The thumb metacarpophalangeal (MCP) joint is particularly vulnerable to injury because of its relatively unprotected position at the base of the exposed lever arm of the proximal phalanx. The severity of these injuries varies considerably, with the higher grade lesions being associated with the potential for permanent instability that can be markedly disabling.

The direction and magnitude of the injuring force determine the site and degree of tissue disruption in the capsuloligamentous complex; and these parameters, in turn, have traditionally formed a useful basis for organizing the classification and treatment of these injuries. Hyperabduction forces, with varying degrees of hyperextension load, create injury to the ulnar collateral ligament (UCL) and volar plate complex, while adduction forces produce tears to the radial collateral structures. Straight hyperextension stresses principally tear the volar restraints and cause dorsal dislocations, often leaving the collateral ligaments relatively intact. Recent reports suggest that straight volar dislocations may also occur. Although some of these injuries can occur in combination with each other, it remains both customary and useful to discuss them independently. Before doing so, some pertinent aspects of the anatomy of the metacarpophalangeal joint warrant review.

FUNCTIONAL ANATOMY

Proper function of the thumb is contingent upon stability at the MCP joint level. The mobility required for thumb function is largely provided by the basal and interphalangeal joints. Thus, the MCP joint of the thumb is unique in the hand in that functional disability following injury to this joint is almost always due to instability, deformity, or pain, as opposed to stiffness.

The stability of the MCP joint is dependent upon the integrity of the collateral ligaments, the volar supporting structures, and the intrinsic and extrinsic musculotendinous units (Figs. 1 to 3). The anatomy of the collateral complexes is particularly important to an understanding of the soft tissue injuries that occur about this joint. The ulnar collateral ligament arises from the dorsal ulnar aspect of the metacarpal and passes distally and palmarward to insert into the volar ulnar base of the proximal phalanx. The more membranous ulnar accessory collateral ligament takes origin just proximal and volar to the collateral ligament proper, on the medial neck of the metacarpal. It passes parallel to the proper collateral, but slightly more volarly, to attach to the ulnar margin of the volar plate. Some of these insertion fibers pass further volarly to attach to, and help suspend, the flexor sheath of the flexor pollicis longus. Stener and others have shown that the collateral ligament proper is taut in flexion and somewhat lax in extension, with just the opposite being true for the accessory collateral ligament. An entirely analogous and symmetric disposition of collateral ligamentous fibers is found on the radial side of the joint. The relationship of the torn ulnar collateral ligament to the adductor tendon aponeurosis (Stener lesion) is of critical importance in the assessment and treatment of ulnar collateral injuries.
Figure 1. Lateral aspect of the MCP joint showing the collateral ligaments and intrinsic tendons. (From Kaplan EB: Functional and Surgical Anatomy of the Hand. Edition 3. Philadelphia, JB Lippincott, 1984, p 118; with permission.)

Figure 2. A: View of interior of the MCP joint from dorsal perspective with collateral ligaments and dorsal capsule removed. The volar plate and sesamoid bones are shown in the depths of the joint. B: Volar view of the joint showing flexor pollicis longus and intrinsic tendons. (From Kaplan EB: Functional and Surgical Anatomy of the Hand. Edition 3. Philadelphia, JB Lippincott, 1984, p 119; with permission.)
Figure 3. A, Volar view of the thumb showing adductor pollicis tendon insertion into the ulnar sesamoid. B, Ulnar aspect showing triradiate insertion of adductor pollicis into the ulnar sesamoid, base of proximal phalanx, and dorsal aponeurosis. (From Kaplan EB: Functional and Surgical Anatomy of the Hand. Edition 3. Philadelphia, JB Lippincott, 1984, p 141; with permission.)

and will be discussed further in the section below that deals specifically with that injury.

Volar support for the thumb MCP joint is provided by the volar plate and its associated structures. The volar plate of the thumb MCP joint is similar to that found in the proximal interphalangeal (PIP) joints of the fingers, but there are important differences. As in the PIP joints, the volar plate here consists of a heavy fibrocartilaginous plate of tissue that finds secure attachment to the proximal volar margin of the proximal phalanx. It rides freely on the volar aspect of the metacarpal head during flexion and extension of the joint. The plate is 2 to 3 mm thick distally, but tapers proximally to become membranous. Unlike the finger PIP joints, however, the check ligament extensions of the volar plate are absent in the thumb MCP joint, and the central portion of the plate is more membranous. For these reasons, the MCP joint of the thumb is particularly prone to hyperextension injury and subsequent chronic dorsal instability.

Radial and ulnar sesamoid bones are invariably present in the distal part of the volar plate. Portions of the short thumb flexor, abductor, and adductor intrinsics insert into these small bones. The flexor pollicis longus is supported between the two sesamoids. These bones articulate with facets on the metacarpal head and function to hold the FPL and intrinsic insertions somewhat volarly displaced, thus increasing their flexor moment arm. The position of the sesamoids, as observed radiographically, can be particularly helpful in the analysis of hyperextension injuries because they mark the position of the distal portion of the volar plate.

The dynamic support to the MCP joint provided by the intrinsic motor units correlates well with their geometric distribution about the joint and their precise manner of insertion into the periarticular tissues. On the ulnar side, the adductor pollicis has three insertions (Fig. 3). The bulk of the tendon inserts into the ulnar sesamoid and the proximal volar corner of the proximal phalanx. The remainder of the fibers pass dorsally and further distally as an aponeurotic sheet to insert into the extensor mechanism. A similar situation is present on the radial side of the joint. Most of the insertional fibers of the flexor pollicis brevis and abductor pollicis brevis insert into the radial sesamoid and radial corner of the proximal phalanx. A significant portion of the power of these muscles, however, is also transmitted dorsally to the extensor tendons via an aponeurotic expansion. These triradiate insertions for the ulnar and radial intrinsics allow them to not only effectively flex the MCP joint and extend the interphalangeal joint, but also to provide strong dynamic protection against varus-valgus and hyperextension loads delivered across the joint.

Motion at the thumb MCP joint shows the most variability of any joint in the hand. This variability is largely due to the shape of the metacarpal head and the tension of the collateral ligaments. The broader and flatter heads tend to be associated with the most stability and the least motion. The motion in flexion varies from 10 to 100 degrees—averaging 75 degrees, while extension varies from 0 to 90 degrees, averaging 20 degrees. Normal abduction and adduction ranges from 0 to 20 degrees, with an average of 10 degrees (measured in 15
degrees of flexion). Several degrees of supination and pronation through the joint are also possible.

Although small amounts of flexion, abduction, and pronation normally occur in unison when the thumb is brought into its working position of opposition, it is interesting to note that no functional deficits have been reported in those patients who naturally have limited MCP joint motion. This correlates well with the clinical observation that patients who have had thumb MCP arthrodesis experience little or no disability. Thus, arthrodesis of this joint is an exceptionally good salvage procedure for failed soft tissue reconstructions.

ULNAR SIDE INJURY

Dislocations and fracture dislocations have been estimated to occur about ten times more frequently on the ulnar aspect of the joint than on the radial side. Often the patient (and sometimes the physician who initially evaluates the patient) fails to appreciate the significance of the injury, thus setting the stage for delay in diagnosis and treatment. If left untreated or inappropriately treated, a high-grade lesion often results in chronic instability, which in turn may cause marked disability due to pain and weakness in pinch and grasp.

Anatomy of Injury

The pathomechanics of ulnar collateral injuries have been studied with a variety of cadaveric models. Although some of the details of the pathomechanics remain controversial, there is general agreement that the basic mechanism of injury is usually that of hyperabduction (often with some hyperextension) resulting in tearing of the ulnar collateral ligament and at least a portion of the accessory collateral. Varying degrees of injury to the adductor tendon aponeurosis, dorsal capsule, and extensor tendons have also been reported. Although the ligament may fail anywhere within its substance, most investigators have reported that the majority of failures occur distally, near the site of the ligament's attachment to the volar corner of the proximal phalanx. An avulsion fracture at this site occurs commonly and serves the useful purpose of radiographically marking the position of the disrupted distal end of the ligament (Fig. 4). Smith, on the basis of combined clinical and cadaveric studies, has suggested that these avulsion fractures only occur if the injuring abduction force is actively resisted by the adductor pollicis. On occasion, a larger bone fragment involving more than 10 per cent of the articular surface of the proximal phalanx may be avulsed. The volar plate is also commonly injured in conjunction with a distal ligament failure, although the plate's absence of a strong proximal check ligament tether makes this less likely than in the case of the analogous injury at the PIP joint.

Smith has reported that volar subluxation of the proximal phalanx on the metacarpal head occurs frequently in association with UCL injuries. He reported this finding in 16 of 66 cases coming to surgery for acute and chronic repairs. He felt that this was due to supination of the proximal phalanx about the intact radial
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... collateral ligament and stressed the need for attention to the repair of the oblique portion of the UCL to correct this deformity (Fig. 5).

It is important to recognize that UCL-type injuries can occur in the skeletally immature patient. Although abduction and extension blows to the MCP joint of individuals with open epiphyses typically result in Salter-Harris type II or III fractures at the proximal phalanx level, simple soft tissue injuries of all grades have been reported. Purely cartilaginous avulsion injuries without bony fracture have also been described. In many of these cases, the radiographs will be normal despite the presence of a significant skeletal injury.

Stener Lesion. As previously noted, one of the critical features of capsuloligamentous injuries on the ulnar side of the thumb MCP joint is the possibility for the dorsal extensor aponeurosis of the adductor pollicis to become interposed between the disrupted UCL and its bony bed—thereby preventing satisfactory healing of the injury with simple immobilization. Stener first called attention to this lesion in 1962. Working with both clinical material and a cadaveric model, he observed that after distal failure of the ulnar collateral ligament under a valgus load, further abduction and flexion of the proximal phalanx could “uncover” the proximal stump of the torn ligament sufficiently to allow the adductor tendon aponeurosis to become interposed between the ligament and its distal bony bed (Fig. 6). Stener felt that if this lesion occurs, satisfactory healing would be prevented. He reported finding this lesion in 25 of 39 specimens. Other authors have consistently confirmed this finding with the reported incidence varying between 14 and 87 per cent. If this lesion is present, it must, of course, be corrected if one hopes to achieve a predictably good result. This has lead to the generally accepted principle that all complete tears on the ulnar aspect of the joint warrant surgical exploration and repair.

Ulnar Collateral Ligament Injuries in Skiers

The term “gamekeeper’s thumb” refers to a chronically unstable UCL. Campbell originally described this as an injury suffered by Scottish gamekeepers due to repeatedly twisting the necks of hares. Over the past two decades, however, it has become increasingly apparent that falls while skiing are the most common etiology of both the acute and chronic form of this injury. During the 1970s, Schulz and Browne published two reports calling attention to the relationship between skiing accidents and UCL injuries. Subsequently, Gutman, Young, and Crane independently reported their observations that between 10 and 24 per cent of all skiing injuries occurred in the thumb. In 1978, we reported on the results of a survey of 1,008 high school skiers undertaken in an effort to determine the prevalence and mechanism of skiing injuries to the thumb MCP joint. The results of that survey...
are summarized in Figure 7. Eleven per cent of these skiers reported having sustained a skiing-related injury to their thumb, with 89 per cent of the injuries occurring on the ulnar aspect of the MCP joint. Only 28 per cent of the students who reported a thumb injury had sought any type of medical treatment acutely. In nearly every case, the individual could relate a history of hyperabduction and/or hyperextension of the joint.

Three specific mechanisms of injury were identified (Fig. 8). Thirty-four per cent reported catching or abducting the thumb in the strap of the pole in the course of a forward or lateral fall. Forty-two per cent reported contacting the snow with the pole wedged in the first web space between the thumb and index finger, thus producing forced abduction of the thumb. Fifteen per cent remembered an abduction or extension force at the MCP joint level occurring during a fall, but did not believe that the pole was a factor.

Seventy-two per cent of the 1,008 skiers indicated that they were using a ski pole grip with a conventional strap, while 25 per cent reported using a pole or grip with a strap or clip across the back of the hand (Fig. 9). Three per cent reported using a pole without any restraint (that is, no strap or clip). The distribution of grip types in the skiers with thumb injuries was essentially the same as the distribution in the 1,008 total skier population (Fig. 10). This suggested to the authors that the two major types of pole grips currently used are equally associated with thumb MCP joint injuries.

Numerous subsequent reports concerning the incidence and mechanism of UCL injury in skiers have essentially confirmed the findings reported here.

A definitive means for preventing this injury in skiers has not been devised. In recent years, there has been general acceptance of the principal of getting the ski away from the falling skier to prevent the ski itself from causing lower extremity injury. Pending the development of a safer ski pole grip, it is felt that a similar separation of the pole from the falling skier should be adopted to control pole-related thumb trauma. By removing all straps or other retention devices from the poles, the unencumbered thumb should be spared injury during most skiing falls.
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Figure 8. Drawings demonstrating three mechanisms of MCP joint injuries of skiers.

Figure 9. Drawing demonstrating the two common types of ski pole grips.
Clinical and Radiographic Evaluation

The important aspects of the history and physical examination in the evaluation of acute injuries to the thumb MCP joint have been emphasized by many authors. In the course of reviewing the mechanism and timing of the injury, the patient should be questioned regarding any history of pre-existing injury or chronic problems with not only the MCP joint, but also with the interphalangeal (IP) and basal joints of the thumb, and other small joints of the hand and wrist.

Concomitant injuries or pre-existing disease are not uncommon in the adjacent joints, and their presence may significantly complicate the management of the MCP joint injury. Figure 11 shows a radiograph of a 59-year-old woman who presented with an acute, third-degree injury to her ulnar collateral ligament. Her management was complicated by the presence of long-standing basal joint arthrosis, an acute intra-articular fracture at the IP joint level, and an acute carpal tunnel syndrome. The collateral ligament was repaired, the fracture reduced and pinned, and her carpal tunnel decompressed. She subsequently had a fascial basal joint arthroplasty, but only obtained her final good result after fusion of the IP joint, which had developed post-traumatic arthrosis.

Examination of the thumb with an acute ulnar collateral ligament injury includes the usual search for areas of maximum pain, tenderness, swelling, and deformity. Because the ligament generally fails at the level of the proximal phalanx rather than the metacarpal neck, findings often localize to this relatively small area, particularly when the patient is seen soon after injury. An assessment of the degree of injury to the collateral ligament structures is, of course,
the cornerstones of the clinical evaluation of these injuries, as the degree of injury dictates the type of treatment that will be required. Unfortunately, the best method for determining that degree of injury remains somewhat controversial.

Most authors agree that clinically stressing the ulnar collateral ligament is the best means for determining the grade of injury, but there are varying opinions as to how this "stress test" should be performed, and how the results should be judged. Eaton prefers that the stressing be done with the joint in extension and feels that valgus laxity in excess of 35 degrees or 15 degrees greater than the contralateral side constitutes evidence of a third-degree tear. Smith concurs with the position for the stress testing, but used 45 degrees of laxity as his upper limit for a second-degree injury. Palmer, conversely, states that the clinical stress test should be done with the MCP joint in maximum flexion—using 35 degrees as the criteria for a complete tear. He favors this positioning for the test based upon the results of evaluating the injury with a cadaveric model. The rationale for performing the test in flexion is related to the fact that the ulnar collateral ligament proper (the integrity of which is under question) is known to be somewhat lax in extension and maximally tight in flexion. In principle, then, a test done in full extension could produce a false-negative result in the face of a third-degree ulnar collateral proper tear if the accessory ulnar collateral ligament has remained completely intact. In my experience, however, there is often a problem in attempting to quantify the degree of laxity with the MCP in full flexion because it is difficult to determine whether the observed valgus angulation of the proximal phalanx is occurring due to laxity of the collateral ligament or axial rotation of the metacarpal through the basal joint.

The author's preferred method for performing the clinical stress test is illustrated in Figure 12. With the MCP joint in extension, a straight line is drawn along the dorsal aspect of the thumb metacarpal and proximal phalanx. Laxity on the ulnar side of the joint is assessed with the joint held in 15 degrees of flexion. It is felt that this degree of flexion relaxes the accessory collateral ligament sufficiently to test the integrity of the proper collateral ligament, while at the same time avoiding the practical difficulties associated with attempting to measure the degree of angular deviation with the MCP joint in full flexion. Laxity in excess of 35 degrees, or more than 15 degrees in excess of the contralateral thumb, is judged to represent a third-degree injury to the collateral ligament and is used as a criteria for undertaking operative treatment. The clinical laxity and "end-point feel" are also assessed in full extension and full flexion because the findings in these positions are usually confirmatory and may help to further delineate the nature and extent of the injury.
Regardless of the precise method used in stressing the joint, it is essential that the intrinsic and extrinsic musculature that supports the joint be fully relaxed. Usually, this type of relaxation requires a median and radial sensory nerve wrist block.

As with any injury of this type, radiographic examination is an essential part of the initial clinical evaluation. Obviously, films should be obtained prior to clinically stressing the joint, to avoid displacing an undisplaced intra-articular fracture or disturbing an epiphyseal injury in a skeletally immature patient. Routine anteroposterior and lateral x-rays are obtained initially. Oblique views are added as necessary to help delineate the nature and position of any fractures visualized on the initial films.

As previously noted, the small avulsion fractures that commonly accompany distal ligament failures are helpful in guiding treatment, as the position of the torn end of the ligament can be determined with relative certainty based upon the plain radiographs alone (see Fig. 5). If the fragment is undisplaced, one can be certain that the Stener lesion is absent and proceed with nonoperative treatment, confident of the prognosis for a good result. Coonrad and associates and Smith found that one third of their patients presenting with ulnar collateral ligamentous injury had had some type of an avulsion fracture from their proximal phalanx. In Smith’s series, 50 per cent of these fractures involved 10 per cent or more of the articular surface. The size of the fracture fragment and the degree of displacement that necessitate surgical intervention (aside from the Stener lesion criteria) has remained controversial and ultimately becomes a matter of clinical judgment. If the fragment is larger than 10 per cent of the articular surface and/or is sufficiently displaced to create joint incongruity, the author favors surgical reduction and K-wire fixation.

The role of stress x-rays in the evaluation of these injuries is another controversial issue. Although in principle they offer an objective means for quantifying the degree of ligamentous laxity produced when the injured joint is stressed, in actual practice there may be problems that can limit their usefulness. For reasons already discussed, stability is best assessed with the joint in at least some flexion. If the stress x-rays are made with the joint stressed in flexion, however, variation between the actual angular deviation present and that recorded on the x-ray film is influenced by both errors associated with the planar projection of a flexed joint and errors introduced by any rotation along the long axis of the flexed thumb. In the author’s experience, these problems have been significant. If the study is to be used, the physician who is to interpret the films should directly supervise the positioning of the hand.

Arthrography is yet another radiographic technique that some authors have found to be useful in helping to make the critical determination as to presence of a third-degree lesion. The details and merits of the technique have been described by Bowers and Hurst and others. If contrast is detected in the soft tissues external to the joint, one can be certain that the capsuloligamentous integrity has been breached; but the goal of making the diagnosis of a Stener lesion with this technique has proved difficult to achieve. Bowers and Hurst have reported some success in this quest by combining special stress films with arthrography.

Treatment—Acute Injuries

Although Coonrad and Nevisier felt that acute complete rupture of the UCL could be managed satisfactorily with closed treatment, most authors agreed that operative intervention is warranted for third-degree lesions if one wishes to achieve consistently good to excellent results. Until a means is achieved for consistently diagnosing the Stener type of lesion, only with operative exploration can one make certain that all of these lesions are identified for surgical repair. A second indication for open repair of an acute injury is the finding of a displaced intra-articular fracture that exhibits sufficient size and displacement to warrant operative reduction and fixation. Smith felt that volar subluxation of the proximal phalanx on the metacarpal head was also a surgical indication.

The surgical technique used by the author in the exploration and repair of acute injuries is relatively straightforward and entirely consistent with what has been detailed previously by many other authors. Either a lazy s-shaped incision on the dorsal-ulnar aspect of the joint or a dorsally based gently curved flap incision is used. The subcutaneous dissection is done bluntly, with care taken to identify and protect an invariably present dorsal branch of the radial sensory nerve that courses along the ulnar aspect of the extensor mechanism. If a Stener lesion is present, it can frequently be identified at this time as an edematous, hemorrhagic mass of ligamentous tissue just proximal to the mar...
gin of the adductor aponeurosis. The aponeurosis is tagged and released from its insertion into the extensor pollicis longus tendon and reflected ulnarily, thus exposing the remainder of the capsuloligamentous injury.

The precise nature of the repair is dependent upon the location of the lesion within the collateral ligament. Usually the tear is at or near the distal insertion into the volar ulnar corner of the proximal phalanx. In this case, the insertional bed is freshened with a curette, and the ligamentous stump is repaired with a pull-out wire tied over a button on the radial aspect of the proximal phalanx. If the tear has extended into the accessory collateral ligament and corner of the volar plate, this area is repaired with interrupted sutures. If the primary ligamentous damage has occurred in the midsubstance or at the metacarpal head origin, then primary soft tissue repair with horizontal mattress sutures is often all that is required. If there is an insufficient proximal soft tissue stump to hold the suture, a pull-out wire technique using a drill hole through the metacarpal head may be required.

When an articular fracture is present, and a decision has been made to reduce it (as opposed to excise it), this reduction can often be facilitated with the tip of a 16-gauge needle. The needle holds the fracture reduced while an 0.045 or a 0.035 K-wire is passed transarticularly. As previously mentioned, Smith has emphasized the need for attention to the repair of the oblique portions of the proper and accessory collateral ligaments to correct this deformity.

At the completion of the articular and capsuloligamentous repairs, the adductor tendon aponeurosis is repaired to the extensor pollicis longus tendon with interrupted 4.0 nonabsorbable suture.

Postoperatively, the thumb is supported for 4 weeks with a thumb spica cast, after which an orthoplast splint is worn on an intermittent basis for an additional 4 weeks. Both the cast and the splint leave the IP joint free to allow early active IP joint motion. The immobilization should maintain the thumb index web. To avoid stressing the ulnar soft tissue repair, this is best done by holding the thumb ray in extension as opposed to palmar abduction. The sutures are removed at 2 weeks, and the transarticular K-wire is removed at 4 weeks. Between 4 and 6 weeks, the orthoplast splint is worn continuously except for range-of-motion exercises performed 4 times a day. These exercises focus on MCP flexion and extension, with active thenar abduction and opposition motions being introduced only gradually. The patient is slowly weaned from the splint between 6 and 8 weeks, at which time progressive resistive strengthening exercises are emphasized by the hand therapist. Patients are advised that it is often 3 to 4 months before they can return to full function, and that swelling and some low-grade symptoms are likely to persist for several more months.

The reported results following this type of surgical treatment of acute (up to 2 to 3 weeks old) grade III lesions has been uniformly good to excellent.

Grade I and grade II lesions are virtually always treated successfully nonoperatively. Nonoperative treatment, however, does not mean no treatment. The general guidelines for our nonoperative treatment of grade II lesions are very similar to the rehabilitation program outlined above for the postoperative management of grade III lesions. The MCP joint splint is worn for 5 days to 2 weeks in 30 degrees of flexion, and because a transarticular pin is not used, extra care must be taken to assure that the cast and splint immobilization do not allow either passive or active stress to develop in the ulnar collateral tissues.

Grade I lesions require less immobilization, and the rehabilitation is obviously more rapid. The resolution of tenderness in the soft tissues provides a useful guide in determining the extent of immobilization required.

**Chronic Injuries**

Like ligaments elsewhere in the body, collateral ligament injuries in the thumb are not amenable to acute repair if more than 2 to 3...
weeks have elapsed from the time of injury. Those patients who present late for their evaluation and treatment may benefit from a trial with cast immobilization for several weeks until all of the swelling and soft tissue tenderness has resolved. An effort should then be made to maximally strengthen the intrinsic musculature, with particular emphasis on the adductor pollicis. If disabling instability, pain, and weakness persist despite these measures, some patients may benefit from a thumb spica orthosis that supports the MCP joint, but leaves the IP joint free. In our experience, most patients find this unacceptable awkward, and for this reason an initial trial with an orthoplast splint is usually advised before prescribing an expensive custom leather brace. If the patient remains disabled despite these measures, he or she should be considered for operative intervention.

Operative treatment for chronic instability of the ulnar collateral ligament consists of either reconstruction of the ligament or arthrodesis of the joint. The best choice of treatment is dependent both upon the status of the joint and the functional demands that the patient anticipates placing upon the joint. If the articular surfaces are well preserved, the patient anticipates only moderate stresses on the articulation, and the joint on the uninjured hand shows good motion, then the patient will almost certainly be best treated with one of the many different ligament reconstructions. If, on the other hand, the joint shows evidence of arthrosis, or the patient is engaged in very heavy manual activities, or the opposite (normal) thumb MCP joint shows very little motion, then the patient will very likely be best served by arthrodesis.

Arthrodesis. As previously noted, arthrodesis of the MCP joint permits retention of exceptionally good function. In my experience, it has been helpful to make a point of discussing arthrodesis as an option that may need to be exercised at the time of a planned ligament reconstruction. Unless this option has been discussed preoperatively, the surgeon may be presented with a dilemma if unanticipated arthrosis is encountered at the time of arthroscopy.

The position of the arthrodesis is important. When the normal thumb is brought into opposition, the MCP joint usually shows a few degrees of flexion, palmar abduction, and pronation. Fusion in this position will provide good results. Fusion of the joint in too much flexion or any adduction will seriously diminish the quality of the result. Although any of the established techniques for fusing this joint should produce a satisfactory result if carefully implemented, the author has found the "ball and cup" method to be most useful as it permits fine adjustments of angular alignment in all three planes just prior to transfixion of the joint.

Soft Tissue Reconstruction. There are a number of methods available for reconstruction of the ulnar collateral ligament. These include efforts at repair of the scarred ligament; reconstruction with a free tendon graft; reconstruction with a static tendon transfer; and reconstruction with a dynamic tendon transfer. Although some authors have reported satisfactory results following simple mobilization and repair of the scarred ligament stump, most have felt this type of repair to be inadequate and have favored one of the more formal types of reconstructions.

Several techniques have been described for the reconstruction of the ulnar collateral ligament employing free tendon grafts. Eaton has described his method using the palmaris longus as a free graft interwoven through drill holes in the metacarpal head and proximal phalanx. Alldred described a similar technique using a toe extensor as the graft material. Smith favors a slightly different procedure, again using the palmaris longus as the free tendon graft material. His method consists of weaving the graft through the residual stump of the proximal ligament on the metacarpal head and then threading it through a drill hole in the proximal phalanx, thereby reconstructing both the oblique and transverse components of the ligament (Fig. 13). He has reported satisfactory results in 25 cases. The author has had favorable experience using this technique. If there is insufficient soft tissue at the metacarpal origin of the ligament, another drill hole can be made at that position, and the reconstructed ligament anchored there with a second pull-out wire.

A variation on the free tendon graft type of reconstruction involves the use of so-called "static tendon transfers." This group of reconstructions also reconstitutes the ligaments with tendon grafts, but with these procedures one end of the graft material is left attached to its bony insertion. This allows the graft (in theory) to retain some of its blood supply and simplifies the anchorage of one end of the repair. Procedures of this type have been described by Strandell using the extensor pollicis brevis, Frykman using a slip of the abductor pollicis longus, and Lamb using the palmaris longus left attached distally. These authors have reported satisfactory results with their methods in small numbers of patients, but there is no
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Figure 13. Diagram showing the surgical technique for Smith's method of reconstructing the collateral ligaments. Note that the reconstructed ligament restores the proximal-dorsal to distal-velar orientation of the normal collateral ligament. (From Smith RJ: Post-traumatic instability of the metacarpophalangeal joint of the thumb. J Bone Joint Surg 59A:14-21, 1977; with permission.)

Figure 14. Drawing showing Ndevaisier's method of distally advancing the adductor pollicis to reinforce dynamically the reefed repair of a scarred chronic UCL injury. (From Green DP: Dislocations and ligamentous injuries in the hand. In Evarts CM (ed): Surgery of the Musculoskeletal System. New York, Churchill Livingstone, 1983 p 2171; with permission.)

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motion and strength. For the athlete, they suggest that the two methods might be combined to yield an optimal result.

RADIAL SIDE INJURY

Compared to injuries of the ulnar collateral complex, very little has been written about either acute or chronic injuries to the radial aspect of the joint. Based upon the author’s experience, and that which has been documented in the literature, it is apparent that the evaluation and treatment of these injuries can proceed in a manner similar to that already outlined for the evaluation and treatment of ulnar collateral injuries. There are, however, important differences.

The reported incidence of injury to the radial side varies between 10 and 30 per cent of that reported for the ulnar side.\(^{10,14,19,23,29,37,41,58,82}\) The mechanism of injury involves adduction with or without an element of hyperextension—usually occurring with a sports injury or fall. Problems with pinch and grip are often absent, and presumably for this reason, the patients commonly present late for evaluation and treatment with chronic symptomatology.\(^{10}\) These late symptoms include a cosmetic deformity consisting of prominence of the radial margin of the metacarpal head due to ulnar and volar subluxation of the proximal phalanx on the metacarpal, and pain on the radial aspect of the joint when the joint is loaded in adduction.\(^{10,37}\) Examples of painful activity include pressure on the flattened hand (as occurs when polishing a tabletop), and pressure on the radial aspect of the thumb tuft (as occurs when pressing on the opening latch on a car door or twisting the lid of a jar). The surgical pathology consists of tearing or attenuation of the radial and accessory collateral ligaments, which may fail at either bony attachment or within their midsubstance.\(^{10}\) Like its companion injury on the ulnar side, volar subluxation often occurs about the intact contralateral collateral ligament.\(^{10,82}\) Smith found this in 65 per cent of his 20 patients.\(^{82}\) This results in a pronation deformity that contributes to the dorsal radial prominence of the metacarpal head, so often noted on clinical exam. Although Camp\(^{10}\) noted no intra-articular fractures in his 26 patients, Smith found that 5 of 20 patients in his series had avulsion fractures, with four of these noted on the metacarpal side of the joint. Although stretching of the extensor aponeurosis may occur, a disturbance analogous to the Stener lesion seen with ulnar-sided injuries has not been reported.\(^{10,14,23,82}\)

Evaluation and Treatment

The clinical assessment of this injury may proceed in a fashion similar to that detailed for problems on the ulnar side of the joint. A clinical “stress test” with the joint held in 15 degrees of flexion usually suffices to establish the grade of the injury. Laxity in excess of 45 degrees, or greater than 15 degrees more than that found on the contralateral thumb, indicates a complete tear of the radial collateral ligament.\(^{10,82}\) The presence or absence of volar subluxation with pronation of the proximal phalanx on the metacarpal head should also be determined. Plain x-rays are helpful and may further assist in the documentation of volar subluxation. Stress x-rays and arthrograms are generally not necessary.
First- and second-degree injuries to the radial aspect of the joint can almost always be managed with simple cast immobilization in a manner analogous to that outlined for acute ulnar-sided injuries provided the injury is identified and treatment instituted within 2 to 3 weeks. Because the Stener-type lesion does not occur on the radial aspect of the joint, many authors state that most third-degree injuries can also be satisfactorily managed with simple cast immobilization. Others, however, have recommended acute operative repair as the best means of assuring reliably good results. If volar subluxation is apparent on evaluation of the acute third-degree injury, this may constitute a more definitive indication for open surgical repair.

If acute surgical intervention is undertaken, the repair proceeds in a manner analogous to that outlined for ulnar-sided injuries. Midsubstance tears and avulsions from the origin at the metacarpal level are more apt to be encountered here than with ulnar collateral injuries.

**Chronic Injuries**

Patients who present with chronic symptoms and findings of radial or radial-volar instability are candidates for ligament reconstruction or arthrodesis.

The principles of soft tissue reconstruction for chronic radial instability are similar to those used for chronic ulnar instability. Smith, in fact, used exactly the same technique in his 13 radial-side reconstructions as was used for his ulnar-side repairs. All of these patients achieved excellent restoration of stability and a good functional result, but some lost as much as 45 degrees of flexion.

The advancement of the abductor pollicis brevis in the treatment of chronic radial injuries was originally described by Sutro and has recently been advocated by Neviaser, Green, and Camp. The surgical technique described by Camp starts with a 5-cm incision on the radial aspect of the joint, with the subcutaneous dissection identifying and protecting superficial branches of the radial sensory nerve. With the abductor aponeurosis divided from the extensor tendons, the capsuloligamentous plane is identified and cleared, and the short abductor tendon detached from its insertion into the proximal volar corner of the proximal phalanx. The abductor pollicis brevis is mobilized from the surrounding soft tissue to allow it to be advanced distally. Camp makes the point that visualization of the radial collateral ligament from the interior of the joint often helps to identify the site of the rupture, which has invariably healed with cicatrix. The scar is taken down, and the ligamentous tissue freshened and repaired with either imbrication or a pull-out wire technique as necessary (Fig. 16). A ½-inch drill hole is then made in the radial cortex of the proximal phalanx, 1 cm distal to...
the articular surface. The abductor pollicis brevis tendon is advanced into this hole and secured with a suture tied over a bony bridge on the ulnar aspect of the mid-proximal phalanx (Fig. 17). Any volar subluxation of the joint should be corrected, and an 0.045 K-wire passed to transfix the joint prior to securing the ligamentous and tendon sutures. The abductor tendon aponeurosis is repaired, recentralizing the extensor tendons if they have subluxed ulnarly. Postoperative rehabilitation is virtually the same as that mentioned for the ulnar injuries. Camp reported good results with this technique in eight patients with excellent restoration of stability and satisfactory maintenance of mobility.

DORSAL DISLOCATIONS

The mechanism of dorsal dislocation is forced hyperextension. The degree of resulting dorsal instability is dependent upon the extent of the volar and collateral soft tissue disruption. Using a cadaver model, Stener showed that an injury limited to the volar plate could result in hyperextensibility of the MCP joint, but that a true dorsal dislocation with bayoneted positioning of the proximal phalanx on the metacarpal could not be produced without the addition of a complete rupture of at least one collateral ligament.88 Failure of the volar plate in a dorsal dislocation may occur either proximally or distally. If the failure occurs proximally, the metacarpal head herniates through the thin membranous central portion of the proximal volar plate, usually passing between the adductor pollicis and flexor pollicis brevis tendons.19 The long thumb flexor is displaced by the metacarpal neck either radially or ulnarly. The intrinsics normally retain their insertion into the sesamoids, and this tends to prevent the volar plate from becoming incarcerated within the joint. This fact, together with the absence of complete tendon and ligament encirclement of the metacarpal head, usually prevents an irreducible dislocation.

Alternatively, if the volar plate ruptures distally at its junction with the volar base of the proximal phalanx, the intrinsics and volar plate may retract volarly as a unit, thereby disrupting both the principal passive and active wrist restraints to hyperextension of the joint. This leaves the joint particularly prone to hyperextension instability. Some authors believe that this situation is an indication for surgical repair in the acute setting. As previously mentioned, the position of the sesamoids relative to the proximal phalanx, as seen radiographically on the lateral projection, provides valuable information as to the exact anatomic site of the volar soft tissue tear. If the sesamoids have remained in their anatomic position adjacent to the base of the proximal phalanx, then the volar disruption must have occurred proximally; whereas, if the sesamoids have retracted proximally, then one can be certain that the volar plate and intrinsics have ruptured at their insertional point into the volar base of the proximal phalanx. Failure through the sesamoids has also been reported.58

Although uncommon, complex (irreducible) dorsal dislocations of the thumb MCP joint do occur.14, 17, 19, 25, 54 The irreducibility of this type of dislocation is caused by interposition of the volar plate between the proximal phalanx and metacarpal head. Unlike the situation with a
Dislocations and Fracture Dislocations of the Metacarpophalangeal Joint of the Thumb

Simple dorsal dislocation where the MCP joint is often fixed in hyperextension, in complex dislocations the alignment of the thumb ray may be minimally disturbed. The metacarpal head is prominent beneath the volar skin, and there is associated volar skin dimpling. The diagnosis is confirmed by the finding of a widened joint space on radiographic examination. On occasion, the sesamoids may be incarcerated within the joint.

**Treatment**

Although Stener recommended that dorsal dislocations be treated with open repair, other authors have found that simple dorsal dislocations of the thumb MCP joint can usually be managed satisfactorily with closed reduction followed by 3 weeks of cast immobilization with the MCP joint in 20 to 30 degrees of flexion. The manner in which the closed reduction is attempted is important because there is risk of converting a simple dorsal dislocation into a complex irreducible one. After obtaining adequate anesthesia with a median and radial sensory nerve wrist block, the thumb metacarpal is flexed and adducted to relax the intrinsics, and the wrist is flexed to relax the flexor pollicis longus. Longitudinal traction is applied to the proximal phalanx, after which the reduction can usually be accomplished by gently flexing the proximal phalanx on the metacarpal. Medial and lateral stability is checked clinically, and the congruency of the reduction is confirmed radiographically. If the joint easily dislocates with active movement following closed reduction, or if the joint shows more than 40 degrees of radial or ulnar laxity on gentle clinical stress, Eaton suggests that open repair is indicated. Excessive hyperextension instability can be corrected by repairing the rupture in the proximal portion of the volar plate and suturing any tears of the intrinsic tendons. In the exceptional case where the volar plate has torn from its attachment to the base of the proximal phalanx, consideration should be given to repairing this with a pull-out wire in the manner described by Eaton and others. In the absence of open treatment, postreduction care includes 4 weeks of thumb spica immobilization with the joint in 20 to 30 degrees of flexion followed by progressive mobilization and strengthening similar to that outlined for acute collateral injuries.

If efforts at closed reduction are not successful, open reduction is required. With a volar approach, the soft tissues encountered will usually be found to be tightly stretched across the metacarpal head, which has herniated into a subcutaneous position. Exceptional care should be taken to identify and protect the radial digital nerve as it crosses the field at this level. The incarcerated volar plate, intrinsic tendons, or other soft tissue that are preventing reduction are retracted or released, after which the joint is reduced under direct vision. Following reduction, the joint is checked for residual instability in both the medial-lateral and flexion-extension planes and repaired as necessary. Postoperative treatment is the same as that indicated for closed reduction.

Although most authors have recommended that a volar or lateral approach be used in the operative treatment of irreducible dorsal dislocations, a good argument can be made for considering the alternative use of a dorsal approach. In view of the fact that the principle block to reduction is usually that of an incarcerated volar plate, a dorsal approach offers the distinct advantages of better exposure of the plate, a lessened risk of injury to the distorted volar neurovascular structures, and improved visualization of the interior of the joint. Although most of the experience with this approach in complex dorsal MCP joint dislocations has been in the index finger, its successful application in the thumb has also been reported. Regardless of the approach used, the key to the reduction is retrieval of the volar plate from within the joint. Often a longitudinal incision in the midsubstance of the volar plate is necessary to effect this retrieval, and should this be the case, there is reason to believe that this may be most easily accomplished through a dorsal approach.

**Chronic Dorsal Instability.** Like the other chronic instabilities about the MCP joint, chronic post-traumatic hyperextension instability may result in compromised thumb function due to weakness and pain in pinching and grasping activity. If these symptoms do not respond to the usual conservative measures, including limiting activities, intrinsic strengthening exercises, and a trial with an orthosis, then the patient becomes a candidate for surgical stabilization with either volar soft tissue reconstruction or arthrodesis.

The soft tissue reconstructions are designed to either reanchor the proximal margin of the volar plate to the metacarpal, or to recreate a volar tether with graft material. Milch in 1929, provided us with one of the earliest descriptions of a technique for reestablishing volar restraint with a free tendon graft. More recently, Kessler has reported his experience with nine patients using the extensor pollicis brevis or extensor digitorum communis tendons to recreate the volar plate.
brevis tendon, rerouted to form a sling across the volar aspect of the joint. By taking this tendon for his graft and leaving it attached distally, he was able to eliminate one of the main deforming forces while accomplishing the reconstruction in a relatively simple fashion, requiring only one drill hole through the metacarpal neck. A similar technique has been described by Brewood for the correction of combined volar and radial instability. The alternative strategy of checking hyperextension by reanchoring damaged existing tissue has been advocated by Green. He described a modification of Zancoli’s sesamoid capsulodesis in which he anchors the proximal edge of the volar plate to a bony trough created in the volar neck of the metacarpal. Green has found this procedure to be effective and simpler than the use of tendon slings.

If the MCP joint is arthritic, then arthrodesis of the joint, as previously described, again provides a good salvage.

**Locked MCP Joint with Partial Dorsal Dislocation**

In addition to simple and complex dorsal dislocations of the thumb MCP joint, partial dislocations resulting in locking of the joint in mild hyperextension can occur. This condition has been alluded to by several authors and has recently been reviewed and expanded upon by Yamanaka in his clinical report of 23 patients. Again, the mechanism of injury is hyperextension, but in this case, the volar disruption of the soft tissue is limited to the isolated herniation of the prominent radial condyle of the metacarpal head through the midsubstance of the radial aspect of the volar plate just proximal to the radial sesamoid (Fig. 18). The most distal margin of the volar plate’s substance remains intact and becomes tightly drawn across the distal prominence of the radial condyle of the metacarpal head, thereby locking the joint in mild (30 to 40 degrees) hyperextension. The sesamoids and volar plate are not entrapped within the joint, but do ride very distally on the volar contour of the metacarpal head. In Yamanaka’s series, 7 of 23 patients were successfully treated with closed reduction under regional anesthesia by manipulating the proximal phalanx towards the volar side of the joint while supinating the thumb on the metacarpal head and simultaneously flexing the metacarpophalangeal joint. In 16 of his patients, however, surgical release of the distalmost margin of the volar plate was required to obtain reduction. Only 2 weeks of postoperative immobilization were necessary for these patients, and no recurrences were reported.

**SUMMARY**

Due to its exposed position, the MCP joint of the thumb is particularly vulnerable to dislocations and fracture dislocations. Depending on the direction of the injuring force, injuries to the ulnar, radial, and volar aspect of the joint can occur. If high-grade lesions are not identified and treated appropriately during their acute phase, marked instability with associated long-term disability due to weakness and pain in pinch and grip can result. In the absence of a reliable method for diagnosing the Stener lesion, surgical repair of acute, third-degree lesions on the ulnar side of the joint remains the treatment of choice. In the presence of chronic instability, a variety of effective soft tissue reconstructive measures are available. The fact that both acute and chronic injuries enjoy a favorable prognosis with operative repair is due to the fact that operative intervention reliably restores stability to the joint. Mild to moderate loss of motion at the joint is well tolerated functionally. For this reason, arthrodesis remains an exceptionally satisfactory salvage for failed soft tissue reconstructions.
Mild to moderate injuries associated with MCP joint subluxation do not require surgical treatment. Chronic dislocations and ligament injuries are generally better treated by nonsurgical means; however, surgical intervention may be necessary in selected cases. In severe cases, with subluxation of the thumb metacarpophalangeal joint, surgical intervention may be required to correct hyperextension deformity of the metacarpophalangeal joint. The specific indications for surgical intervention include persistent instability, significant loss of range of motion, and pain that interferes with daily activities.

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