Injury to the collateral ligaments of the metacarpophalangeal joints of the fingers

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PG Harris, JF Mosher. Injury to the collateral ligaments of the metacarpophalangeal joints of the fingers. Can J Plast Surg 1994;2(3):125-129. Injury to the collateral ligaments of metacarpophalangeal (MCP) joints of the fingers has not been given much attention in the literature compared with the more frequently encountered lesion involving the thumb ('game keeper's' or 'skier's' thumb). Nevertheless, such lesions can result in significant disability if not appropriately treated. To prevent this, awareness of the pathology is required. Pain and lateral instability at the MCP joints may be the only signs. The anatomical lesions vary in sites. Instability to laterally directed stress in full MCP flexion is diagnostic. Most lesions heal with corrective immobilization with the MCP joint at 40° or 45° and 'buddy taping' of the fingers. Surgery, through a dorsal approach, is required in cases of rotated or significantly displaced bony attachment and in chronic instability.

Key Words: *Collateral ligaments, fingers, injury diagnosis, metacarpophalangeal (MCP) joints, treatment*

Lésion aux ligaments collatéraux des articulations métacarpophalangiennes

RÉSUMÉ: Les lésions des ligaments collatéraux des articulations métacarpophalangiennes des doigts n'a pas fait l'objet d'autant d'attention dans la littérature que les lésions plus fréquentes mettant en jeu le pouce («pouce du skieur», rupture du ligament latéral interne de l'articulation métacarpo-phalangienne). Or, ces lésions peuvent occasionner une incapacité significative si elles ne sont pas traitées de façon appropriée. Pour les prévenir, il est nécessaire de se sensibiliser à leur existence. La douleur et l'instabilité latérale au niveau de ces articulations risquent de n'être que des signes. Les lésions anatomiques varient quant à leur localisation. L'instabilité face à un stress dirigé en latéral lors de la flexion complète est utilisée pour le diagnostic. La plupart des lésions guérissent après une immobilisation correctrice, l'articulation étant maintenue à 40° ou 45°, et par l'immobilisation des doigts au moyen de sparadrap. La chirurgie par l'approche dorsale est nécessaire dans les cas d'excroissance osseuse avec rotation ou déplacement significatif et dans l'instabilité chronique.

The metacarpophalangeal (MCP) joints of the fingers must withstand continuous stress during almost all holding, lifting, gripping, pinching or throwing activities. In the power position of MCP flexion, this lateral stability is provided by the collateral ligament.

Injuries to these ligaments in the fingers appear to be rarer than the well-known 'game-keeper's' or 'skier's thumb'. The literature reveals a few case reports of such injuries (1-4). Most of these injuries have been reported on the ulnar digits and involved the radial collateral ligaments. The vast majority of the injuries of the collateral ligaments are not significant except for the discomfort and are probably much more common than realized. Because the anatomic peculiarity of the Stenner's lesion (MCP joint of the thumb) is not present in the fingers, this injury usually heals with little consequence. However, some do not heal and this leads to painful instability and considerable compromise of hand function.

The anatomy, the pattern of injury and a plan of treatment are presented to heighten awareness of this injury and prevent late instability.

ANATOMY AND FUNCTION

The anatomy of the MCP joints, the radial and ulnar collateral ligaments and accessory collateral ligaments has been well described (5-7).

The MCP joint of the fingers is classified as an ellipsoid articulation with the shallow concave surface of the proximal phalanx fitting the convex metacarpal head. The metacarpal head, however, is not uniformly convex. It is trapezoidal in cross-section with the volar base being broader than the dorsal. The articular surface is therefore also broader volarly.

Ellipsoid joints are by definition biaxial, ie, permit motion about two axes at right angles to one another. In the case of the MCP joints this means flexion-extension and abduction-adduction movements. Circumduction represents the combination of these motions. Some rotation about the longitudinal axis of the proximal phalanx, supination and pronation, is also permitted, especially in extension. Thus the MCP joint is actually triaxial in extension and biaxial in flexion.

The stability of this joint is provided by the shape of the articulating surfaces, the collateral ligaments, the volar plate, and the intrinsic and extrinsic musculotendinous elements.

A large degree of mobility is present in extension with 20° to 30° of abduction-adduction motion permitted. In flexion, however, the joint is quite stable to abduction-adduction

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Figure 1) *Metacarpophalangeal joint and collateral ligaments*

Figure 2) *Ligamentous injury*

stresses. This increased stability in flexion is imparted almost entirely by the collateral ligaments. The interossei which provide dynamic stabilization in extension have a markedly decreased mechanical advantage in flexion.

The radial collateral ligament is more significant than the ulnar collateral ligament; it is also more oblique in its course. It is broader at its MCP head origin which is just distal to the growth plate of the metacarpal. It inserts proximal to the growth plate at the base of the first phalanx and its insertion blends with the insertion of the intrinsic tendon distally. Therefore, its insertion is always on the epiphysis and never crosses the growth plate. The ulnar collateral ligament is longer and narrower. It originates on the epiphysis of the head of the metacarpal, while the accessory collateral ligament originates from the shaft of the metacarpal. Therefore, the ulnar collateral ligament crosses the growth plate of the metacarpal.

The collateral ligaments are relatively lax in extension and taut in flexion. The increased tension (and hence stability) in flexion is the result of two anatomical factors. First, the cam effect produced by the eccentrically dorsal origin of the collateral ligaments on the metacarpal head, and second, the increased divergence of the radial and ulnar ligaments in flexion due to the volar flaring of the head (Figure 1). It is obvious, therefore, that diagnostic stress testing of these ligaments should be carried out in full flexion where they are normally tight and not in extension where they are lax and normally permit 30° to 40° of abduction-adduction mobility.

The accessory collateral ligament is a thin triangular structure arising just volar to the collateral ligament on the metacarpal head and fanning distally to insert into the lateral borders of the volar plate and transverse intermetacarpal (or intervolar plate) ligament.

PATTERNS OF INJURY

A significant force is reported to be required to injure the collateral ligament with acute ulnar deviation or forced twisting injury (4,6). The ligaments are susceptible to injury from laterally directed stresses. In extension or hyperextension, such stresses are usually associated with some dorsally directed component and collateral ligament ruptures will usually be accompanied by at least a partial volar plate tear. In flexion, however, the volar plate is lax while the collateral ligaments are tight, and isolated collateral ligament injuries are more apt to occur.

The lesion may be purely ligamentous or may involve bony avulsion (Figures 2,3). Avulsion fractures almost invariably involve the volar tubercle at the base of the proximal phalanx and in young patients this may take the form of a Salter type II or III lesion.

ANATOMICAL STUDY OF INJURIES

Four (two right and two left) frozen cadaver forearms and wrists were thawed to room temperature. With the hand immobilized at the metacarpal level, the injury mechanism of flexion with acute ulnar or radial deviation were recreated on 16 digits. An anatomical dissection with a dorsal splitting incision revealed multiple injuries to the collateral ligaments. Evaluation of the radial collateral ligaments of the 16 fingers revealed: five complete ruptures of the ligament proximally near the metacarpal head; one midsubstance tear; one distal substance tear; two complete ruptures at the base of the first phalanx insertion; four fractures of the base of the first phalanx or of the metacarpal head; and three uninjured specimens.

Evaluation of the ulnar collateral ligament injuries revealed nine complete ruptures near the insertion at the base

Figure 3) *Fracture avulsion*

of the first phalanx, four fractures of the metacarpal head or the base of the first phalanx and three uninjured digits.

CLINICAL PRESENTATION

A specific injury can or cannot be remembered. The patient will usually complain of pain and swelling over one side of the MCP joint which is accentuated by gripping. They will relate a weakness of pinch.

PHYSICAL EXAMINATION

Pain or tenderness is present at the lateral aspect of the MCP joint. Instability must be tested in maximal MCP flexion by a radially or ulnarly directed force on the head of the proximal phalanx (Figure 4).

X-RAY

Radiography is an important part of the investigation because a displaced fracture is an indication for operative treatment. The avulsion fracture is most commonly seen at the base of the proximal phalanx and much more rarely at the metacarpal head origin. It may be necessary to obtain oblique views (ie, Brewerton view) for proper evaluation (8,9). Patients may present with a fracture which may include a significant portion of the joint surface (Figure 5). Arthrography of the involved joint has also been suggested to be diagnostic in cases of leakage of dye (10), but does not provide much more information.

TREATMENT PLAN

Treatment will depend on the type of injury. Basically acute injury can be divided into two types: avulsion fracture and pure ligamentous injuries. If an avulsion fracture is displaced 2 mm or more or the fragment is clearly rotated this is an indication for operative repair. If there is no fracture,

Figure 4) *Instability test*

Figure 5) *Intraarticular fracture*

nonoperative treatment is adequate. The anatomic peculiarity (abductor expansion) that exists at the ulnar aspect of the thumb MCP joint does not exist in the finger; therefore, all such purely ligamentous injuries can be treated conserva-

Figure 6) Hand splint with buddy taping

Figure 7) Dorsal approach and visualization with rotation of the finger

Figure 8) Repair with bone anchor

Figure 9) Repair with suture to bone

Figure 10) Reconstruction of chronic injury with tendon graft

tively, regardless of the amount of instability noted on physical exam.

The involved finger is 'buddy taped' to the finger abutting the side of injury when possible. This taping should be continued until all discomfort has ceased, especially for sports activity. This may be for an extended period, up to six months.

Initially a hand based splint, extending to the proximal interphalangeal joints of the 'buddy taped' fingers, is advised with the MCP flexed at angle of 40° or 45° (Figure 6). The splint can be removed at quiet times and for bathing. Flexion beyond 45° is usually painful as the ligament is stretched in flexion. Nevertheless, active flexion exercises are begun at 10 days with the aim of achieving 60° flexion by four weeks post injury. If the finger is comfortable at 60° flexion, the

splint can be discontinued, and progressive exercise and use of the hand are encouraged. 'Buddy taping' is continued (at least for sports) until lateral stress at full MCP flexion is not tender.

The operative approach is required in displaced fracture avulsion. Via a longitudinal dorsal extensor tendon split, the whole gamut of collateral pathology can be examined and repaired (Figure 7). With rotation the palmar base of the proximal phalanx can be presented into the wound for repair or reconstruction. The fracture is reduced and internally fixed (11).

The avulsion fracture end of the ligament may be attached by bone anchor sutures or suture to local bone (local or pull-through) (Figures 8,9).

Reconstruction with tendon graft (ie, portion of the pal-

maris longus or slip of the extensor digiti quinti) can be attached in the same manner as above (Figure 10).

The palmar approach is infinitely more complex and does not allow inspection of the dorsal part of the ligament.

DISCUSSION

Injury to the collateral ligament of the MCP joints of the fingers is a well described entity (1-3,5,6). It appears to be rarer than injuries to the thumb. However, the latter might be recognized more often since instability of the MCP joint of the thumb is so debilitating while instability at the MCP joint of the finger can be compensated by splinting with the adjacent fingers. Therefore, injuries to the collateral ligaments of the MCP joints of the fingers are probably more common than reported or diagnosed and should be looked for in cases of closed injuries to the MCP joints.

Classically, the treatment has been immobilization. A few cases of open repair have been documented as well as ligament reconstruction. Probably because phylogenetically pinch requires more stability from the radial aspect of the MCP joint, the radial collateral ligaments are thicker, stronger, more oblique than the ulnar collateral ligament and rupture, more commonly proximally at the metacarpal head origin.

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The ulnar collateral ligaments are longer, narrower and appear to be weaker at the insertion of the base of the first phalanx.

The anatomical study in frozen specimens probably does not correlate well with the in vivo reality since the bones were very friable. However, it certainly illustrates the varied pathology of rupture sites in the cases of collateral ligament injuries.

Clinical evaluation requires stressing the MCP joint in full flexion to thoroughly evaluate the status of the collateral ligament. Regular radiological investigation might miss small fracture avulsion but the Brewerton view, classically described to evaluate arthritic changes at the MCP joints, can reveal otherwise unseen fracture dislocation. Fracture avulsion, especially in children where the articular surface of the proximal phalanx is rotated, needs to be openly reduced and internally fixed.

CONCLUSION

Injuries to the collateral ligaments of the MCP joints of the fingers are probably more common than expected. Ligamentous rupture should be splinted. Displaced fracture avulsion should be addressed surgically as well as the chronic instability.