



Voluntary reducible recurrent anterior dislocation of radial head in juvenile baseball player. A case report and review of the literatures



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The etiology of anterior dislocation of radial head is divided into 2 main causes, congenital and post-traumatic. Regardless of the etiology, dislocation was persistent in most of the cases and could not be reduced without open reduction. Recurrent posterior subluxation of radial head is quite popular and often occurred due to posterolateral rotatory instability;² however, voluntary reducible recurrent anterior radial head dislocation is an extremely rare condition and there have been several reports in the literature.^{4,7,13} We reported a case of voluntary reducible recurrent anterior dislocation of radial head occurred in a juvenile baseball player treated by corrective ulnar osteotomy with annular ligament repair.

Case report

A 12-year-old right-handed baseball player came to our hospital with snapping sensation of his right elbow while throwing a ball. He started to feel this feeling when he was in early childhood; however, he never had any significant trauma to the elbow since then. He also recognized the bony prominence at the palmar side of

the elbow only when he extended his elbow. This symptom increased in frequency after he started to play baseball, especially while throwing a ball. On the initial visit to our hospital, anterior dislocation of radial head was observed only when he extended his elbow in forearm supination position, whereas it was not occurred in forearm pronation position (Fig. 1) (See additional [Movie File Clip 1](#)). The dislocated radial head was spontaneously reduced with pop sensation when he flexed the elbow. It was also easily reduced by pushing back posteriorly, but easily redislocated like a piano key (See additional [Movie File Clip 2](#)). There is no neurological abnormality in the right upper extremity, and no ligamentous laxity was seen.

Plain X-ray showed no obvious deformity or malalignment of radius and ulna (Fig. 2). Maximum ulnar bow was 1.8 mm on dislocated side and 1.6 mm on the healthy side measured by the Lincoln et al's method.¹⁰ On the lateral view, radial head was not dislocated in 90 flexion position; however, it dislocated anteriorly when the patient extended the elbow joint in forearm supination position (Fig. 3). Magnetic resonance imaging also showed no obvious bony and epiphyseal cartilage deformity of both radial head and capitellum regardless of the redundancy of anterior capsule of radio-humeral joint (Fig. 4).

According to these findings, this condition was diagnosed as voluntary reducible recurrent anterior dislocation of radial head without obvious ulnar malalignment. Since the main pathogenesis was determined to be due to annular ligament insufficiency, open reduction and stabilizing the radio-capitellar joint would be

Institutional review board approval was not required for this case series.

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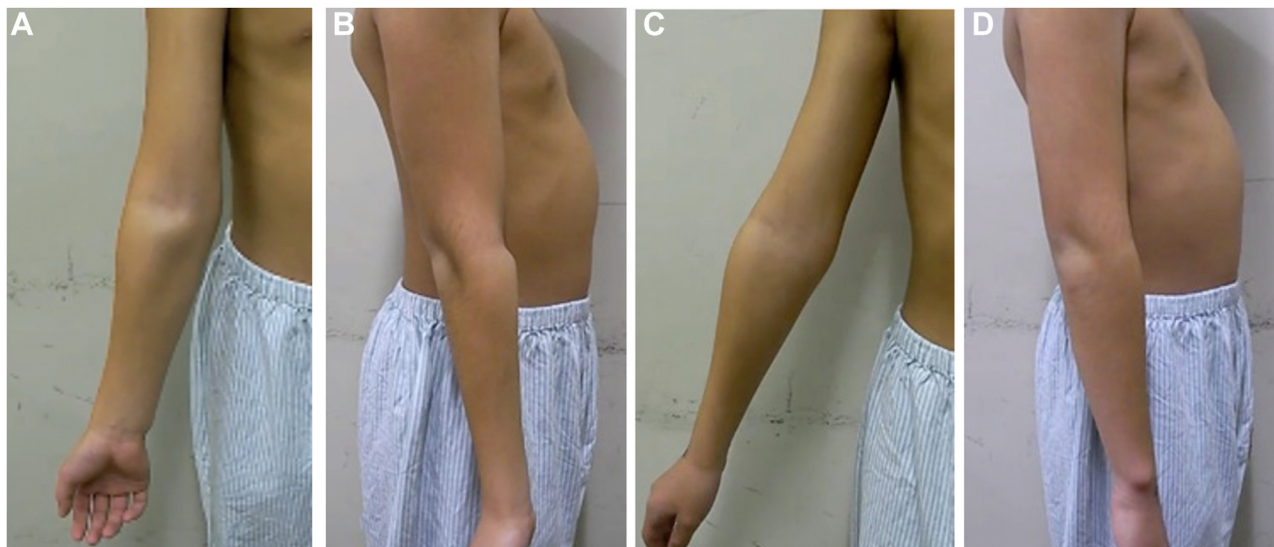


Figure 1 Inspection of right arm (at first visit). (A) Forearm supination position (front view). (B) Forearm supination position (lateral view). (C) Forearm pronation position (front view). (D) Forearm pronation position (lateral view). Anterior radial head dislocation was observed only when he extended his elbow in forearm supination position (A and B), whereas it was not occurred in forearm pronation position (C and D).

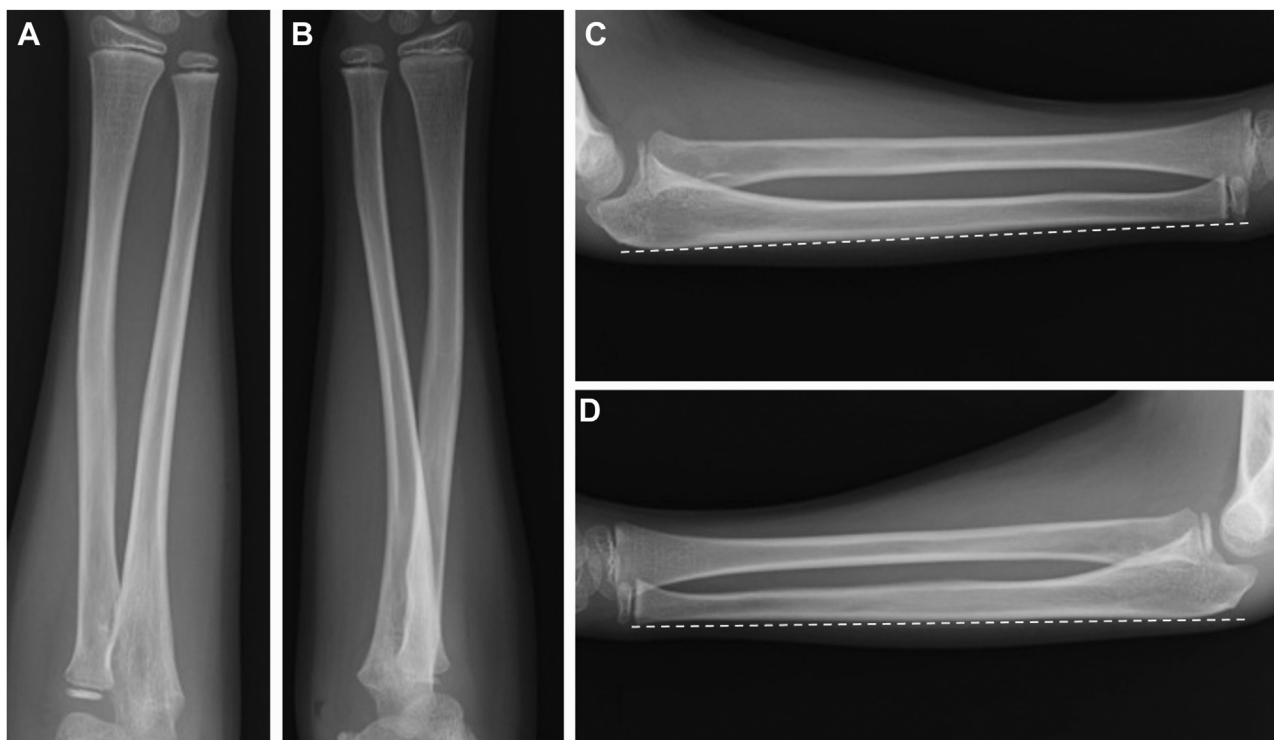


Figure 2 Plain X-ray of both forearm. (A) Right forearm (anteroposterior view). (B) Left forearm (anteroposterior view). (C) Right forearm (lateral view). (D) Left forearm (lateral view). There was no obvious deformity or malalignment of radius and ulna in both sides (A–D). Maximum ulnar bow was 1.8 mm on dislocated side (C) and 1.6 mm on the healthy side (D).

needed to improve this condition. Diagnostic arthroscopy was first done before open reduction. Viewing from the proximal medial portal, the articular surface of radial head appeared normal concave shape and congruity of radio-capitellar joint was well preserved; however, radial head was dislocated anteriorly with pop sensation when the elbow was passively extended with forearm supination position (See additional [Movie File Clip 3](#)). After diagnostic

arthroscopy, open reduction was performed. First, the radio-humeral joint was exposed using Kocher’s lateral approach to assess the condition of the annular ligament and anterior capsule in details without damaging the attachment of the anconeus muscle. The annular ligament around the radial head was elongated, whereas there was no obvious tear or discontinuity. In elbow extension position, the radial head was dislocated when the



Figure 3 Plain X-ray of right elbow joint (lateral view). (A) Elbow flexed position. (B) Elbow extended position. In elbow extended position, radial head was dislocated anteriorly in forearm supination whereas not dislocated in forearm pronation.

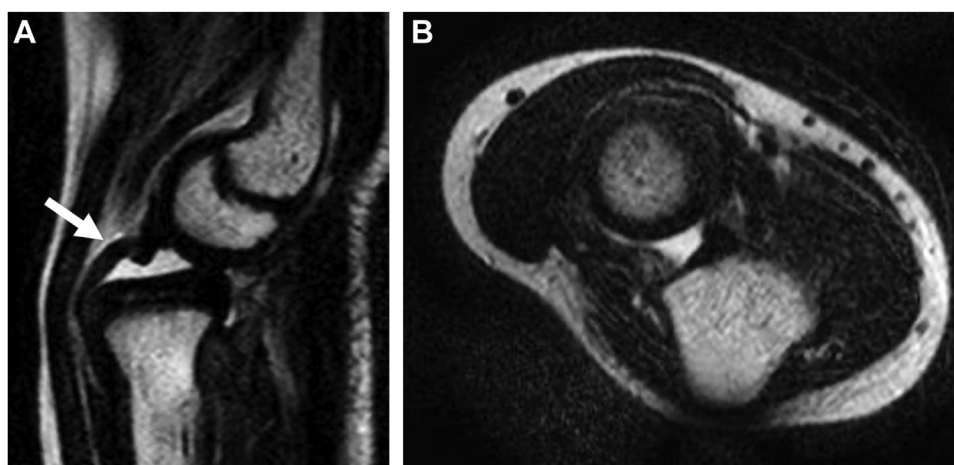


Figure 4 Magnetic resonance imaging of right elbow (T2 weighted image). (A) Sagittal view. (B) Axial view. There was no obvious bony and epiphyseal cartilage deformity of both radial head and capitellum regardless of the redundancy of anterior capsule of radio-humeral joint (arrow).

forearm was supinated but easily reduced by forearm pronation (Fig. 5) (See additional [Movie File Clip 4](#)). To reduce and stabilize the radial head, corrective ulnar osteotomy was done at 7 cm distal to the olecranon tip and fixed with appropriately bended 7-hall titanium limited contact dynamic compression plate (Fig. 6). The degree of distraction and angulation was adjusted observing the stability and congruence of radio-capitellar joint and finally fixed after confirming that radial head was not dislocated in all direction in forearm pronation with elbow extension position. Elongated annular ligament was cut and stitched tightly with reinforcing by the fascia flap of anconeus.

After 4 weeks of immobilization by cast, range of motion exercise was started except for elbow full extension with forearm supination. Nonrestricted range of motion exercise was started 2 months after surgery and return to play baseball was allowed after 3 months, confirming enough bony calluses (Fig. 7). One year after the initial surgery, metal removal surgery was performed after confirming complete bone union to avoid inhibiting normal bone growth (Fig. 8). Subsequently, there was no recurrence of radial head dislocation, and he could play baseball for 5 years without any symptoms until graduating high school. At final follow-up, there was no limitation of elbow range of motion and radial head was not dislocated when he extended the elbow in forearm supinated position (Fig. 9) (See additional [Movie File Clip 5](#)). Plain X-ray showed well congruence of radio-capitellar joint and there was no anterior

dislocation of radial head when the elbow was passively extended with forearm supination position (Fig. 10).

Discussion

There have been 4 case reports including our case which describe the voluntary reducible recurrent anterior dislocation of radial head (Table 1). First case was reported by Salama et al in 1976.¹³ They reported a 19-year-old male of self-manipulated traumatic anterior radial head dislocation. They considered the cause of dislocation as the rupture of annular ligament caused by violence of muscular contraction and hyper extension of elbow joint induced by the electric shock. Although there was the deformity of radial head with damage to the articular cartilage, they performed radial head resection to avoid impaired function of elbow joint after soft-tissue reconstruction. Itadera et al reported traumatic anterior radial head dislocation of a 16-year-old female volleyball player.⁷ The patient felt intense elbow pain while receiving a ball. Dislocation was occurred when she actively flexed her elbow in forearm supination position after the event. They assumed the main pathogenesis of dislocation as rupture of both the annular ligament and interosseous membrane by trauma, and active contraction of the biceps brachii might induce the dislocation. They treated it by the reconstruction of annular ligament using a palmaris longus tendon graft and achieved a good result. Hatta

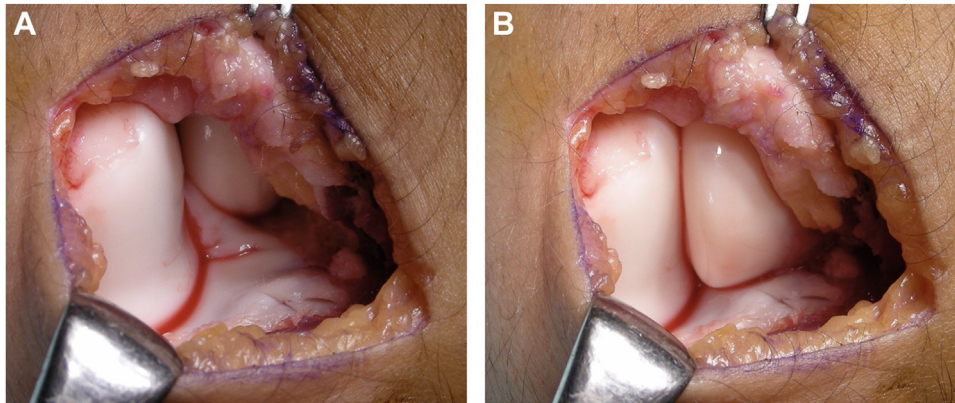


Figure 5 Intraoperative findings of radio-humeral joint. (A) Dislocated position. (B) Reduced position. In elbow extension position, the radial head was dislocated when the forearm was supinated (A) but easily reduced by forearm pronation (B).

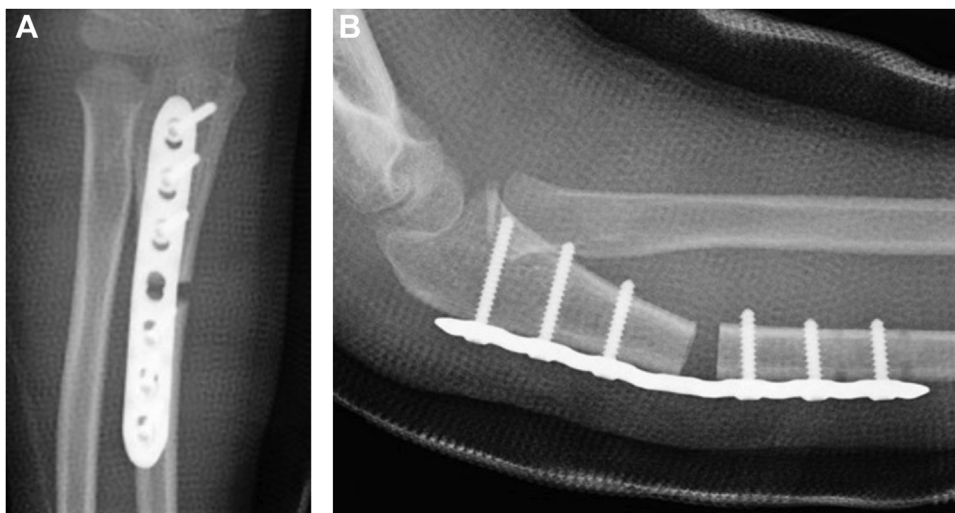


Figure 6 Plain X-ray of elbow joint after surgery. (A) Anteroposterior view. (B) Lateral view. Corrective ulnar osteotomy was done at 7 cm distal to the olecranon tip and fixed with appropriately bended 7-halls titanium LC-DCP plate.

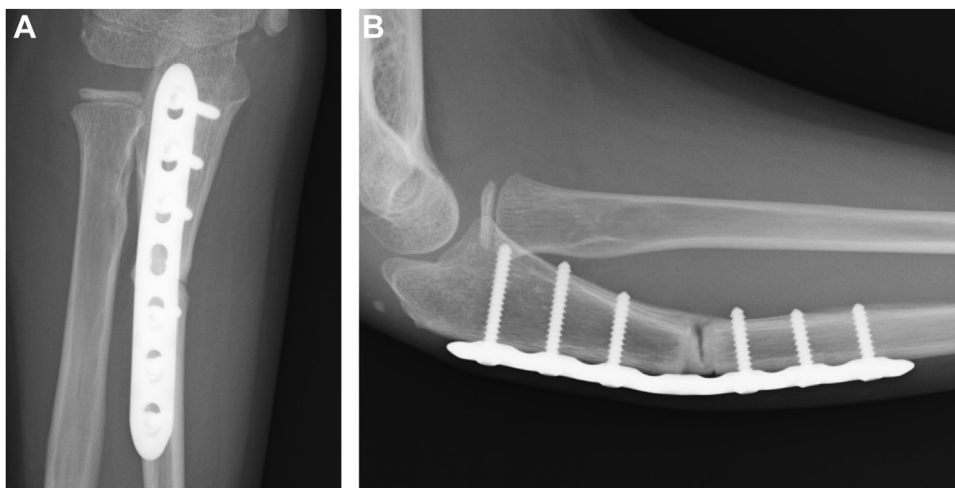


Figure 7 Plain X-ray of the elbow joint three months after surgery. (A) Anteroposterior view. (B) Lateral view. Enough bony callus is observed.

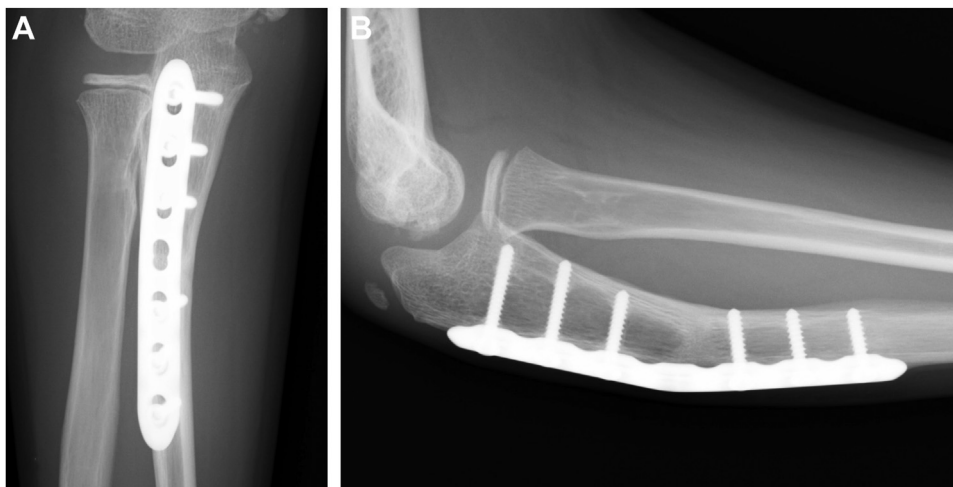


Figure 8 Plain X-ray of the elbow joint one year after surgery. (A) Anteroposterior view. (B) Lateral view. Complete bone union is confirmed.



Figure 9 Inspection of *Right* arm at final follow-up (5 years after surgery). (A) Elbow flexion. (B) Elbow extension. (C) Elbow extension with forearm supination. There was no limitation of elbow range of motion (A, B), and radial head was not dislocated when he extended the elbow with forearm supination (B, C).

et al reported a 13-year-old female basketball player who recognized pain and apprehension with prominence at the anterolateral elbow.⁴ Unlike the Salama and Itadera’s cases, there was no history of major trauma around the elbow. The patient recognized asymptomatic stiff prominence at the anterolateral aspect of elbow for 3 years before the symptom occurred. Dislocation was occurred only when the forearm was supinated and absent when the forearm was in neutral to pronated positions regardless of elbow position. Plain X-ray showed no obvious malalignment of forearm. They considered the cause as an insufficiency of lateral collateral ligament complex includes annular ligament and performed the ligament reconstruction using a palmaris longus tendon graft.

As with the previous cases,^{4,7} the dislocation in our case was occurred when the forearm was supinated, and insufficiency of annular ligament might be involved in the dislocation according to

the radiographic and intraoperative findings. Given the cause of the dislocation, the pathogenesis of our cases might be identical with Hatta’s case because both cases had no history of obvious trauma. Lincoln et al described that isolated radial head dislocation might not exist but rather this diagnosis is a misnomer for an injury that is more accurately described as a minimal Monteggia fracture–dislocation.¹⁰ It is fact that our case had no history of trauma and there was no obvious difference in bony alignment of forearm in both sides. However, considering the intraoperative status of the radial head during forearm rotation, slight undetectable ulna or radius malalignment caused by severe plastic deformation due to mild trauma might have occurred at his younger age and produced the abnormal anterior motion of the radial head during forearm rotation. Furthermore, throwing motion requires repetitive forearm rotation along with elbow flexion and extension. This repetitive abnormal kinetics of the



Figure 10 :Plain X-ray of elbow joint at final follow-up (5 years after surgery). (A) Anteroposterior view. (B) Lateral view (elbow flexion with forearm supination). (C) Lateral view (elbow extension with forearm supination). Plain X-ray showed well congruence of radio-capitellar joint (A, B) and there was no anterior dislocation of radial head when the elbow was extended with forearm supination (C).

Table 1

Lists of reported cases of recurrent anterior radial head dislocation.

	Authors	Year	Age	Gender	Initial cause of first dislocation	Dislocated position	Method of manipulation	Methods of surgical treatment
1	Salama et al ¹³	1976	19	Male	Electric shock (major trauma)	Not described	Push back the radial head	Radial head resection
2	Itadera and Ueno ⁷	2014	16	Female	Volleyball (minor trauma)	90° elbow flexion and forearm supination	Forearm pronation	Reconstruction of annular ligament using palmaris longus tendon autograft
3	Hatta et al ⁴	2019	13	Female	Basketball (no trauma)	Forearm supination regardless of the elbow position	Forearm pronation	Reconstruction of annular ligament using palmaris longus tendon autograft
4	Otoshi K et al	2021	12	Male	Baseball (no trauma)	Elbow extension with forearm supination	Elbow flexion	Corrective ulnar osteotomy with annular ligament repair

radial head, particularly during ball throwing, might have induced annular ligament insufficiency gradually and eventually resulting in anterior dislocation of the radial head.

Open reduction and corrective ulnar osteotomy with annular ligament repair have been reported to be the standard treatment of chronic anterior radial head dislocation with ulnar malalignment.⁶ As previously described, there have been several reports on performing anatomical reconstruction of the annular ligament for recurrent anterior dislocation of the radial head. Itadera et al performed annular ligament reconstruction using the palmaris longus tendon.⁷ Hatta et al performed annular ligament reconstruction as well as radial collateral ligament reinforcement using the plantaris tendon with 1.3 mm Suture Tape (Arthrex, Naples, FL, USA) to increase the initial strength of the reconstructed regions.⁴ Despite the short-term follow-up period, both reports indicated a good treatment result without any dislocation recurrence. However, several reports described that annular ligament reconstruction could not stabilize the radial head when the forearm had malalignment.^{8,12} In addition, some risks of resubluxation, heterotopic ossification, postoperative loss of pronation, and hourglass-like deformation of

the radial neck have been reported.^{3,9,11} The interosseous membrane has been reported to be an important stabilizer in preventing anterior radial head dislocation and contributing more to radial head stability compared with the annular ligament.^{1,5} Since our case had no obvious ulnar malalignment, we performed corrective ulnar osteotomy as a main procedure to avoid these risks caused by heavy load to the repaired or reconstructed ligament. Based on our result, corrective ulnar osteotomy was recommended regardless of ulnar malalignment because it might provide not only surefire reduction in the radial head but also long-term preventive effect by reducing the load to the repaired or reconstructed ligament.

Conclusion

Recurrent voluntary reducible anterior radial head dislocation was a quite rare condition.

Abnormal kinetics of radial head during repetitive forearm rotation caused by slight undetectable forearm malalignment might induce the insufficiency of the annular ligament and eventually bring on the anterior dislocation of radial head. As with the

case of permanent anterior radial head dislocation with ulnar malalignment, corrective ulnar osteotomy with annular ligament repair provided a good long-term result.

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