascular bundle damage, and residual pain.

CONCLUSION
In this article, we revisit PIPJ autologous reconstruction using perichondrium in patients with posttraumatic osteoarthritic changes, a technique at reach for most hand surgeons.

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PATIENT CONSENT
Informed consent was obtained from all individual participants included in the study.
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