Ascension® PyroCarbon PIP Total Joint surgical technique
HUMANITARIAN DEVICE: The Ascension PIP is authorized by U.S. federal law for use in arthroplasty of the proximal interphalangeal (PIP) joint when the patient:

- has soft tissue and bone that can provide adequate stabilization and fixation under high-demand loading conditions after reconstruction; and
- needs a revision of a failed PIP prosthesis or has pain, limited motion, or joint subluxation/dislocation secondary to damage or destruction of the articular cartilage.

The effectiveness of this device for this use has not been demonstrated and as such the use of this product requires IRB approval at your institution prior to implant placement. For more information regarding the steps required to obtain approval from your hospital's IRB board, or if you have questions concerning your present IRB approval status, please contact Ascension Orthopedics at (512) 836-5001.
surgical instrumentation

Streamlined Instrumentation

› **Alignment Awl and Guides** – provide an accurate visual reference along the bone axis.
› **Color-coded Radiopaque Trials**
› **Dorsal Approach Cut Guides**
› By request: **Volar Approach Cut Guides**

Color-coded Instrument Set

- Proximal Broaches
- Impactors
- Trials
- Distal Broaches
- Starter Awl
- Alignment Awl
- Trial Extractor
- Vertical Osteotomy Guide
- External Alignment Guide
- Oblique Cut Guides: Dorsal Approach
- Distal Sizing Template
pre-operative evaluation

The patient evaluation begins with the physical exam. Painful and swollen PIP joints with limitations in motion provide the first evidence of PIP arthritis. X-ray examination of all patients should include a carefully positioned AP of the hand as well as a true isolated lateral of the involved finger(s). This will allow for careful evaluation of the joint and degree of deformity.

After the patient has been determined to be an acceptable candidate for surgery, the surgeon should discuss the post-operative finger PIP therapy regimen. The duration of post-operative surgical therapy is usually 10-12 weeks. Patient understanding and compliance with the post-operative therapy protocol is essential for a successful outcome. For additional information on the implants and postoperative therapy, patients may also be directed to our website, www.ascensionortho.com, to obtain “Patient Information Brochures,” “Post-Operative Guidelines,” and patient testimonials.

Prior to the procedure, patient X-rays are examined with the PyroCarbon PIP X-ray template, which has a 3% parallax enlargement over the X-ray. The templates help the surgeon choose the component sizes that best fill the medullary canal of the proximal and middle phalanx. Final determination of prostheses size will depend on the fit of the trial prostheses during surgery. Keep in mind the Ascension PIP implant allows upsizing or downsizing of proximal and distal components (see “Possible Size Combinations” table).

CAUTION: If there is evidence of insufficient bone stock, inadequate intramedullary space, marked soft tissue compromise, or ongoing active or chronic infection, arthroplasty may be contraindicated. If failure of the arthroplasty occurs, arthodesis, fibrous arthroplasty or disarticulation may be necessary for finger salvage. All of these potential complications should be discussed with the patient in the pre-operative setting.
surgical approach

The PIP joint may be approached from a dorsal, a lateral or a volar aspect, but a dorsal longitudinal exposure is preferred in most instances because of the improved exposure and ease of insertion of the prosthetic device. Complete descriptions of alternative approaches can be found online at www.ascensionortho.com, or by contacting Ascension Orthopedics at (512) 836-5001.

**Brief Description of Alternative Approaches:**

**LATERAL APPROACH**

The lateral approach has been described by multiple surgeons including Dr. Ceruso and Dr. Mazzone, with a modified version described by Dr. Beckenbaugh. This approach is thought to be an option for patients who have few or small dorsal osteophytes and who may be unable to complete the recommended post-operative therapy protocol. This approach to the joint involves division of one collateral ligament in line with the fibers themselves, and allows maintenance of the extensor tendon insertion and origin of the check-rein ligament radially. This approach should not be used in patients who present with significant bony deformity, extensive synovitis, and more than 20° of ulnar deviation on pre-operative radiographs.

**VOLAR APPROACH**

The volar approach has been described by multiple surgeons, including Dr. Duncan and Dr. Ross, and is thought to be an option in younger patients whose main goal is to increase range of motion over pre-operative values. Although the approach is technically more demanding, the potential for greater gains during rehabilitation exists.
dorsal approach surgical guidelines

Ascension Orthopedics does not recommend a particular surgical technique when using this implant. Proper surgical techniques are necessarily the responsibility of the medical profession. Each surgeon must evaluate the appropriateness of the surgical technique used, based on personal medical training and experience. A description of the procedure used by Dr. Steven Moran and Dr. Mark Ross follows:

STEP 1: Skin Incision, Capsular Opening and Exposure

A dorsal longitudinal straight or curved skin incision, 2-3 cm in length, is made over the PIP joint. FIGURE 1A. A longitudinal incision is then made through the center of the extensor tendon beginning at the middle of the proximal phalanx and ending just distal to the insertion point of the central slip of the middle phalanx. FIGURE 1B. Using sharp dissection, the central slip insertion is mobilized radially and ulnarly, taking care to elevate a full thickness of the central slip insertion from the base of the middle phalanx. The middle phalanx is then flexed. This creates a radial and ulnar tendinous band which includes 1/2 of the extensor tendon and the lateral band complex. At the completion of the procedure, the tendon halves will be repaired using drill hole fixation into bone of the middle phalanx.

ALTERNATIVE DORSAL EXPOSURE: 
Chamay Approach

Two parallel 2.0 cm incisions are made proximal to the dorsal rim along the lateral border of the central slip. FIGURE 1C. The two incisions are joined with a transverse incision to form a rectangle. The extensor tendon is dissected from the underlying tissue and reflected distally to the dorsal rim of the middle phalanx.
**STEP 2: Medullary Canal Opening and Alignment**

The joint is flexed to 90° and the osteophytes are removed. A 0.035” K-wire is inserted into the dorsal 1/3 of the proximal phalanx head to achieve a centralized starting point in the proximal phalanx. **FIGURE 2A.** Once the proper position is confirmed with X-ray, the hole is enlarged using the Starter Awl. The hole is made large enough for the insertion of the Alignment Awl into the medullary canal. Do not advance Starter Awl over the laser mark, as this will cause the Alignment Awl to shift during the vertical osteotomy. **FIGURES 2B & 2C.** The Alignment Guide is attached to the Alignment Awl and inserted into the proximal phalanx. **FIGURE 2D.** The Alignment Awl should be positioned parallel to the dorsal surface of the proximal phalanx and in line with the long axis of the bone. The centralized position can be confirmed with X-ray in both AP and lateral views.

**STEP 3: First Proximal Osteotomy – Vertical Cut**

While maintaining Alignment Awl position, the Alignment Guide is removed and replaced with the Vertical Cut Guide. The Vertical Cut Guide is placed 0.5-1.0 mm distal to the proximal attachments of the collateral ligaments. The proper guide position can be confirmed by placing the saw blade (safe mode) onto the Cut Guide and checking the osteotomy position. Viewing the templated size Proximal Trial laterally can serve as an additional visual guide for the osteotomy. **FIGURE 3.**

Using a micro sagittal saw, the articular surface of the proximal phalanx is partially removed. Once the starting cut has been made, the Alignment Awl is removed from the medullary canal and the cut is completed.

**SURGICAL PEARL:** Be sure to save offcuts for impaction grafting.
STEP 4: Proximal Component Broaching

Following the vertical cut, the proximal phalanx is broached. The goal is to fill the medullary canal with the largest implant stem possible while maintaining centralized alignment within the canal. Be sure to evaluate both the AP and Lateral views on the X-ray before proceeding to the next Broach as this will determine if you can increase your Broach size and ensure proper positioning.

In some cases, the proximal phalanx bone stock may be hard and sclerotic. If the Broach cannot be fully inserted, additional bone stock must be removed. To aid in this process, a side-cutting burr can be used to open the entry of the proximal phalanx in order to begin broaching. It is important to minimize burring within the canal as this will disrupt the press fit of the implant, and may damage the endosteal bone. Overheating the bone should be avoided at all costs. It is strongly suggested to use irrigation while utilizing powered burrs. If burring within the canal is necessary, impaction grafting is highly recommended. (See page 11.)

With the Alignment Guide attached, begin with the smallest size Broach and insert it halfway into the medullary canal. Proper positioning is confirmed with lateral and AP X-rays. If you notice any malalignment, remove the broach and correct positioning with a side-cutting burr. Re-insert the Broach and confirm position with X-ray. The Broach may now be fully seated. Continue upsizing the Broach size until you have filled the medullary canal or are limited in one view (AP/Lateral). Most often, you will be limited in the lateral view. The final Broach should be seated flush, or slightly recessed, with the vertical edge of the osteotomy. FIGURE 4. Incomplete or partial insertion of the Broach should be corrected prior to Trial insertion.

SURGICAL PEARL: It should be noted that the proximal component may only be one size larger than the final distal component. Pre-operative templating can be helpful to estimate component sizing, paying particular attention to the lateral view.

### Possible Size Combinations

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STEP 5: Second Proximal Osteotomy – Oblique Cut

The Oblique Cut Guide is placed into the medullary canal of the proximal phalanx. FIGURE 5A. The size of the guide should be the same size as the final Broach used. The Oblique Cut Guide must be fully inserted into the broached medullary canal, this can be confirmed with light tapping with a mallet. Full insertion is achieved when the seating plane on the guide contacts the vertical osteotomy. Incomplete or partial insertion exists if there is a gap between the seating plane and the vertical osteotomy. It is important to check rotational positioning of the Oblique Cut Guide, as this will determine the rotation of the prosthesis, which can be confirmed by inserting a K-wire into the hole on the Oblique Cut Guide and evaluating position. FIGURE 5B.

Using a sagittal saw, place the blade flush with the cutting guide and perform the entire bony cut. It is imperative that the proper angle is maintained while making the osteotomy, so ensure your saw blade is flush with the Oblique Cut Guide. FIGURE 5B. To ensure all bone fragments are removed, an osteotome can be passed down the Oblique Cut Guide along the osteotomy plane. If bone fragments are found, additional shaving passes with a saw or osteotome will be required to ensure adequate bone removal and adequate implant seating.

At this time the appropriate size proximal Trial is inserted and examined. The Trial surfaces should seat flush against both the vertical and oblique osteotomy surfaces. The Trial may be tapped lightly into better contact with the proximal phalanx, but if the Trial is not seating completely flush, re-broach to increase cavity size and/or remove additional bone to provide clearance for the Trial. Evaluate the joint position with lateral and AP X-rays and by taking the finger through ROM. FIGURE 5C. To remove the Trial, insert the Trial Extractor tongs into the lateral sides of the Trial between the collar of the Trial and the osteotomies. FIGURE 5D.
**STEP 6: Middle Phalanx Exposure and Distal Surface Preparation**

After completion of the proximal side, the joint is hyper-flexed to expose the articular surface of the middle phalanx.

Osteophytes are removed and a 0.035" K-wire is inserted into the dorsal 1/3 of the base of the middle phalanx, and the position is confirmed with X-ray. It is undesirable to position the distal component too volar as this may disrupt the joint mechanics. **FIGURE 6A.** After confirmation, the hole is enlarged with the Starter Awl and further enlarged with a side-cutting burr to create an opening to accept the distal Broach. Irrigation is recommended while utilizing powered burrs. **FIGURE 6B.**

Using a small end cutting burr (Ascension PIP Disposable pack), remove the articular surface of the middle phalanx base taking care to preserve as much of the central slip insertion as possible. **FIGURE 6C.** The Distal Sizing Template can be used to determine if the head will seat uniformly on the smoothed surface, or if additional bone removal is required. It also shows you how much bone can be maintained for the central slip insertion.

**SURGICAL PEARL:** You can also confirm proper distal surface preparation by holding the trial implant upside down onto the middle phalanx.
STEP 7: Distal Component Broaching

After an entry way is made to allow insertion of the Size 10 Distal Broach the canal is broached. The goal is to insert the largest implant possible while maintaining a centralized alignment within the canal. The Distal Broach size can be the same size, one size smaller, or one size larger than the size selected for the proximal component. (See “Possible Size Combinations” table at lower right.)

In some cases, middle phalanx bone stock may be hard and sclerotic. If the Broach cannot be fully inserted, additional bone stock must be removed; to aid in this process a side-cutting burr can be used to open the entry of middle phalanx in order to begin broaching. It is important to minimize burring within the canal as this will disrupt the press fit of the implant, and may damage the endosteal bone. Overheating the bone is to be avoided at all costs. It is strongly suggested to use irrigation while utilizing powered burrs. If burring within the canal is necessary, impaction grafting is highly recommended. (See page 11.)

Begin with the smallest size Distal Broach with the Alignment Guide attached and insert it halfway into the medullary canal. Proper positioning is confirmed with lateral and AP X-rays. If you notice any malalignment, remove the Broach and correct positioning with a side-cutting burr, re-insert the Broach and confirm position with X-ray. Once proper position is confirmed the canal may be sequentially enlarged with the broaches until the final broach rests flush to 0.5 mm deeper than the osteotomy level. **FIGURE 7.** Incomplete or partial insertion of the Broach should be corrected before the Trial is inserted.

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Broaches should be tapped gently into and out of the phalanx with a mallet. Avoid turning or side-to-side movements with the broach as this may disrupt the initial press fit of the implant.
STEP 8: Trial Insertion – Reduction – Removal

The joint is then flexed and the appropriately sized Distal Trial is inserted. To ensure correct axial rotation, verify the intercondylar notch is dorsal. **FIGURE 8A.** Use the Distal Impactor to lightly impact the Trial to ensure a press fit. The collar should abut the cut surface after 2 impacts. The Proximal Trial should be seated with finger pressure first and checked before impaction to ensure complete seating against osteotomy angles. **FIGURES 8B and 8C.** To ensure complete seating, hyper-flex the PIP and examine the alignment of the osteotomies against the component from the lateral view on both sides. There should be both dorsal and volar collar contact. If there is incomplete seating, a correction is required – examine both osteotomies and ensure the vertical cut is perpendicular to the axis of the bone, and that there are no volar bone fragments that may be impeding the trial from seating.

The finger should extend and flex passively with ease but with minimal lateral play or laxity with traction. Use the Trial Extractor to remove Trials (proximal first) by inserting extractor tongs into the lateral sides of the Trial, between the collar of the Trial and the osteotomy. **FIGURE 8D.**
Surgical Pearls

If you have over broached or utilized burrs in the intramedullary canal:

This may occur inadvertently during attempts at placing larger implants or in patients with very sclerotic bone. In such cases, cancellous allograft may be impaction grafted into the intramedullary canal using the Trial. Grating is performed using morcellized graft from the proximal phalanx osteotomies. Grafting may be continued until the final Broach or Trial size fits snugly against the osteotomy edge. Many surgeons frequently use impaction grafting.

If a lax joint is encountered:

Ensure you have selected the largest size implant that can fit into the medullary canals. Occasionally a larger implant may be placed either proximally or distally by enlarging the intramedullary canal with a burr. If stability is not obtained with a larger implant, closely examine the collateral ligament insertion sites; these may have been inadvertently damaged during the osteotomy process. If collateral ligament stability has been compromised, a collateral ligament stitch will be required to re-establish lateral stability.

Collateral Ligament Suture:

Collateral ligament stabilizing sutures may be useful at the PIP joint when there is radial or ulnar laxity or a tendency for hyperextension after insertion of the implant trials. This technique is most often utilized if there is excess ulnar deviation seen during the pre-operative evaluation. Adequate soft tissue is usually found at the mid-portion of the proximal phalanx in the vicinity of the accessory collateral ligament. Distally, the volar plate and insertion areas of the collateral ligament are usually sufficient to support a strong suture. If adequate soft tissue purchase is not possible with a standard suture, a drill hole prepared with a .045" K-wire can be utilized to pass the suture through bone for fixation. The drill holes may be created at the lateral margins of both the proximal and middle phalanges.

The suture should be inserted with the implant in place if bone fixation is not required. A strong absorbable (2-0 or 0) or non absorbable (2-0) suture is used on a larger needle. The suture is passed in a horizontal mattress fashion volarly through the proximal phalanx soft tissues and then through the middle phalanx soft tissues volarly, with the joint reduced. Figure 8E. The sutures may be placed on one or both sides of the joint depending on the clinical situation. The implant is then extended until it reaches 15° of extension lag. The sutures are tied snugly, first on one side and then the other side of the joint. Alternatively, if a transosseous suture is utilized, they should be placed before the insertion of the prosthesis.

The volar placement of the suture will prevent hyperextension. If hyperextension is seen following suture placement, sutures should be re-directed to a more volar position.

If a tight joint is encountered:

Increasing the depth of the proximal osteotomies can increase the joint space to improve extension or relieve tension. Remove bone in small increments to avoid laxity or instability. Reproach the medullary canal, examine osteotomies and reinsert the trials. Reduce the joint and assess stability, joint laxity, and range of motion.
STEP 9: Implant Placement

After successful Trial insertion and reduction, a fine K-wire (0.035") may be utilized to drill two sets of holes in the central dorsal bony ridge through which strong sutures may be passed for the reattachment of the middle slip. **FIGURES 9A and 9B.** The sutures are placed before the PyroCarbon implants are inserted.

The appropriately sized Ascension PIP distal and proximal sterile components are opened. Insert the distal component first. To assure correct axial rotation, verify the intercondylar notch is dorsal.

![Notch is dorsal.](image)

Use the Distal Impactor, in line with the implant, to apply firm but gentle force to secure a good press fit. Flex the joint to avoid impingement on the distal component when inserting the proximal component. Insert the proximal component with firm but gentle force to ensure a good press fit. **FIGURE 9C.**

Do not use excessive force to seat implant. The collar should abut the surface after minimal impacts. If not, re-broach to increase cavity size or remove additional bone.

Always take final intra-operative radiographs of both the AP and lateral views. Examine these radiographs to confirm that the implants have been placed centrally within the intramedullary canal.
STEP 10: Closure

The middle slip reconstruction is achieved by utilizing the sutures that have been passed through the drill holes in the middle phalanx to grasp both the radial and ulnar aspects of the extensor tendon flaps created at the beginning of the surgical procedure. FIGURE 10A-D. The remaining proximal tenotomy can then be repaired with a series of interrupted 4.0 non-absorbable sutures. At the conclusion of the middle slip reconstruction, the repair should be strong enough to confidently flex down to 90° on the table (see figure below). This will facilitate post-operative rehabilitation utilizing an accelerated short arc active range of motion program.

The skin is closed with nonabsorbable sutures, and a padded dressing with a plaster splint is applied with the finger in slight flexion at the PIP and DIP (10-15°), with 20-30° of flexion at the MCP.

It should be emphasized that regardless of whether the patient has undergone a dorsal approach or a volar approach, full PIP extension should not be the goal of surgery. Often full extension may lead to PIP joint hyperextension and may result in complications. Our preference is to end up with a fixed flexion deformity at the PIP joint of between 5°-10°. This provides excellent function and minimizes the risks associated with PIP hyperextension. Therapy directed at preventing PIP hyperextension is discussed in the following section.
post-operative guidelines

Therapy Protocol following PyroCarbon PIP Total Joint Replacement

DORSAL APPROACH
The following protocol was designed as a guideline for treating patients with degenerative and post-traumatic arthritis, who have a good central slip and ligament integrity. Patients with rheumatoid arthritis require individual assessment of pre-operative deformity, and may need up to three weeks of immobilization to provide for soft tissue stabilization prior to initiation of therapy. Every PIP patient will have individualized program adjustments according to the guidelines listed below.

This protocol is intended to be used as a guideline and consideration must be given individually according to the surgeon’s directive.

PRECAUTIONS
Variations depend upon the integrity of the central slip/fibro-osseous insertion. Hyperextension of the PIPJ must be AVOIDED, as this may lead to complications. A mild fixed flexion deformity (5-10°) is preferred to help prevent hyperextension, even long term.

Initial Assessment
- Pre-operative ROM/function
- Pre- & post-operative pain levels
- Reason for surgery
- Surgical approach used: dorsal, volar or lateral
- Integrity of soft tissue structures (noted by the surgeon intra-operatively), especially central slip and collateral ligaments
- Type/strength of repair

1-2 Weeks Post-Operative Care

WOUND / ODEMA CONTROL
- Wound care
- Coban/elevation to manage swelling

SPLINT
Resting splint
- Dorsal static PIP extension splint
- Blocking PIP in 15-20° flexion
- DIPJ may be included if susceptible to lag
- Thin LTT suggested

Consider any lateral instability and extend at sides to give appropriate support.

Exercise splint as per the active short arc motion (SAM) protocol – only required if central slip integrity is compromised or lag is evident; otherwise exercise should be performed in resting splint.

If splinting required: Volar PIPJ to 30° (week 1), 45° (week 2), or as directed by surgeon.

EXERCISES
For those with good central slip integrity
- Accelerated SAM Protocol
- Perform exercises in resting splint
- Blocked DIPJ flexion (Active)
- Active PIPJ flexion – amount of flexion is titrated against the maintenance of active extension i.e. extension lag
- If minimal lag, aim for 70-90° of flexion by the end of week 2
- Gentle composite flexion (active)
- Active extension to splint
- “Place and hold” active extension if lag
- Frequency: 5-10 repetitions, 5X daily

For those with compromised central slip integrity
- SAM Protocol
- Blocked DIP flexion (Active)
- Active PIP flexion to exercise splint (30-45°)
- Active extension to -15° (resting splint)

Other
- Avoid deviation/rotation
- No strong gripping, pinching, lifting, etc.
- Light ADL’s
3-4 Weeks Post-Operative Care

WOUND / OEDEMA CONTROL
- Compression as necessary – may change to Lycra (take care to avoid hyperextension)
- Scar massage

SPLINT
- Resting splint as previously described
- Exercise splint – increase PIPJ flexion to 45-60° if necessary due to concern regarding extensor lag.

EXERCISES

For those with good central slip integrity
- Accelerated SAM
- If difficulty achieving flexion, include active hook; should have full DIPJ flexion
- At four weeks, aim for -10° extension (10° FFD)
- AVOID hyperextension
- Intrinsic extension (blocked PIPJ extension to -10°)

For those with compromised central slip integrity
- Modified SAM
- Increase to 45-60° PIPJ flexion
- Allow extension to -10° at 4 weeks; AVOID hyperextension

Other
- Avoid deviation/rotation
- No strong gripping, pinching, lifting, etc.
- Light ADL’s

5-6 Weeks Post-Operative Care

WOUND / OEDEMA CONTROL
Compression as needed

SPLINT
- Continue resting splint – if lag, ensure DIPJ is included; intermittent wear during day
- Cease exercise splints
- May use buddy taping if flexion is poor or alignment issues

EXERCISES
- Accelerated SAM or modified SAM
- Active flexion – no limits
- If stiff, isolated passive DIPJ; if lag, place/hold extension+++ 
- Continue to aim for -10° (at PIP)
- May commence gentle passive assist, if no lag exists

7-8 Weeks Post-Operative Care

WOUND / OEDEMA CONTROL
Compression as necessary

SPLINT
Cease splinting if no extension lag is present.

EXERCISES
- Accelerated SAM or modified SAM
- Active flexion – no limits
- Aim for full flexion
- If stiff, isolated passive DIPJ; if lag, place/hold extension+++ 
- Continue to aim for -10° (at PIP)
- May commence gentle passive assist, if no lag exists

8-12 Weeks Post-Operative Care:

WOUND / OEDEMA CONTROL
Compression as necessary

SPLINT
Cease splinting if no extension lag is present.

EXERCISES
If lag exists, commence gentle resisted extension

Other – Avoid isolated pinch

More detailed therapy protocols for patients who have undergone a volar or lateral approach can be found online at www.ascensionortho.com, or by contacting Ascension Orthopedics at 512-836-5001.

Thanks to Wilma Walsh of Extend Rehabilitation, Brisbane, Australia, for compiling this protocol.
complications

The most common complications following PIP arthroplasty are:

1) Joint Instability – can result in dislocation, hyperextension, or radial or ulnar deviation. The causes of joint instability are A) improper placement of the implant, B) inadequate soft tissue stabilization, and C) loss of bony support.

2) PIP Stiffness

3) Joint Hyperextension

Each complication will be dealt with individually.

Joint Instability

A) Improper placement of the implant – most frequently seen in the proximal component where the stem is placed dorsally or palmarly, leading to increased eccentric loading of the joint surface. In such cases the implant can be reinserted after impaction grafting and re-broaching to ensure the implant is now seated within the center of the intramedullary canal. Joint stability may also be improved by increasing the implant size of either the proximal or distal implant. X-rays are advised to confirm that the patient’s anatomy can accept a larger size implant: impact grafting is also suggested. The one size mismatch between proximal and distal must be respected if considering a change in implant size.

B) Inadequate soft tissue stabilization – inadequate soft tissue can also frequently lead to post-operative instability or frank dislocation of the joint. The cause of the soft tissue deficiency can include inadvertent injury to the collateral ligaments during the surgical procedure, inflammatory arthritis and attritional degeneration. In all cases, soft tissue stabilization sutures should be added to improve stability. Collateral ligament sutures, in conjunction with extensor tendon drill holes, help establish joint stability during the rehabilitation process. Scaring and capsular healing allow for re-establishment of long-term joint stability.

C) Loss of bony support – can occur if a fracture occurs in the post-operative period or intra-operatively. In such cases the bone can be reinforced with cerclage wires or sutures. Alternatively, a silicone implant may be used temporarily, until the bone heals, allowing the re-insertion of a PyroCarbon implant.

PIP Stiffness

PIP stiffness can result following PIP arthroplasty and is usually rectified with physical therapy. Occasionally, flexor or extensor tendon tenolysis and partial collateral ligament release are necessary to restore complete joint flexion.

Joint Hyperextension

Hyperextension at the PIP joint can be seen following improper splinting or placement of the implants. A flexed alignment of the proximal component or extensive volar placement of the distal component, increases the lever arm of the middle slip, thereby predisposing the joint to hyperextension. In such cases, a hyperextension deformity can be seen early within the post-operative course. Such implants will often “squeak” during flexion. Correction of this deformity can be performed by placing the patient into a dorsal blocking splint, holding the finger in 15-20° of flexion. This splint is maintained for 4-8 weeks. If splinting does not resolve the problem, re-positioning of the implant may be necessary. For extreme cases, a superficialis tenodesis may be necessary to hold the PIP joint in mild flexion.

Salvage

Occasionally situations will necessitate removal of the implant. These occurrences are rare and have mainly been limited to persistent joint instability and joint infection. In cases of persistent instability, not amenable to arthroplasty revision, the implant can be removed and exchanged for a constrained silicone implant. Alternatively, the patient can undergo a joint fusion. Joint fusion may be performed with any number of surgical techniques. Bone grafting is often required to accelerate the healing process, as medullary bone has been removed during the arthroplasty process.
# PyroCarbon PIP Implants

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# PyroCarbon PIP Instruments

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**OPTIONAL ITEM:**

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**Also Available:**

**Ascension® Silicone PIP**

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  - Humeral Resurfacing Arthroplasty

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- **Ascension® PyroCarbon & Silicone MCP Joints**

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877.370.5001  TFP  
512.836.6933  Fax  
888.508.8081  TFF

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