Simultaneous Bilateral Functional Radiography in Ulnar Collateral Ligament Lesion of the Thumb: An Original Technique

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Abstract

In any thumb injury, particularly one caused by hyperabduction, an ulnar collateral ligament lesion (gamekeeper's or skier's thumb) must be considered. If the diagnosis is suspected, and radiographs show no fracture, comparative radiographs should be obtained in forced valgus.

This examination, which uses a stress test to cause joint tilt, is crucial in making an accurate diagnosis and deciding on the most appropriate therapeutic approach. The forced valgus maneuver typically is performed by the examiner, who must stay with the patient in the radiography room and wear radiologic protection.

We report on a simple, reliable, reproducible method that allows the patient's thumbs to be compared, under the same force application conditions, on a single radiograph. This technique reduces the patient's and examiner's exposure to x-rays and is well tolerated by the patient. Anesthesia for the thumb is usually not necessary.

Gamekeeper's or skier's thumb is caused by an injury to the ulnar collateral ligament (UCL) of the metacarpophalangeal (MCP) joint of the thumb. The mechanism of injury is forced radial and palmar abduction and hyperextension.

This lesion was initially described in 1955 by Campbell.[1] It occurred in gamekeepers who worked in preserves in Scotland. The UCL was injured because of the way they killed rabbits—hence, *gamekeeper's thumb*. Now these injuries are more common in skiers—*skier's thumb*. In skiers, the mechanism of injury is the force exerted by the ski pole strap on the thumb during a fall. This injury is also seen in breakdancers.[1,2]

Different lesions can result, the most common being that of the UCL. The UCL lesion may be partial, with no joint instability,[3,4] or total, with instability and subdislocation of the proximal phalanx.[5-9] Rupture of the thumb adductor aponeurosis and displacement of the long extensor have been described as the cause of thumb instability.[6-8]

UCL rupture can occur in its extension or can cause a fracture-tearing in the proximal phalanx.[9-12] Intra-articular fractures are sometimes found. The essential problem in UCL injuries is the impossibility of spontaneous healing once the rupture is complete, because of the Stener effect. (When the UCL ruptures, its proximal part retracts and runs above the fibrous expansion of the adductor muscle, which is interposed between the 2 parts of the ruptured UCL and prevents healing, even if the thumb is immobilized.) In these cases, only surgery can repair the lesion.[2]

In any thumb injury, particularly one caused by hyperabduction, a UCL lesion should be considered. The main problem is diagnosing sprain severity, which is evidenced by the degree of joint hypermobility. Radiologic examination should be performed in all cases to rule out fracture with tear, posterior capsular tear, palmar plate tear, and palmar subdislocation of the proximal phalanx, all of which are associated with UCL tearing.[7-9]

If the diagnosis is suspected, and radiographs show no fracture, comparative radiographs should be obtained in forced valgus.

Technique

We report on a simple, reliable, reproducible method that allows the patient's thumbs to be compared, under the same force application conditions, on a single radiograph. This technique reduces the patient's and examiner's exposure to x-rays and is well tolerated by the patient. Anesthesia for the thumb is usually not necessary.

In each hand, the patient holds a cylindrical object, such as a drinking glass (standard diameter, 7.5-8.5 cm). We use an elastic crepe bandage roll (diameter, 7.5 cm; width, 10 cm). This roll is common in emergency departments (EDs) and easily accessible. The patient holds the rolls in his or her hands with the thumbs in the posteroanterior position (**Figures 1–3**) and places himself or herself on a 18×24-cm frame or directly on the radiography table.

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Figure 1. Forced valgus position with flexion of metacarpophalangeal joint of thumb. Bandage roll is thick enough to generate forced valgus in patient with large hands. This nonrigid roll makes examination more tolerable and use of anesthetic blockade unnecessary.

Figure 3. Elastic crepe bandage rolls (diameter, 7.5 cm; width, 10 cm) over radiographic frame.

Both thumbs are captured on a single functional radiograph for comparison of forced valgus of the MCP joints, as in our example cases. The patients provided written informed consent for print and electronic publication of these case reports.

Case Reports

Control Case

The single functional radiograph of both thumbs showed no evidence of joint laxity on the valgus stress test (**Figure 4**).

Case 1

A 72-year-old woman landed on her left hand when she fell backward while supporting the hand on a piece of furniture. She presented to the ED with pain in the region of the thumb and thenar eminence. Posteroanterior and lateral radiograph projections showed no significant bone injury (**Figure 5**). Given the patient's persistent pain, the traumatologist suspected damage to the thumb UCL, so a simultaneous bilateral functional radiographic projection was obtained. The projection showed joint laxity, implying damage to the thumb UCL. Repair and reinsertion of the UCL were performed using a bone harpoon suture.

Figure 2. In patient with smaller hands, forced valgus is evident with use of system.

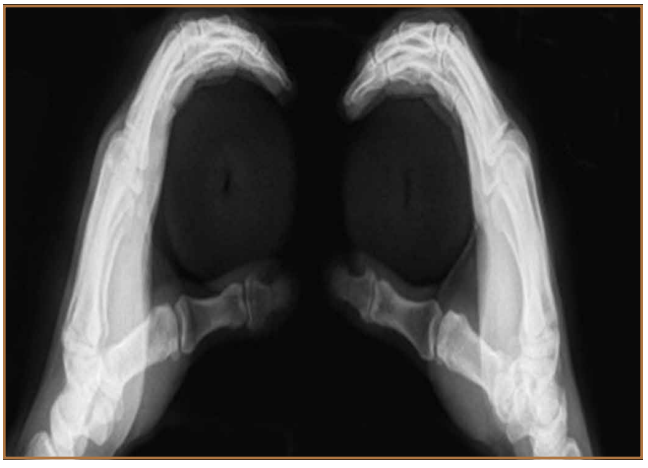

Figure 4. Normal case. Radiographs of uninjured hands (no instability).

Case 2

A 58-year-old man sustained a left hand injury when, using both hands, he tried to catch hold of a falling wooden plank. When he presented to the ED the following week, he was given a diagnosis of thumb contusion and forced hyperabduction and was wearing a metal strap for immobilization. Radiographs showed no bone damage (**Figure 6**). Thumb UCL injury was suspected on the basis of the physical examination findings and the mechanism of injury. A bilateral simultaneous functional radiographic projection showed significant joint laxity. Surgical treatment with the pull-out technique was performed.

Case 3

A 44-year-old woman experienced forced traction from a dog leash and presented to the ED with pain in the right thumb region. Radiographs showed no bone damage (**Figure 7**). Thumb UCL injury was suspected. A bilateral simultaneous functional radiographic projection showed slight joint laxity, a sprain was diagnosed, and plaster bandaging was applied. **Figures 8A–8D** show the accurate thumb positions

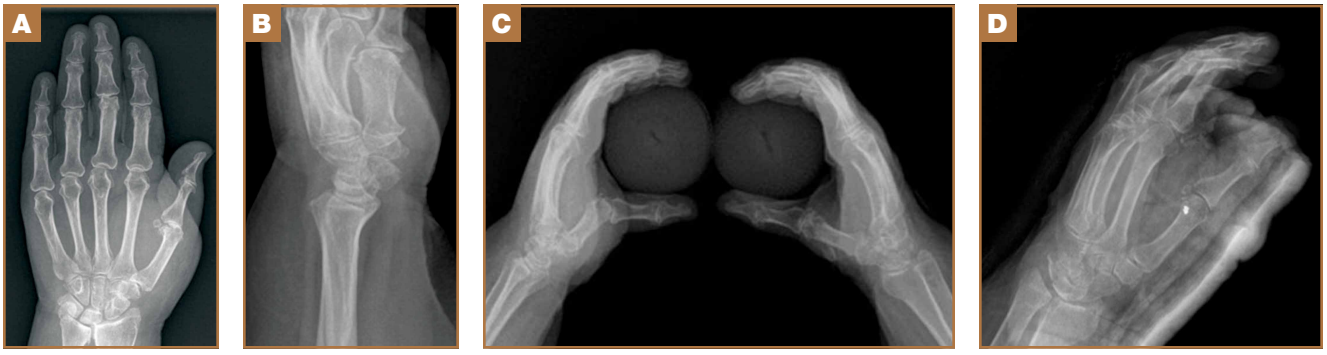

Figure 5. Case 1. A 72-year-old woman with pain in region of left thumb and thenar eminence. (A) Lateral and (B) posteroanterior radiographic projections of thumb show no significant bone injury. (C) Simultaneous bilateral functional radiographic projection shows rupture of ulnar collateral ligament (UCL) with joint tilt of 53°. Surgical repair and reinsertion of UCL were performed with bone anchor to allow for reinsertion. (D) Repair and reinsertion with bone harpoon suture.

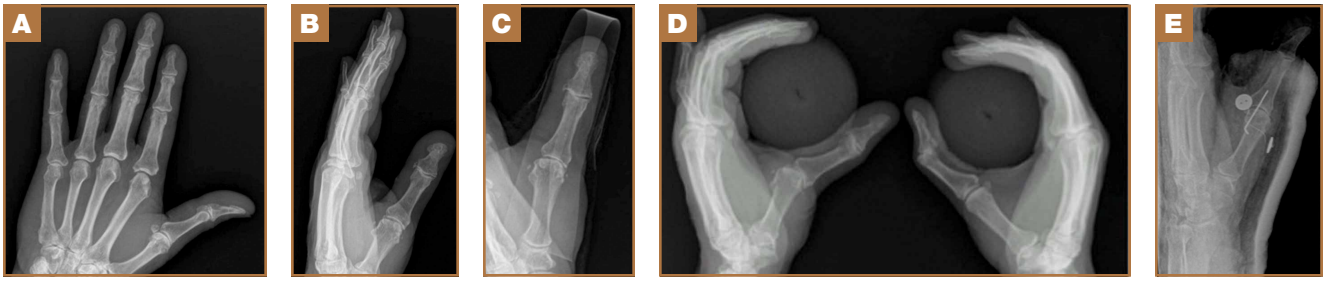

Figure 6. Case 2. A 58-year-old man with left hand injury sustained the previous week. (A) Lateral and (B) posteroanterior radiographic projections of thumb show no bone lesion or ulnar collateral ligament (UCL) lesion. (C) Metal strap as immobilizer; UCL lesion not suspected. (D) UCL lesion with joint tilt of 40°. (E) Surgical treatment with pull-out technique.

for performing the functional radiograph in forced valgus. We call the technique *J.J.'s thumb radiographic projection*.

Discussion

Examination using the stress test to cause joint tilt is crucial in making an accurate diagnosis and deciding on the most appropriate therapeutic approach.[10] Most authors accept that surgical management is required in joint tilts over 30°, as these involve complete UCL rupture.[10-12]

The MCP joint must be examined in flexion, when the main fascicle of the UCL is tight, and not in extension, when the main fascicle of the UCL is relaxed. If we examine the thumb in extension, radial deviations may occur that are not caused by joint instability. Tilt here must be compared with that of the healthy side.[11]

Early diagnosis and adequate management are essential, as unnoticed or undervalued injuries can progress to painful sequelae, associated with stiffness, instability, and osteoarthritis, with evident harm to the grip and pinch functions of the hand. In many cases, clinical evidence of MCP joint instability is difficult. The radiologic diagnosis is usually obtained with comparative radiographs in forced valgus of both thumbs.

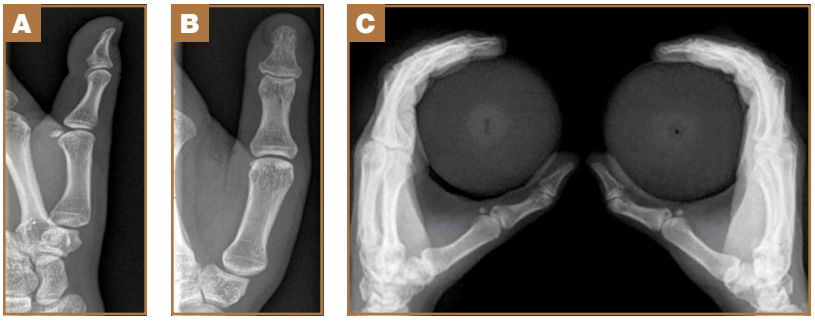

Figure 7. Case 3. A 44-year-old woman with suspected sprain of right ulnar collateral ligament. (A) Lateral and (B) posteroanterior radiographic projections show no bone lesion. (C) With forced valgus maneuver, tilt was less than 30°. Conservative management involved plaster cast.

The forced valgus maneuver typically is performed by the examiner, who must stay with the patient in the radiography room and wear radiologic protection. Incredibly, some patients must force the valgus themselves.

The maneuver we have described clearly has complications, as it is painful, and some patients are uncooperative. Usually the thumb is anesthetized, and the examiner assumes the exposure to x-rays. The valgus deviation force that can be applied during stability testing may lead to further disruption of a

Figure 8. J.J.'s thumb radiographic projection. Accurate thumb positions for performing functional radiographic projection in forced valgus. (A) Lateral oblique view, (B) frontal view, (C) lateral view, and (D) coronal view of position in flexion of metacarpophalangeal joint of thumb.

partially torn ligament or displacement of a ruptured ligament if the overforced maneuver is performed.[13,14] That does not occur with our technique. On the other hand, the forces applied to the thumbs must be symmetrical for comparison purposes. The way to prevent these inconveniences is to perform the forced valgus maneuver over both thumbs simultaneously, under the same force application conditions and on a single radiograph, without requiring the examiner to remain with the patient in the radiography room.

Heim[15] designed a system for simultaneous functional radiographs, but an apparatus must be built to adapt it to the frame of the radiography table, and the technique involves hyperpronating both hands and bandaging them to the forearm—which is uncomfortable and bothersome for patients and, in our opinion, has a poor application in high-volume EDs.

The technique of having the patient hold a bandage roll (J.J.'s thumb radiographic projection) offers several advantages:

1. The thumb can be placed in flexion, tightening the main fascicle of the UCL, which is how the UCL must be examined.
2. Forced valgus is allowed. Holding a water glass involves opening the thumb and the necessary stability of the MCP joint of the thumb (grip function of thumb); this radiographic technique is functional.
3. The examiner need not stay with the patient in the radiography room or be exposed to x-rays.
4. The bandage roll is thick enough to generate forced valgus in a patient with large hands. The nonrigid roll makes the examination more tolerable and avoids overforced valgus, eliminating the need for anesthetic blockade.
5. The technique is accessible and simple. In fact, there is no need to remove the roll from its wrapping.

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