Technical Note

Metacarpophalangeal Arthroscopy

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Summary: Although small joint arthroscopy has become commonplace over the past decade, relatively little attention has been paid to the investigation and clinical utility of metacarpophalangeal (MP) joint arthroscopy. The literature is scant in this area and consists of only a handful of case reports. In addition, the arthroscopic anatomy of the MP joint has not as yet been reported. Six cadaveric hands (24 joints) were rigorously studied in the laboratory using standard 2.5-mm small joint arthroscopic instrumentation and 5 lb of overhead traction. Radial and ulnar portals were used with care not to injure the extensor tendons. Arthroscopic anatomic landmarks include: (1) A consistent tripartite configuration of the main radial and ulnar collateral ligaments with characteristic changes in relative fiber orientation as the digit goes from extension to flexion, (2) nonvisualization of the accessory collateral ligament from inside the joint, (3) transitional amorphous capsular fibers connecting the collateral ligaments to the volar plate and dorsal capsule, (4) four synovial recesses (radial, ulnar, volar, and dorsal-proximal), (5) metacarpal head and proximal phalanx, (6) a consistent circumferential meniscal equivalent around the margin of the proximal phalanx articular surface, and (7) the sesamoid-metacarpal articulation in the thumb MP joint. There are published case reports on the utility of MP joint arthroscopy for synovectomy in rheumatoid arthritis and hemachromatosis and realigning Stener lesions in gamekeepers' thumbs. The current clinical series reveals preliminary experience with the technique. MP joint arthroscopy was useful in relieving a locked MP joint from a loose osteochondral body and sagittal tear in the volar plate that enfolded into the joint surface. Intra-articular release of post-traumatic volar plate and dorsal capsular contracture were readily accomplished using this technique. Juxta-articular bone lesions such as osteoid osteomas can be removed with careful preoperative planning. Gamekeeper's thumbs that are unstable on stress radiographs can undergo arthroscopy with excellent sensitivity to determine the presence of a Stener lesion before an open or arthroscopic repair. The advantages of arthroscopic versus open techniques are similar to those experienced in larger joints. With time, more indications will emerge.
Key Words: Metacarpophalangeal joint—Anatomy—Stener lesion—Gamekeeper's thumb—Arthroscopy.

Despite the universal acceptance of arthroscopy in the diagnosis and treatment of major joint disorders, relatively little attention has been given to the practicality of using these techniques for the metacarpophalangeal (MP) joint. Since 1979, there have only been five reports in the literature describing these methods. Three of these are single case histories and only two describe series of patients, their treatments and outcomes. The pertinent arthroscopic anatomy of the MP joints was described, as were the operative techniques. However, each article focused on the specific treatment given to that particular problem. The overall utility of the technique as a whole was not discussed and there was no comprehensive discussion

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of the arthroscopic anatomy of the MP joint. As more has been learned in general about the arthroscopic anatomy of major joints, new techniques have evolved to treat old orthopaedic conditions. For the most part, however, open operative techniques for the treatment of intra-articular pathology about the MP joints are still being used. It is the purpose of this article to explore the utility, indications, advantages, and technical aspects of MP joint arthroscopy. Arthroscopic anatomy is dealt with systematically and in detail.

TECHNIQUE

Under a regional or local anesthetic, patients were placed in a supine position with the shoulder abducted and the elbow flexed to 90°. The affected digit was suspended with a finger trap from an overhead traction device with 5 lb of tension (Fig 1). The joint was insufflated with 3 mL saline by syringe and 25-gauge needle. Two dorsal portals were developed: radial and ulnar to the central extensor tendon in the digits and to the extensor pollicis longus and the extensor pollicis brevis in the thumb. A No.11 blade is used to open the skin and sagittal shroud fibers. Care is taken not to injure the central extensor tendon slip in the palmar digit and the extensor pollicis longus in the thumb. A blunt conical probe is used to open the joint capsule and the arthroscope is placed initially into the radial portal. Inflow with an intravenous saline bag and tubing and lighting are established and there is no outflow until the 2.5-mm shaver is placed into the ulnar portal. The instrument and arthroscope portals are interchangeable. Standard small joint arthroscopic hand instruments fit easily into the MP joint.

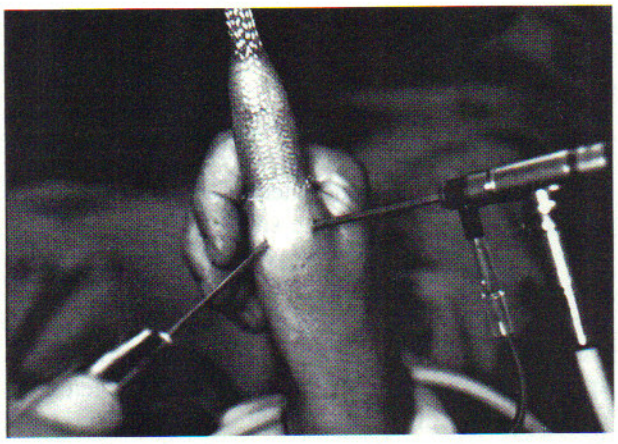

FIGURE 1. Operating room set-up for MP joint arthroscopy.

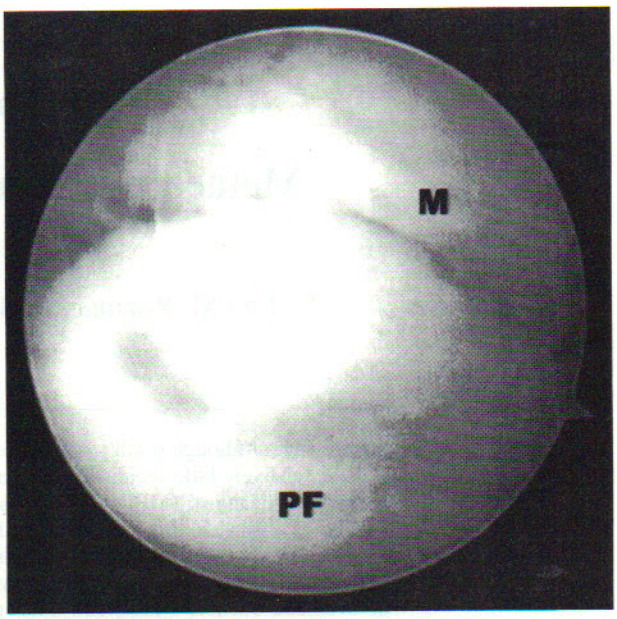

FIGURE 2. Circumferential "meniscal" rim (M) of the articular surface of the proximal phalanx (PF).

Arthroscopic Anatomy

Similar techniques were used in the arthroscopic evaluation of eight cadaveric joints as well as the 25 clinical cases by the authors. Examining the joint through the radial portal, the following anatomical points are stressed. The metacarpal head and the articular surface of the proximal phalanx are examined from radial to ulnar, from the dorsal capsule to the volar plate. The metacarpal head is wider at the volar end than the dorsal. The surfaces are examined for integrity of the cartilage surfaces and for the presence or absence of degenerative changes. In most joints, the articular surface of the proximal phalanx is ringed by a fibrocartilagenous "meniscus" (Fig 2) that appears to serve as a shock absorber for forces traveling across the MP joint. The main collateral ligaments are easily visible across the joint. These are in reality a bundle of three vertically oriented fibers that originate in the ulnar recess at the side of the metacarpal head and run to the base of the proximal phalanx (Fig 3). At the origin, the ligament fibers twist and coil (Fig 4) and with digital flexion these uncoil to accommodate the widened metacarpal head in flexion as well as the longer axis of rotation in flexion due to the cam shape of the head in the sagittal plane. With flexion and extension there is differential tensing of the fibers with equal tension in full extension and increased tension on the dorsal fibers as the digit moves into flexion. Volar to the main collateral ligament lies an amor-

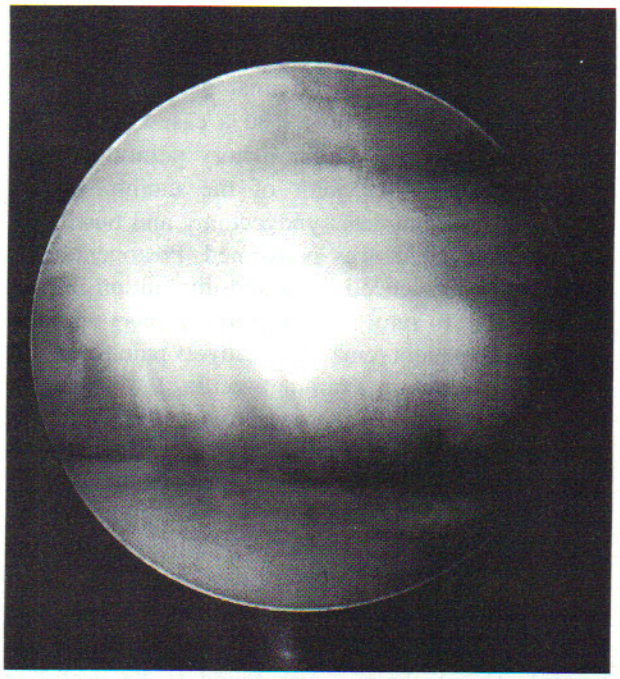

FIGURE 3. Ulnar collateral ligament index MP joint notes the three distinct bundles. With joint motion, there is relative motion between the fiber bundles.

phous fibrous layer leading to the volar plate. The fibers are less well defined and are thinner in consistency. This is the accessory collateral ligament. The volar plate is a thickened, vascular-rich ligament stretching obliquely from the metacarpal head to the proximal phalanx articular surface (Fig 5). With flexion of the finger, the volar plate is seen to relax and become less oblique, and with extension it becomes taut and drapes around the metacarpal head. It is only during flexion that a recess becomes apparent between the metacarpal head and the volar plate. A small amount of synovium rests in this recess. During digital extension, this recess closes and becomes inaccessible.

The dorsal capsule begins at the well-defined dorsal boundary of the main collateral ligament. The fibers are thinner and ill defined with fibers running longitudinally. The junctional fibers between the dorsal capsule and the main collateral ligament run obliquely in both directions forming a weave. Distally, the fibers attach directly to the meniscus surrounding the articular surface of the proximal phalanx. Proximally, the dorsal fibers extend into a recess around the metacarpal head. The recess is filled with areolar and synovial tissue . This recess is easily entered and explored when the digit is in full extension. On each side of the metacarpal head lies a narrow recess that is accessible only in the thumb and large digits. It also is filled with areolar tissue and synovial folds. The origin of the main collateral ligaments is visible in these recesses.

The MP joint of the thumb is similar in most respects to the palmar digits but there are a few notable exceptions. The volar plate is covered by a layer of synovium that, when removed, reveals the articular surface of two sesamoid bones embedded in the volar

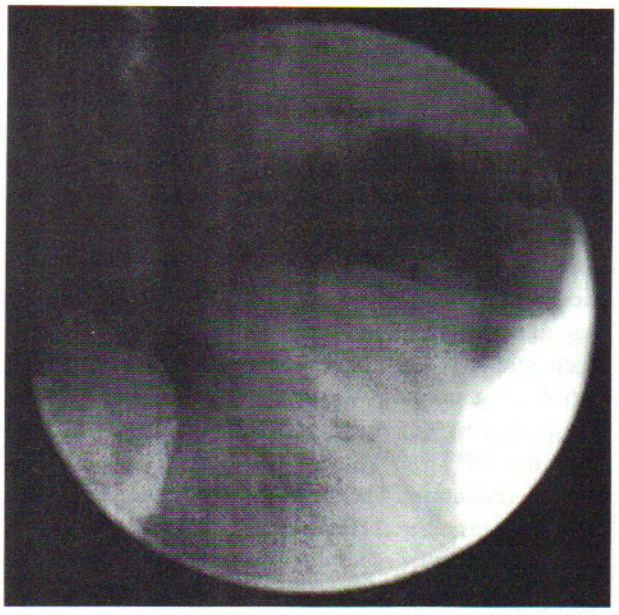

FIGURE 4. The origin of the ulnar collateral ligament at the side of the metacarpal head. Note the spiral shape of the origin. With digital flexion, the ligament origin uncoils to accommodate the greater distance to the center of rotation.

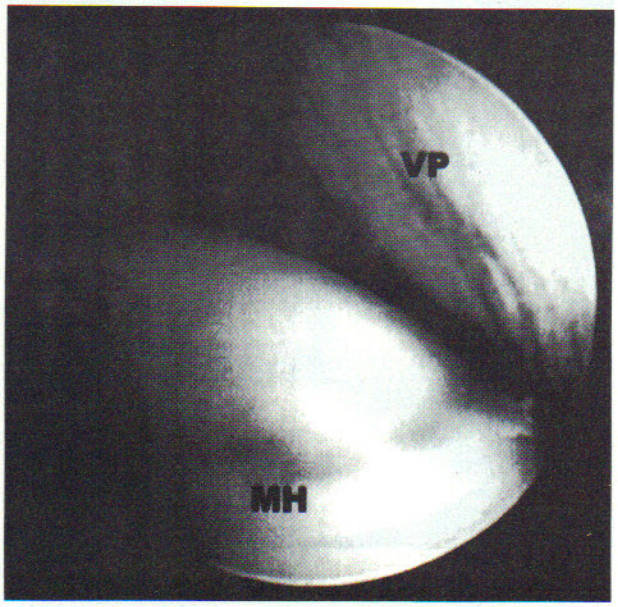

FIGURE 5. The volar plate (VP) with the MP joint in extension. The close apposition to the metacarpal head (MH) and the tautness of the ligament relax with digital flexion.

plate. These rise and fall with respect to the metacarpal head with thumb extension and flexion (Fig 6). There is a notable absence of a meniscus surrounding the articular surface of the proximal phalanx. The arrangement of the collateral ligaments is similar to the palmar digits but the radial and ulnar recesses are deeper, wider and easily accessible.

Gross anatomic dissection of the MP joint in the laboratory reveals that the portals traverse the sagittal shroud fibers and the dorsal capsule of the MP joint. The area is crossed by fine terminal branches of the radial sensory nerve. These are avoided in forming the portals by bluntly dissecting the subcutaneous tissue with a mosquito clamp after the longitudinal skin incision.

DISCUSSION

The advantages of arthroscopic versus open surgery of the MP joint with the appropriate indications are similar to those of larger joints. These include: (1) Less surgical exposure—the extensor hood is protected, (2) excellent joint visualization, (3) short learning curve, (4) immediate postoperative joint mobilization, and (5) shorter rehabilitation period.

Since 1979, there have been five reports in the literature. In 1979, Chen[1] described MP joint arthroscopy in a rheumatoid patient with villi protruding from a recess. He also described the meniscus encircling the articular surface of the proximal phalanx. In 1985, Vaupel and Andrews[2] described a case of a professional golfer with a 1-year history painful chronic synovitis in the MP joint of the thumb. During arthroscopy, a complete synovectomy and burring of the chondral defect was performed. Postoperatively, the patient experienced a marked diminution in pain and was able to return to competitive sport within 6 months. The patient remained relatively pain free at his 20-month follow-up examination. In 1987, Wilkes[1] performed arthroscopic synovectomy on 13 joints in five patients with rheumatoid arthritis. All these patients have synovitis without joint subluxation or destruction. The synovitis was located in the radial and ulnar recesses and the dorsoproximal recess under the extensor tendon. While most of the patients experienced early diminution of pain at 4-year follow-up, all joints were considered to be moderately to severely painful. This technique was found to be useful in alleviating pain and inflammation over the short term but does nothing to alter the natural history of the disease at the MP joint. Declercq et al[4] described a patient with painful swelling and recurrent locking of the MP joints with loss of both flexion and extension. Intraoperative findings included inflamed synovium cartilage detachment and osteochondral loose bodies. The presumptive diagnosis was hemochromatosis. Synovectomy and chondroplasty resulted in pain relief and improved range of motion. In 1995, Ryu and Fagan[5] reported on eight gamekeeper's thumbs with Stener lesions treated arthroscopically. The proximally retracted ulnar collateral ligament was reduced into the joint with a nerve hook placed into the ulnar recess at the ligament origin. In this series, the ligament was simply reduced back into its anatomic location and left there without direct internal fixation. The joints were fixed with Kirschner wires. The postoperative course was uncomplicated and all patients achieved good pinch strength; seven of the eight patients had no pathological laxity of the MP joint. In 1998, Slade et al[6] reported on 10 patients with intra-articular fractures about the MP joints treated with arthroscopic-assisted fracture reduction. These results compared favorably with standard open techniques with improved range of motion and shorter rehabilitation time.

It is curious that there have been only five articles published on the subject since 1979. I believe this the result of a perception that the MP joint is simply too small to perform operative arthroscopy in a meaning-

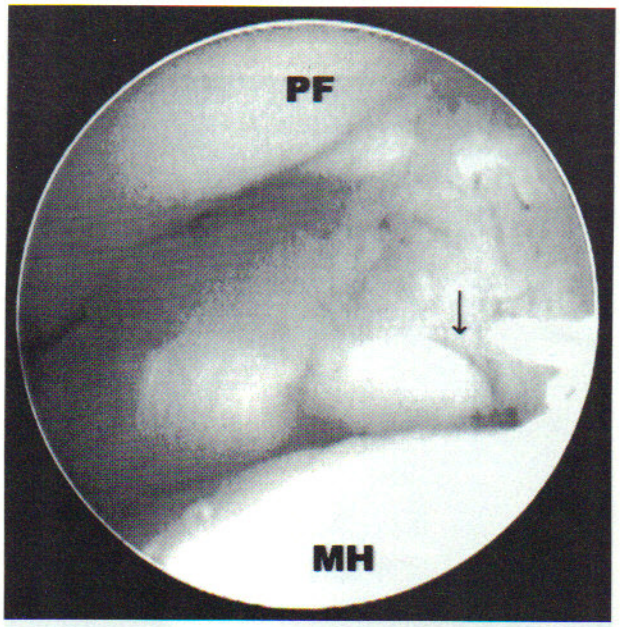

FIGURE 6. One of two sesamoid bones embedded in the volar plate (arrow). In some specimens, the sesamoids were apart and in some they were adjacent to one another. Note the proximity to the proximal phalanx (PF) and the metacarpal head (MH).

ful and practical fashion. To date, both the authors have accumulated a clinical experience of approximately 35 patients. Although it is too soon to make statements about the long-term follow-up of this technique, the following indications are emerging: (1) Joint synovectomy and biopsy, (2) removal of foreign or loose bodies /locked MP joint, (3) capsular debridement and release, (4) osteochondral lesions, (5) juxta-articular lesions, (6) intra-articular fractures, and (7) collateral ligament repair and debridement.

The experience of the authors reflects that of those who have reported previously that this technique is highly utilitarian and effective when used for the appropriate indications. Further work on the arthroscopic anatomy of the MP joint should further delineate the kinesthesiology of this joint.

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