CASE REPORT

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Radial collateral ligament reconstruction of the proximal interphalangeal joint of a finger with severe bony defect: revising a failed ligament reconstruction – a case report

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Chronic proximal interphalangeal joint (PIPJ) instability of the finger is rare, and when it occurs usually requires surgical reconstruction. Complications arising from failed ligament reconstruction may result in a situation more difficult to address than the initial reconstruction. This situation is more likely for the finger than other orthopaedic reconstructions because the phalangeal bones are so small. We present a case of chronic radial PIPJ instability of the finger and severe bony defect caused by multiple failed ligament reconstructions that was treated successfully using a modification of the bone-ligament-bone graft technique.

Keywords: BLB graft; chronic PIPJ instability; complication; revision.

Chronic collateral ligament injury of the proximal interphalangeal joint (PIPJ) of the finger can be caused when acute complete collateral ligament rupture, often misdiagnosed as a simple sprain, is treated inadequately. When this occurs, the outcome is usually poor and reconstruction is needed. Previously described reconstructive methods for chronic PIPJ instability include flexor digitorum superficialis tenodesis,[1,2] palmaris longus grafting,[3] direct collateral reapproximation[4,5] and dynamic reconstruction using the lateral band.[6] However, if reconstruction has failed, the case is more difficult to address.

This report aimed to describe a case of chronic radial PIPJ instability and severe bony defect caused by failed ligament reconstruction that was treated successfully by the bone-ligament-bone (BLB) graft technique introduced by Wu et al.[7]

Case report

A 17-year-old, female, right-handed judo athlete presented with one-year history of weakness and instability of the PIPJ of the right ring finger. Before presenting, she had undergone surgery twice for the same digit at a private clinic. A review of her previous medical records revealed she had been injured during a judo competition six months prior to her initial presentation to the private clinic. Initial plain stress radiographs she brought with her revealed more than 20 degrees of right ring finger PIPJ radial instability compared to left ring finger (Fig. 1). Because it had been six months since initial injury, the surgeon at the private clinic planned radial collateral ligament (RCL) reconstruction using the lateral band, as suggested by Ahmed and Goldie.[6] Postoperatively, a dorsal splint with PIPJ flexion was applied. However, recommended protection was not followed, and during

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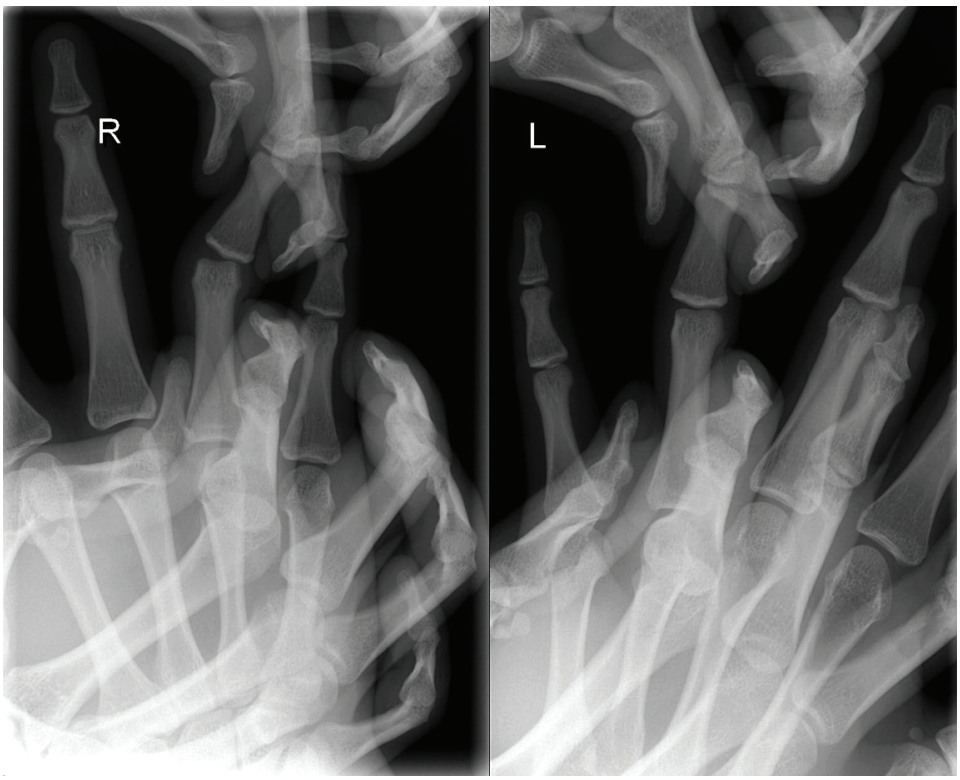

Fig. 1. Initial stress radiographs revealed 23 degrees of radial instability of the right ring finger PIPJ, while the contralateral left ring finger PIPJ showed no instability.

judo exercise three weeks postoperatively, without any protection, a sudden snapping sensation occurred, and she felt immediate weakness and pain. She presented to the same surgeon, and recurrent radial collateral instability was noted. Six weeks after initial surgery, a revision was performed using a palmaris longus graft with an absorbable anchor screw as interference screw for tendon graft in a bone tunnel of the proximal phalanx head. At six weeks post-operation, the splint was taken off and PIPJ range of motion (ROM) exercises were started. Despite the revision surgery, she had had persistent pain and instability, and as result was referred to our hospital. Plain radiographs taken at our hospital revealed a severe bony defect with palmar cortical fracture of the proximal phalanx head, and a small bony defect in the base of the mid-phalanx, likely caused by the previous surgery (Fig. 2). On physical examination, despite the bony defect in the proximal phalangeal head being through the palmar cortex, instability was mainly radial sided and unidirectional, and hyper-extension instability was not remarkable. To gain ROM before a second revision surgery, the patient participated in three months of physiotherapy. After physiotherapy, PIPJ ROM was increased from 25 (5-30) to 60 (5-75) degrees. RCL reconstruction was performed using a BLB graft six months after revision surgery. The same incision as a previous surgery was used and the bony defect, with a slack tendon graft and worn absorbable anchor screw, was found in the proximal phalangeal head and roughened with a burr and curette. A BLB graft was harvested from the anterior iliac crest as described by Wu et al.[7] A 4-cm longitudinal incision was made along the anterior iliac crest. After dissecting to the subcutaneous tissue, a slightly oversized bicortical graft was harvested from the inner half of the iliac crest for future trimming to adjust the size to the defect. Once the graft was harvested, the bone at the centre was removed. The space between the bone pegs was prepared so as to be the shortest distance between the edges of the two bone defects across the joint. The pegs at both ends of the BLB graft were trimmed to size. The resultant graft had thick tendinous fibers on the top between the long cylindrical bone peg on the side of the proximal phalangeal head and the short bone peg on the side of the base of the mid-phalanx. Because the bony defect of the proximal phalangeal head was through the palmar cortex, the BLB graft was inserted into the defect with the inner cortex on the palmar side. However, with the bony defect of the proximal phalanx being through the far cortex, strong fixation could not be achieved by a single screw or addition of a washer, as suggested by Wu

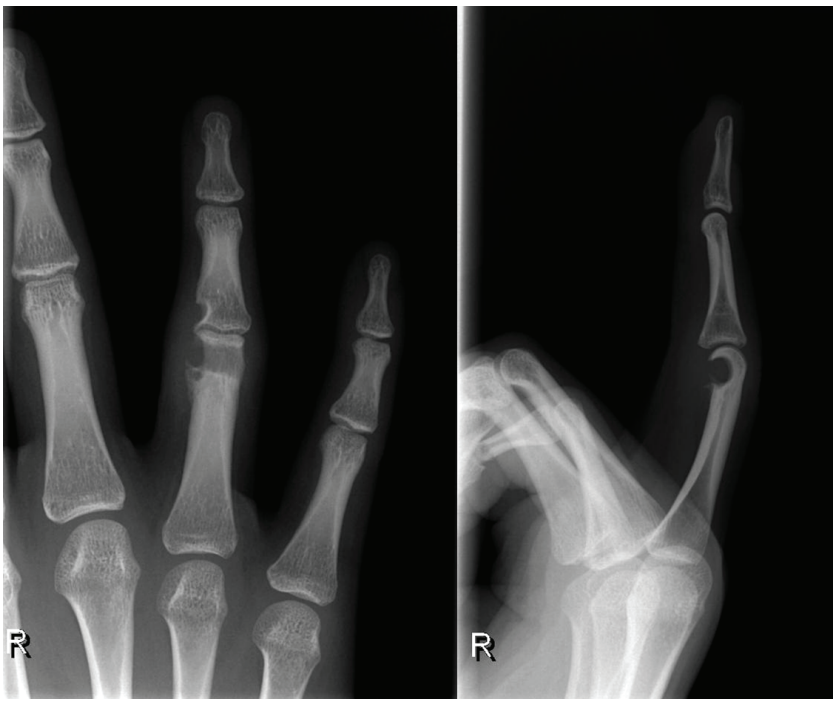

Fig. 2. Pre-operative radiographs taken before second revision showing enlarged bone tunnel with palmar cortical fracture.

et al.[7] A mini-plate was broken into two parts and used with screws separately to secure the bone peg into the defect while checking the plate position, in order not to interfere with the ligament and block ROM. After fixation, joint stability was restored immediately. Postoperatively, a full-time protective splint with slight flexion of PIPJ was worn for four weeks (Fig. 3). Physiotherapy was then commenced. Six weeks postoperatively, unprotected ROM exercise was started. Regular follow-up was scheduled to identify radiological union between the bone peg and host bone as well as to monitor clinical improvement. Nine months after surgery, the plate and

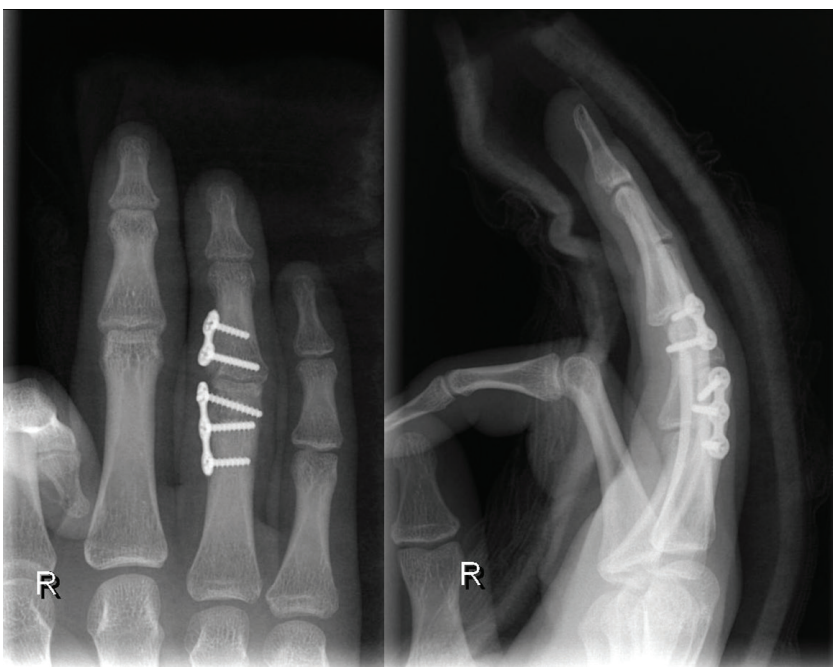

Fig. 3. Post-operative radiographs showing BLB graft fixed using mini-plate and screw.

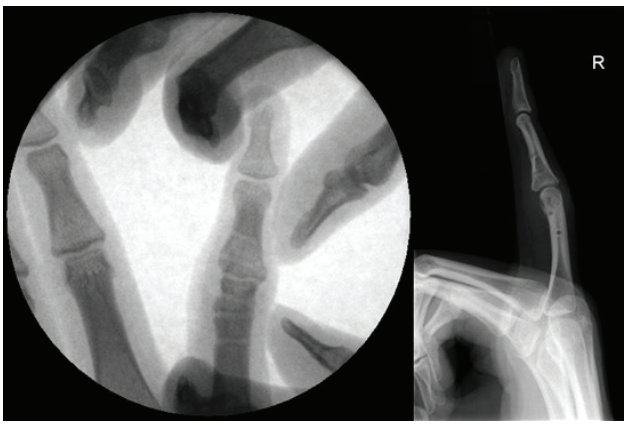

Fig. 4. Nine months after second revision, plate and screw were removed and shows no instability under stress.

screws were removed (Fig. 4). One year postoperatively, right ring finger total active ROM was 205 degrees. The PIPJ was stable with 85 (5-90) degrees of ROM and the distal proximal interphalangeal joint (DIPJ) had 30 (5-35) degrees of ROM (Fig. 5). Two years postoperatively, the patient presented again, this time with a problem other than her right ring finger. She had returned to practising judo. She did not show any residual instability, with ROM of both the PIPJ and DIPJ almost the same as at previous follow-up. Examination was remarkable for mild swelling only, thought to be due to multiple surgery on the same digit.

Discussion

The PIPJ of the finger is a hinge joint and most of its stability is derived from the surrounding three-dimensional box-like complex of soft tissues. Dorsal dislocation due to hyperextension force is the most common type of injury,[8] but pure complete lateral injuries also occur, and are often misdiagnosed as a simple sprain. The radial collateral ligament is injured much more commonly than the ulnar collateral ligament.[9] Almost all collateral ligament injuries can be treated non-operatively, and the literature from this group indicates that well- planned conservative treatment is sufficient for a functionally stable joint.[10,11] However, some authors believe that non-operative treatment itself might result in pain, stiffness, swelling and occasionally chronic joint instability, possibly leading to significant functional disability. Therefore they recommend operative repair on the torn ligament.[1,9] Despite the rarity of chronic collateral ligament injuries of the PIPJ in the presence of appropriate protection, when they occur, they may require surgical intervention, especially if the injured finger is important for the patient's athletic activities. In this case, surgical RCL reconstruction was essential as the patient was a judo practitioner and the injured ring finger was very important in gaining a firm grasp on a competitor's garment. The many reports of chronic collateral ligament reconstruction can be grouped into static and dynamic procedures.[1-6] Static procedures usually use a tendon graft such as the palmaris longus tendon to replace damaged ligament with various configurations. In dynamic procedures, a musculo-tendinous unit is used to pull the bone distal to the joint in the opposite direction to the instability.[12-14] In this case, the index surgery was a dynamic collateral ligament reconstruction using the lateral band, as suggested by Ahmed and Goldie.[6] They reported using a strip of the lateral band of the extensor tendon to treat the combined laxity of collateral ligament and palmar plate. In our patient's previous medical records, it was written that initial postoperative stability was excellent. Poor compliance with postoperative protection might be a cause of the later failure. Revision surgery was performed using a palmaris longus tendon graft with triangular configuration. It might be very difficult to pass two strips of ten-

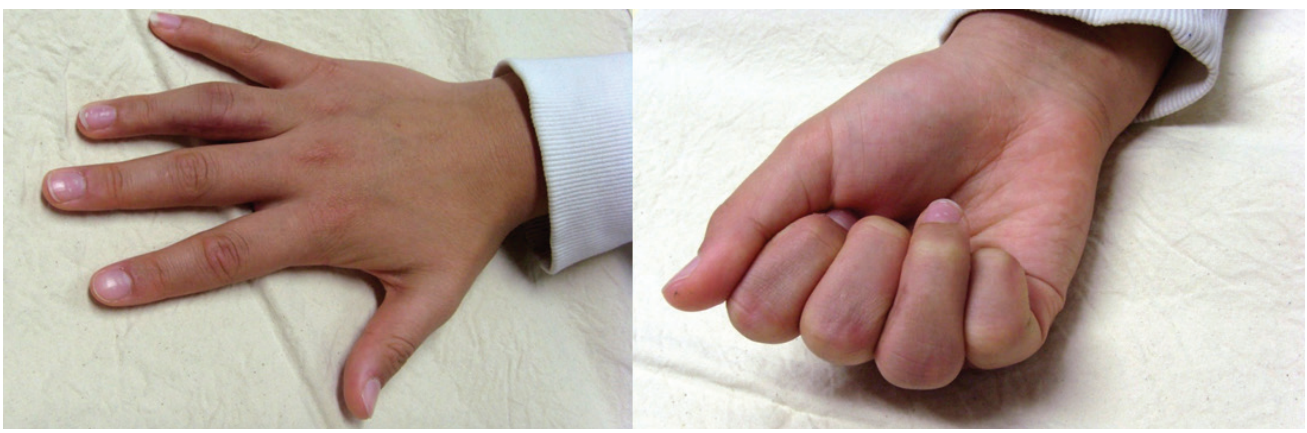

Fig. 5. One year after second revision, photographs showed slight limitation of motion of right ring finger PIPJ and DIPJ. [Color figures can be viewed in the online issue, which is available at www.aott.org.tr]

don end through a single hole together. It is likely that the hole made was too large and contact between tendon and bone tunnel was not achieved. To mitigate this, the surgeon used an absorbable anchor screw as interference screw, similar to anterior ligament reconstruction of a knee joint in the femoral tunnel. However, postoperative tendon-to-bone healing was not achieved as expected. The plain radiograph taken at our hospital revealed a severely enlarged bone tunnel with a palmar cortical defect in the proximal phalangeal head. We suppose the motion between graft and anchor resulted in bone erosion, causing enlargement of the tunnel and a palmar cortical defect. It was necessary to address both the ligament and bone defect. Wu et al.[7] introduced the BLB graft for the treatment of chronic instability of finger and thumb, and Guelmi et al.[15] introduced bone-retinaculum-bone (BRB) free graft for ulnar collateral ligament reconstruction of chronic thumb metacarpal joint instability. In this case, both BLB graft and BRB graft were attractive treatment options for addressing ligament reconstruction and bone defect simultaneously because of the potential advantage of both methods as a bone-soft tissue-bone graft would be almost the same. However, we supposed that with a BRB graft it would be more technically demanding to fit the size of the bone defect in this case. Wong et al.[16] reported excellent final outcome with no residual instability and complications in their report of minimum 5-year follow-up using BLB graft. In our case, the RCL reconstruction using BLB graft was similar to Wong's method. However, there were several differences with the cases in Wong's series. Firstly, the patient had both chronic collateral ligament insufficiency and severe bony defect caused by previous failed ligament reconstruction. Secondly, the bone defect in the proximal phalangeal head was so large it extended through the far and palmar cortex. Thirdly, because a single screw and washer could not provide sufficient stability to the BLB graft, a mini-plate and screws were used for fixation.

The many complications that can occur following failed ligament reconstruction mean that the resultant situation is more difficult to address than the initial reconstruction. This situation is all the more likely for the finger, with the phalangeal bones being so small. This was a case of multiple surgical revisions. For this kind of complication, a BLB graft with mini-plate fixation can be a good alternative to address both ligament instability and bone defect caused by failed ligament reconstruction.

Conflicts of Interest: No conflicts declared.

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