



The internal joint stabilizer for chronic elbow dislocation: a surgical technique



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ARTICLE INFO

Keywords:

Internal joint stabilizer
IJS
Chronic elbow dislocation
Elbow instability
Elbow stiffness

Level of evidence: Review and Technique Article

The main goal of treatment for chronically unreduced elbow dislocations is to restore a stable, concentric joint and regain a satisfactory arc of motion. Due to the conflicting goals of restoring elbow stability and regaining a good arc of motion, the treatment of chronic elbow dislocation remains a challenge for even the experienced orthopedic surgeon. The standard treatment of these dislocations consists of open reduction, V-Y muscleplasty of the triceps, and temporary arthrodesis or cast immobilization. However, prolonged postoperative immobilization may result in elbow stiffness, which significantly limits the functional outcome. We present our surgical technique with a focus on restoring stable reduction such that early motion can be instituted and complications of prolonged immobilization can be avoided. From position to wound closure, surgical steps are presented in detail, with pearls for practice and a discussion on chronic elbow dislocation. The internal joint stabilizer is a safe and effective implant that complements the management of chronic elbow dislocations. This reproducible surgical technique allows for stability and early mobility while having the added benefit of circumventing complications associated with prolonged immobilization and hinged external fixation. Understanding the surgical indications, as well as the nuances of the surgical technique utilizing the internal joint stabilizer, is critical in order to improve patient outcomes and avoid complications.

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The elbow joint is the second most frequently dislocated major joint in adults, following the shoulder.^{7,9} The estimated incidence of an elbow dislocation in the United States, more than 7000 elbow dislocations occur per year.²⁶ Posterior and posterolateral dislocations account for 80% of all dislocations, but lateral, posteromedial, medial, anterior, and divergent dislocations also occur.⁷ Considering the elbow anatomy with the bony structures providing major stability, a significant force is required to disrupt the joint. Acute elbow dislocation frequently occurs in adolescent male athletes during sporting activities when they fall on an extended elbow. Varsity football and wrestling participants are particularly susceptible to acute elbow dislocation.²⁸ Most patients with elbow dislocation often seek treatment soon after the initial injury, but an

inadequate evaluation, incomplete examination, insufficient therapy, and nonmedical solutions may lead to the dreaded chronic unreduced dislocation, especially in the developing nations.^{2,13} Chronic elbow dislocation, defined as an unreduced joint for more than 2 weeks,⁴ is uncommon in the United States; thus, most literature stems from third world countries.¹⁵ If not appropriately managed, prolonged elbow dislocation leads to rapid arthritis, severe instability, significant pain, and limited elbow function.¹⁰

Treatment of chronic elbow dislocation remains challenging due to the opposing goals of regaining elbow stability while maintaining a good arc of motion. Chronic elbow dislocation management involves open reduction because beyond 2 weeks, muscular, capsular, and ligament contracture usually ensues, making acceptable closed reduction nearly impossible.^{1,15} Following reduction, osseous and ligamentous reconstruction may be performed along with a traditional V-Y triceps plasty.^{13,24} A hinged external fixator or cast is usually applied thereafter to preserve stability and allow motion. However, external fixation is cumbersome and challenging to care for in complex patients like those with intellectual disability, morbid obesity, or cognitive

This study was exempt from approval by the University of Texas Health Science Center, San Antonio Institutional Review Board.

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<https://doi.org/10.1016/j.xrrt.2022.02.001>

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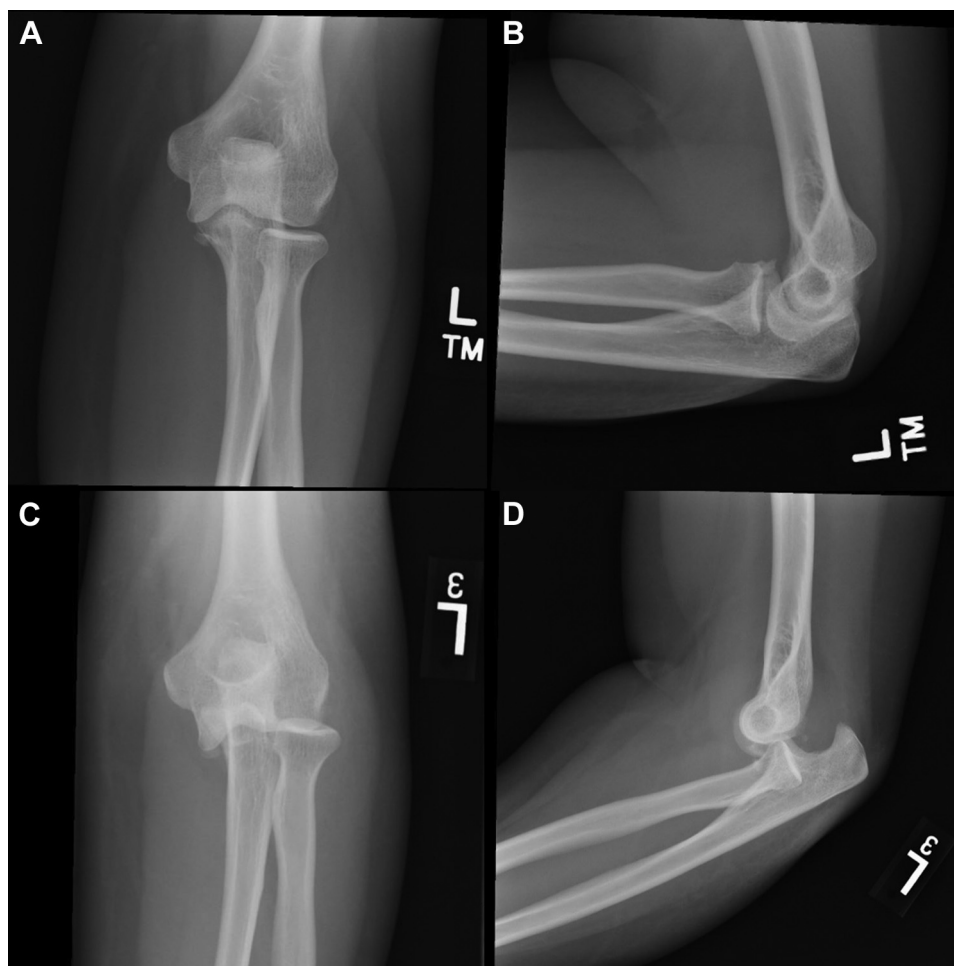


Figure 1 Preoperative anteroposterior (A) and lateral (B) radiographs demonstrating a coronoid process fracture as well as a chronic, fixed posterior dislocation (C and D). When the deformity is long-standing, considerable osteoporosis and contracture of the triceps, collateral ligaments, and all the soft tissues ensue.

dysfunction. External fixation has also been associated with pin tract infection, loosening, limited early mobilization, and nerve palsies.^{5,14,20}

Presently, there is a paucity of studies on using an internal joint stabilizer (IJS) for chronic elbow dislocation.²³ These implants function as internal hinged fixators, keeping the elbow in its concentric location while permitting early motion. This device was introduced recently as an alternative to external fixation with promising results.¹⁷ The technique outlined below describes a reproducible procedure for chronic elbow dislocation utilizing an IJS. The primary benefit of this procedure is re-establishment of stability with the ability to maintain a good arc of motion. IJS implants are also user-friendly and easy to take care of for patients as they lack the bulk and weight of external fixators.

Case presentation

A 31-year-old left hand dominant female presented to the emergency department after a fall while walking her dog. The patient sustained a left elbow dislocation at that time, which was reduced and splinted in the emergency department. She was subsequently placed in a hinged elbow brace, and radiographs demonstrated a well-reduced dislocation with an avulsion fracture of the coronoid process of the ulna (Fig. 1A and B). She subsequently presented to the orthopedic clinic with a chronic

posterior dislocation of the same elbow approximately one month later (Fig. 1C and D). The patient did not report any new injury but described constant pain in the left upper extremity with restricted range of motion.

Physical examination revealed decreased range of motion at the elbow with a 30-degree arc secondary to pain and increased laxity of the distal radioulnar joint compared to the contralateral side. The left upper extremity was tender to palpation over the elbow with intact radial and ulnar pulses, along with normal motor and sensory function in the median, ulnar, and radial nerve distributions. The treatment plan included open reduction with lateral ulnar collateral ligament reconstruction as well as internal joint stabilization.

Surgical technique

Preoperatively, radiographs commonly show considerable osteoporosis and a chronic, fixed posterior dislocation. In the operating room, the patient is positioned supine with the arm across the chest, and a small, padded bolster is rolled under the chest. The arm is draped free, movements of the elbow are unrestricted, and operative site access is increased by rotation of the shoulder. The image intensifier is introduced from the head end, which provides easy access for anteroposterior and lateral views of the elbow. The combination of general anesthesia with an



Figure 2 Medial dissection: Large full-thickness subcutaneous medial and lateral skin flaps are elevated for exposure of the elbow. The ulnar nerve is identified (vessel loop), dissected, and followed proximally along the course on the medial intermuscular septum.

interscalene brachial block are used. Intravenous antibiotics in the form of a weight-based third-generation cephalosporin are administered. One gram of tranexamic acid is used because of the expected duration and complexity of the procedure. The involved extremity is circumferentially prepared and draped from the shoulder to the fingertips. A well-padded sterile pneumatic tourniquet is placed as far proximal as possible on the involved arm. Medial epicondyle, lateral epicondyle, radial head, olecranon, and ulnar nerve are palpated and marked with a surgical marking pen.

A single standard 15- to 20-cm midline posterior incision curving around the olecranon to the radial side is used. Large full-thickness medial and lateral skin flaps at the deep fascia level are elevated for exposure of the elbow. The dissection is carried to the tendinous insertion or the aponeurosis of the triceps muscle and extensor expansion.

Exposure

As a first step, the dissection is carried medially to the ulnar nerve, which is identified and dissected from its bed along the groove in the medial humeral condyle. Proximally, the ulnar nerve is followed along its course on the medial intermuscular septum retracting the triceps muscle radially (Fig. 2). A pocket is developed, and the nerve is isolated and protected with a vessel loop. The medial intermuscular septum is released from the bony supracondylar ridge, and the ulnar nerve is carefully retracted. The vascular structures that supply the ulnar nerve are preserved. Laterally, the dissection of the lateral skin flap is continued anteriorly to the palpable radial head and lateral epicondyle.

The elbow joint is exposed through a paratricipital approach. A longitudinal dissection is carried along both sides of the triceps tendon, keeping the triceps insertion intact. The medial incision is extended along the floor of the cubital tunnel retracting the ulnar nerve gently with a vessel loop. Careful dissection is also paramount, as the nerve is often deeply encased in the scar. At the level of the medial epicondyle, the effort is made to divide the soft

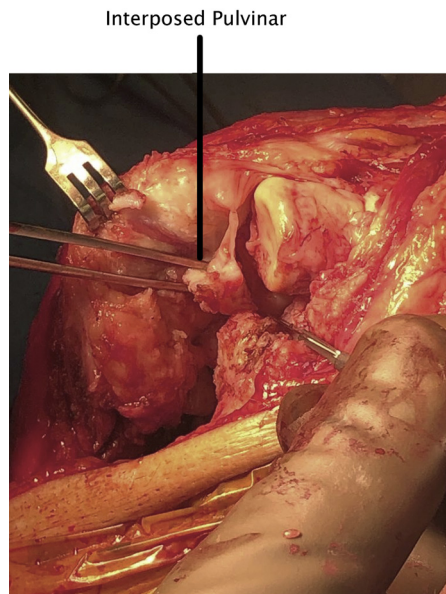


Figure 3 Lateral dissection: Radial head exposed through Kocher's interval. Dissection extended proximally at the level of the lateral epicondyle with subperiosteal dissection along the supracondylar ridge dividing the soft tissue into anterior and posterior sleeves exposing the capitellum and lateral column.

tissues into anterior and posterior sleeves; the anterior sleeve contains the flexor-pronator mass, brachialis, and the insertion of the medial collateral ligament, and the posterior soft tissue sleeve contains the scar, pericapsular tissue, and the triceps expansion. The medial structures with medial collateral ligament and capsule are released directly from the medial humeral epicondyle and condyle. The triceps is fully mobilized off the posterior humerus with a periosteal elevator to the tip of the olecranon.

Laterally, Kocher's interval between the anconeus and the extensor carpi ulnaris is marked and extended proximally at the level of the lateral epicondyle and the supracondylar ridge dividing the soft tissue into anterior and posterior soft tissue sleeves (Fig. 3). A no. 10 scalpel blade is used to divide the tissue over the palpated radial head during forearm pronation/supination, avoiding damage to the radial head cartilage. Once the radial head is exposed, the common extensor mass, lateral collateral ligament, and lateral capsule which is divided into anterior and posterior sleeves are released directly from the lateral epicondyle and distal supracondylar humeral ridge. The dissection is extended anteriorly and posteriorly to expose the capitellum and lateral column. Distally, the dissection is stopped just distal to the radial head to protect the posterior interosseous nerve. Proximally, the lateral column of the humerus is exposed by releasing the lateral intermuscular septum and mobilizing the distal triceps muscle off the posterior humerus. The brachialis is subperiosteally mobilized off the anterior humerus with care to stay on the bone. Subperiosteally, all muscle attachments from the distal humerus are freed, both anteriorly and posteriorly, followed by release of the attachments of the joint capsule and collateral ligaments around the condyles of the humerus. The capsule is excised anteriorly and released posteriorly. The triceps tendon is fully mobilized from the humerus medially and laterally while preserving its insertion on the olecranon. The lateral dissection in the distal region is carried anterior to the radial head and proximal ulna in the medial direction by subperiosteally releasing the anterior capsule, thick fibrotic tissue, and adhesions (Fig. 4A). The

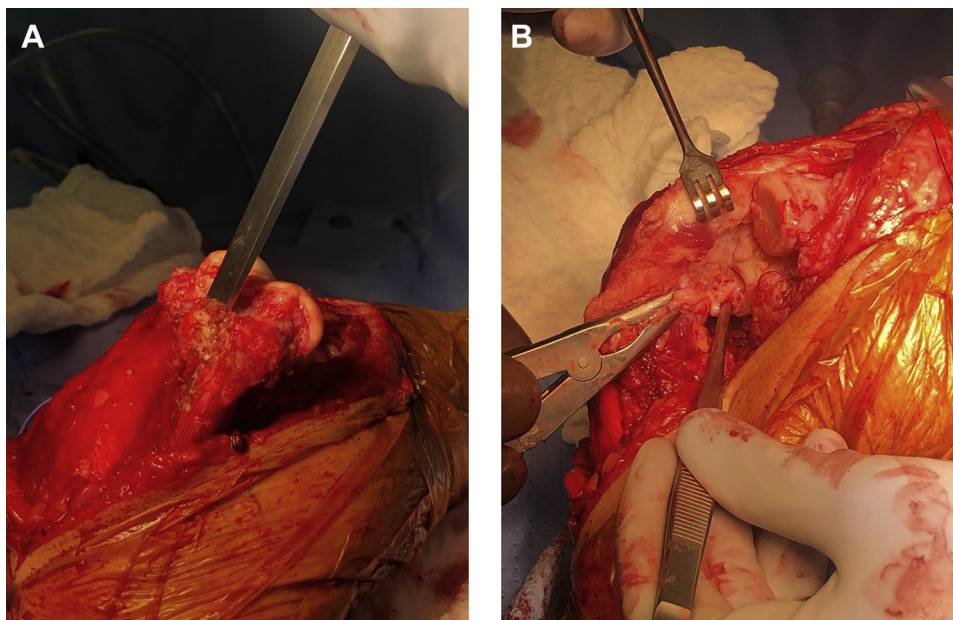


Figure 4 (A) The elevated posterior callus along with the adherent scar is removed with an osteotome. (B) The forearm is externally rotated, and the interposed pulvinar is removed from the greater sigmoid notch. The olecranon articular surface cartilage is identified.

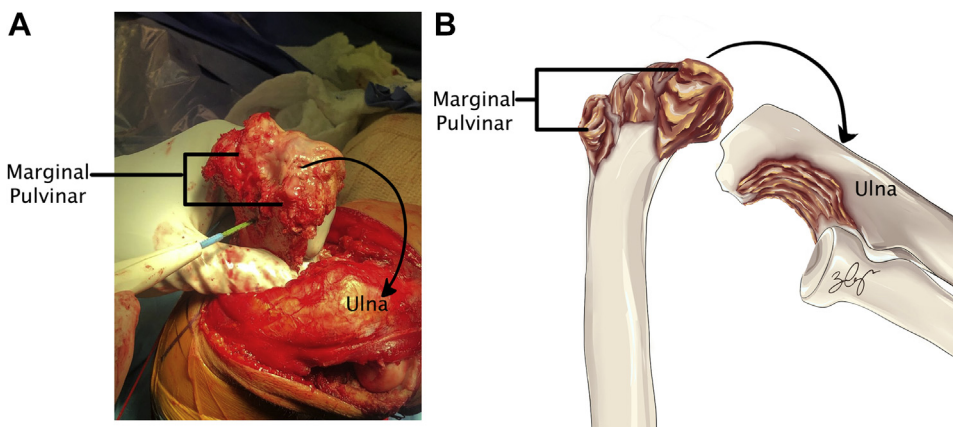


Figure 5 (A) The elbow fully dislocated with “the maneuver”. Distal humeral articular surface covered with the adherent scar and surrounding soft tissue. (B) Interposed pulvinar in both sigmoid notch and distal humerus.

anterior joint dissection is carried out until the elbow joint is loosened and the lower end of the humerus is adequately mobilized.

Elbow reduction

Attention is now directed to the lateral elbow again, and the radial head and the lateral aspect of the olecranon process are exposed. The forearm is pronated, and the greater sigmoid notch is exposed (Fig. 4B). The mass of the adherent articular scar is mobilized and completely excised. After removing the fibrosed tissue, it is possible to identify the edges of the actual cartilage finally. A small lobster claw can be applied on the dorsal surface of the proximal ulna to help externally rotate the ulna to expose the olecranon articular surface and cartilage further. The radial head is checked if it can be brought to its normal anterior position by gently pressing on the anterior surface of the capitellum. If the radial head

cannot be reduced easily, dissect the soft tissues more widely instead of applying force that may injure the articular surfaces. Attention is redirected medially, and any scar from the olecranon and coronoid fossa is completely excised. All the capsular and collateral attachments around the distal humerus are released, and the elbow is then gently manipulated to reduce the ulnohumeral and radiocapitellar articulations. If the elbow cannot be reduced easily, work from both the lateral and the medial aspect of the joint as needed to remove any additional fibrotic tissue and try to reduce by slipping the coronoid process distally and then anteriorly over the trochlea. Care should be taken to avoid entrapment of the ulnar nerve when reducing the elbow. The elbow is then carried through a range of motion; the elbow should remain reduced without any significant external force.

Upon completing this step, the elbow joint is disarticulated, and the denuded distal humerus is mobilized from the medial side of the wound. The humeral, ulnar, and radial head articular

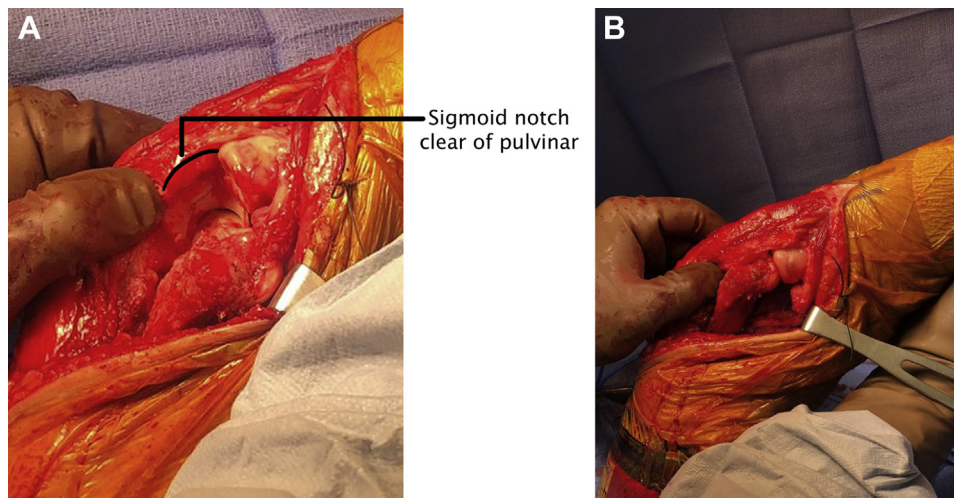


Figure 6 (A) The elbow prior to full reduction with all pulvinar removed. (B) The elbow is then gently manipulated so as to reduce the ulnohumeral and radiocapitellar articulations.

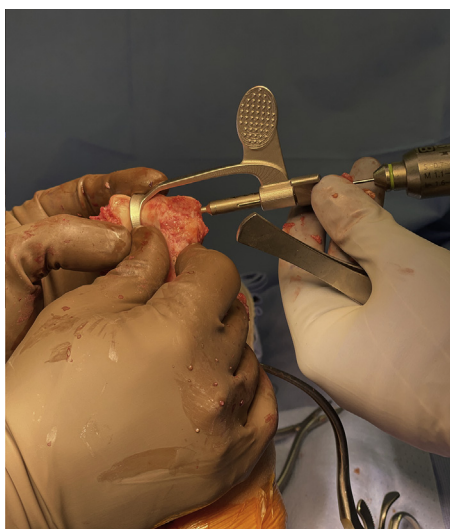


Figure 7 A 1.5-mm guide wire is inserted through the IJS axis guide placed over the trochlear notch. IJS, internal joint stabilizer.

cartilages are evaluated. The humeral articular surface is often covered with adherent scar and surrounding soft tissue (Fig. 5A and B). Once the edge of the articular cartilage is identified, the adherent scar is excised starting from one margin and working across the joint. The scar is elevated en masse from the cartilage with gentle dissection with a 15 blade while attempting to preserve the underlying articular cartilage. In our patient, we can see the anterior half of the articulation remained in relatively good condition while the posterior half has some wear posterolaterally. There is a great deal of callus on the posterior surface of the humerus and in the olecranon fossa as a result of the periosteum being elevated at the time of injury. The callus, along with the adherent scar, is removed with an osteotome in good condition. A pencil burr is used to smoothen the posterior surface and deepen the olecranon fossa. The coronoid and radial fossa are cleared. Attention is now diverted to the proximal radius and ulna. All the soft tissue that is interposed in the proximal ulna along the greater sigmoid notch is removed, and it is possible to identify the

actual cartilage finally (Fig. 6A). The elbow is completely reduced after thorough irrigation, and stability is assessed. Care is taken to avoid forceful manipulation, and gentle, incremental manipulation is enough to stretch the triceps (Fig. 6B).

Ligament repair and stabilization

At the completion of the reduction, to impart stability for early range of motion, the medial and lateral collateral ligaments are repaired, and the elbow is neutralized with Internal Joint Stabilizer (Skeletal Dynamics, Miami, FL, USA). We do not do a primary reconstruction of the collateral ligaments but augment their repair with suture anchors, and the IJS protects healing while mobilizing. We reckon to repair the soft tissue on the lateral side first to ensure radial head congruency with the capitellum. The elbow is disarticulated, and the handle of the IJS axis guide is positioned over the trochlear notch, and a guidewire (1.5-mm K-wire) is inserted under the image intensifier (Fig. 7). Correct positioning of the guide pin ensures that the elbow joint will remain concentric throughout the entire range of motion after application of the IJS construct (Fig. 8). A 2.7-mm drill hole for an appropriate size axis pin is made in the center of the capitellum. To repair the lateral collateral ligament, we sharply dissect the posterior soft tissue sleeve of the residual extensor origin, anconeus, and triceps fascia with a no. 10 scalpel blade to create a longitudinal band of tissue (Fig. 9). Care is taken throughout to not create individual tissue layers, which would only weaken the band. A single loaded ComposiTCP Suture Anchor (Biomet, Warsaw, IN, USA) is inserted at the origin of the lateral collateral ligament on the lateral epicondyle (Fig. 10). The proximal limb of the suture is then whipstitched along the band, starting in the middle and going proximally and then reversed at the top for double reinforcement. The distal limb of the suture is then whipstitched along the band, starting in the middle and going distally and then reversed at the bottom for double reinforcement. The limbs of the sutures are tied after the final IJS construct placement.

The baseplate of the IJS is placed on the proximal ulna and fixed with a 3.5-mm compression screw through the center-sliding slot. Drill for bicortical fixation, aiming toward the coronoid process and away from the radial notch. The center-sliding slot facilitates the baseplate positioning, confirmed under the image intensifier and fixed with the remaining two 3.5-mm compression screws. Avoid drilling into the articular surfaces. The transtrochlear construct is

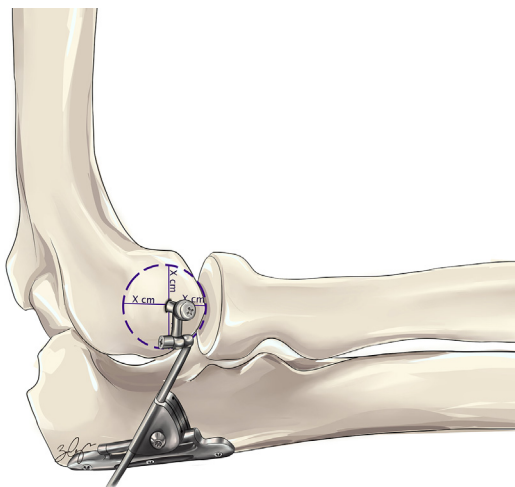


Figure 8 Proper isometric placement of the internal joint stabilizer (IJS).

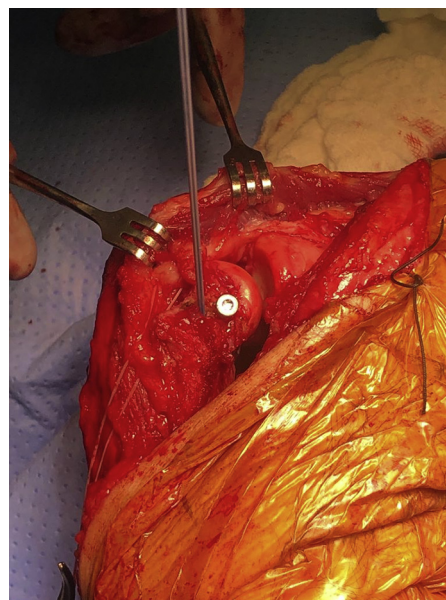


Figure 10 A guidewire for the suture anchor being inserted at the isometric point.

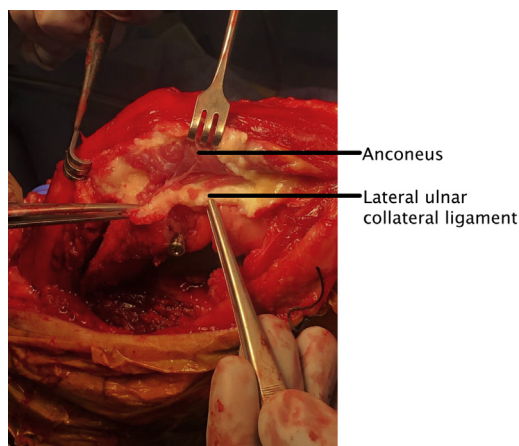


Figure 9 Sharp dissection of the lateral ulnar collateral ligament (LUCL).

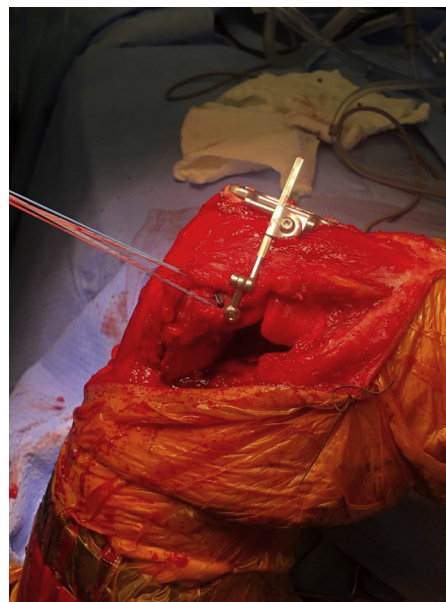


Figure 11 The proximal and distal limbs of the anchor sutures tied after the final IJS construct placement with the elbow in 90° of flexion and confirming the congruency of the radial head. IJS, internal joint stabilizer.

assembled and mounted on the baseplate, ensuring the head of the proximal locking screw and the arrow of the distal locking joint are pointing proximally. A 15-mm axis pin is passed through the proximal connecting rod in the trochlear drill hole, and the stabilizer bar screws are locked in both flexion and extension to improve the concentricity of the reduction. Use a pin cutter to remove any excess length from the distal connecting rod. The proximal and distal limbs of the lateral sutures are now tied with the elbow held in 90° of flexion, enveloping the radial head posteriorly and confirming congruency with the capitellum (Fig. 11). The residual soft tissue envelope is further reinforced with interrupted No. 1 Vicryl (Johnson and Johnson, Cincinnati, OH, USA) sutures just proximal to the axis pin. The scar is incorporated into the repair and adds strength (Fig. 12A and B).

The medial soft tissue attachments fall in place with the bony anatomy, returning to their normal position. The elbow is flexed to 90° and checked for concentric reduction. The soft tissue envelope, including scar, ligamentous tissue, capsular tissue, and muscle attachments, is closely repaired around the elbow. A 1.8-mm Q-Fix (Smith and Nephew Andover, MA, USA) suture anchor is used to augment the medial collateral ligament. A 1.8-mm Q-Fix (Smith and Nephew Andover, MA, USA) anchor is inserted at the origin of

the medial collateral ligament on the medial epicondyle (Fig. 13A). The anchor suture limbs are passed proximally and distally in a running manner until the anterior sleeve (common flexor origin, flexor-pronator mass) is firmly secured with the posterior sleeve (the triceps expansion), and the joint is completely closed (Fig. 13B). The soft tissue envelope is further reinforced with interrupted No. 1 Vicryl (Johnson and Johnson, Cincinnati, OH, USA) sutures (Fig. 14).

The ulnar nerve is now transposed subcutaneously and stabilized in the anterior elbow using a soft tissue fascial sling. Transposition of the ulnar nerve may be beneficial when intraoperative flexion produces tension across the nerve. The tourniquet is

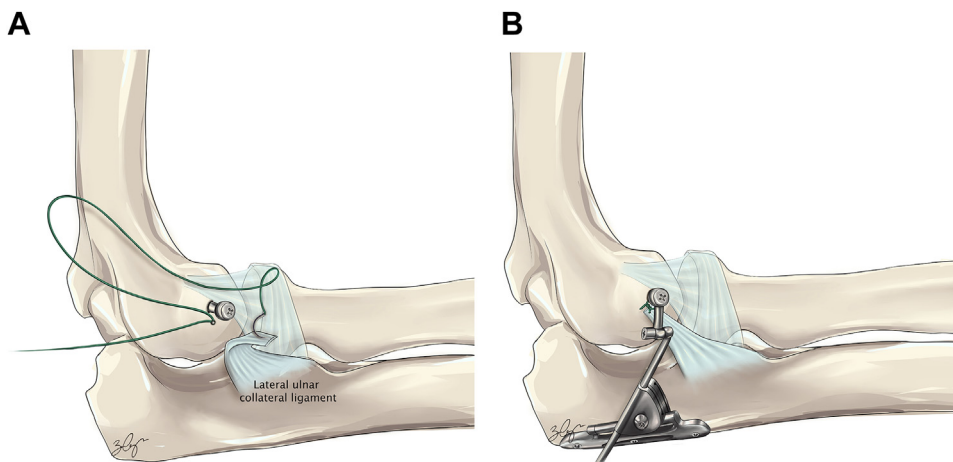


Figure 12 (A) The IJS in proper position with the suture anchor passing through the LUCL. (B) LUCL restored. IJS, internal joint stabilizer; LUCL, lateral ulnar collateral ligament.

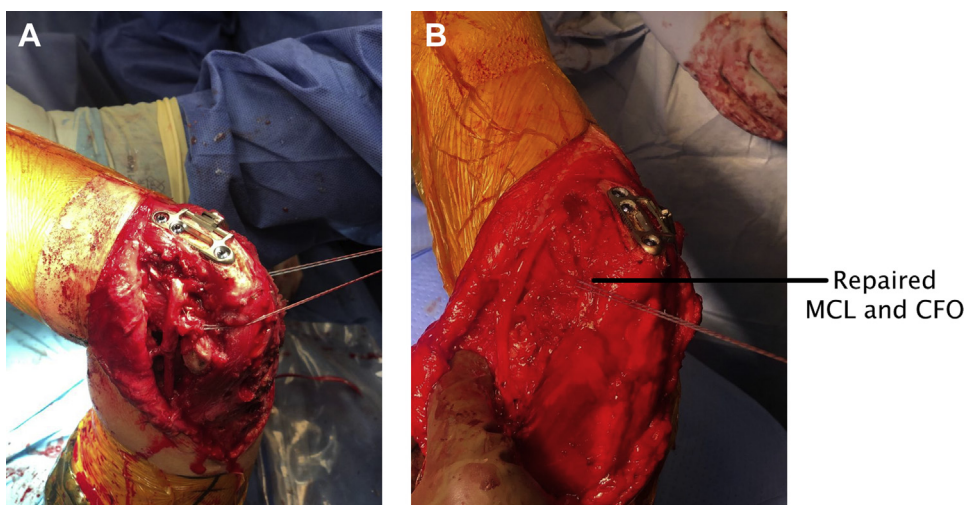


Figure 13 Medial closure: A suture anchor inserted at the origin of the medial collateral ligament on the medial epicondyle (A) and anterior and posterior soft tissue sleeves are completely closed (B), reinforcing the medial collateral ligament.

released, and the wound is irrigated. Restoration of elbow flexion/extension, pronation/supination, and stability in all directions is assessed intraoperatively before wound closure (Fig. 15A–D). The skin is closed using 2-0 Vicryl and staples. The elbow is placed in a posterior splint at 90 degrees.

Postoperative management

Patients are seen 2 weeks after the index procedure, and the wound is inspected. Elbow stability is assessed for any evidence of subluxation or dislocation clinically and radiographically (Fig. 16A–D). The presence of catching, clicking or popping on elbow motion and symptoms of giving way indicate potential subluxation or dislocation. The staples are removed, the splint is discontinued, and the patient is referred to therapy. Unprotected elbow flexion/extension and pronation/supination motion is allowed after the first postoperative visit. Therapy initially consists of active and active-assisted motion exercises, edema control, scar management, pain modalities, and home program exercises performed at least four to five times per day. We plan to surgically

remove the IJS device after the first six weeks when soft tissue healing is expected to maintain stability. During follow-up visits, we evaluate elbow motion, including flexion-extension, pronosupination, finger motion, and radiographic alignment. Interval removal of the IJS in this patient showed healed elbow with a restored range of motion (Fig. 17). At 6-month follow-up, this patient experienced no complications and had an arc of motion from 5 degrees to 130 degrees with full pronation and supination.

Our findings of functional elbow stability and a near-normal range of motion indicate that this surgical technique of reduction, ligament repair, and IJS for stabilization can be considered as a treatment option for chronic elbow dislocation.

Discussion

Chronic elbow dislocations continue to present a significant challenge for surgeons with serious sequelae. They are generally associated with severe instability, elbow function limitation, continued pain, and arthritic changes.¹⁰ The morbidity of chronic elbow dislocations is a result of contracture of the triceps muscle

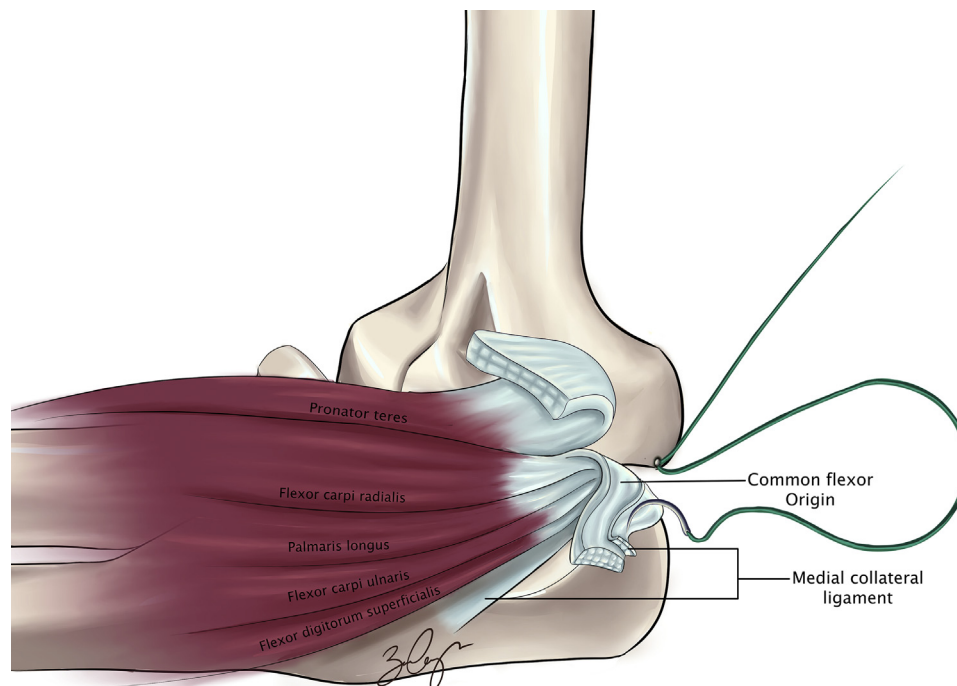


Figure 14 Illustration of suture anchor repair of the medial collateral ligament (MCL) and common flexor origin (CFO).

and collateral ligaments in conjunction with fibrosis/contracture of the joint capsule and articular surface. Treatment must therefore address this consistent pattern of pathology. Goals of surgical interventions include acquiring a concentric reduction and restoring an adequate elbow arc of motion while maintaining elbow stability. The standard management of chronic elbow dislocation involves open reduction, collateral ligament reconstruction, triceps lengthening in a V-Y fashion, and external fixation application.^{7,15} In the elderly population greater than 65 years, total elbow arthroplasty is recommended instead of open reduction.¹⁵ Variations of this treatment strategy certainly exist, and controversy remains regarding the necessity of all of these steps in order to achieve stability. However, the main focus of the current technique is to offer the use of an IJS as a sound alternative to hinged external fixation (HEF).

All methods of elbow stabilization to date are associated with serious drawbacks. Any method that prevents ulnohumeral motion delays rehabilitation and may result in stiffness. Therefore, post-operative immobilization with casts or static external fixators is problematic.⁹ Nonetheless, HEF is a modality that rose to popularity because proponents believed it could allow for early motion while preserving stability. In 2001, Ruch and Triepel successfully treated 5 patients with chronic elbow dislocation using HEF without complete osseous or ligamentous reconstruction.²² Satisfactory functional results were subsequently replicated by numerous studies thereafter.^{6,10,12,16,27} Most of these studies, though, had a small sample size, and those with five or more patients in their series had notable complications associated with external fixation in 31%–60% of their patients.^{10,21} Complications included blistering, pin breakage, ulnar neuritis, and pin tract infections.^{10,21} A more comprehensive case series of 100 patients by Cheung et al⁵ further delineated a complication rate of 10%–15%. Ten of their patients developed a major complication defined as pin loosening, purulent pin drainage, deep infection, and external fixator malalignment. Fifteen patients had a minor complication defined as nonpurulent

drainage, erythema, and release of the skin surrounding the pin site. In their study of 19 patients treated with HEF for post-traumatic instability, Ring et al²⁰ reported 9 of 19 (47%) device-related adverse events. There were three pin tract infections, one radial nerve palsy, one ulnar neuritis, one suture abscess, one pin tract fracture, and one residual subluxation.

Other treatment options for chronic elbow dislocation that do not use HEF are sparse but have been described. Anderson et al³ recently demonstrated a new surgical technique on 32 patients with chronic elbow dislocation without articular fractures consisting of open reduction with development of medial and lateral soft tissue sleeves about the humerus and repairing them with bone tunnels and suture, followed by a simple sling. They experienced no adverse events outside of a transient ulnar nerve palsy. Aminata et al² applied the box-loop ligament reconstruction technique and a removable splint postoperatively to treat six chronically dislocated elbows. The box-loop technique was introduced in 2015 by Finkbone et al⁸ for elbow instability, and Aminata's series displayed adequate functional outcomes with no complications and an average arc of motion of 119 degrees postoperatively. A case report where bilateral ligament reconstruction was carried out using palmaris longus tendons and a postoperative cast was recently described for chronic elbow dislocation. Following treatment, Kataoka et al¹¹ opted for cast immobilization instead of HEF due to the patient having autism spectrum disorder in order to avoid possible difficulty keeping the elbow immobilized. They similarly reported no complications and a range of motion from -15 degrees in extension to 140 degrees in flexion. Though successful, this report highlights another challenge of using HEF in complex patients.

Conversely, IJS devices are relatively simple to use in challenging patients and have had promising results in the elbow instability literature. Introduced by Orbay and Mijares in 2014, the IJS was developed as an internal dynamic fixator in the treatment of traumatic elbow instability.¹⁷ Since then, studies have shown

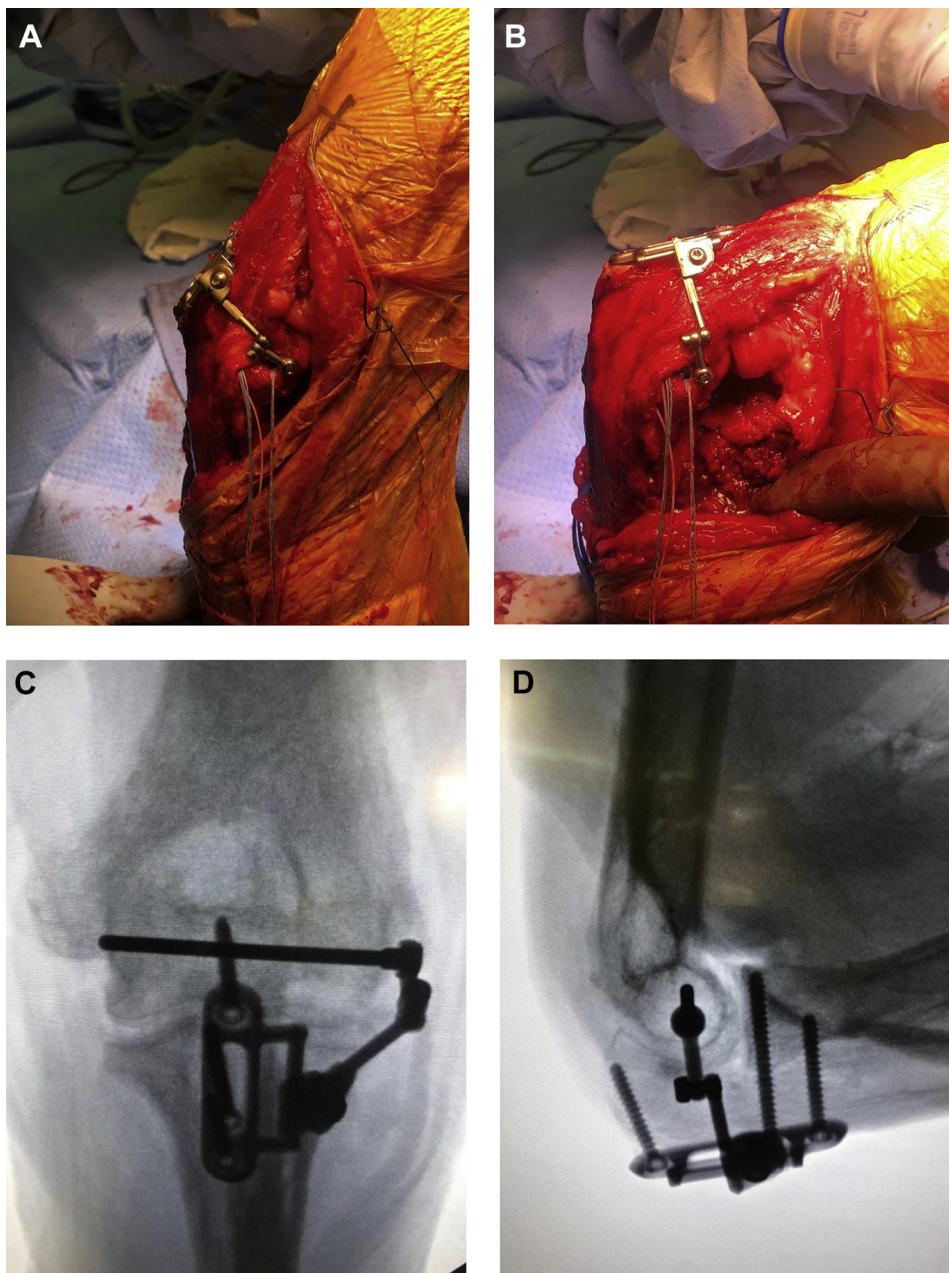


Figure 15 Restoration of elbow alignment (A), flexion/extension range of motion (B), and stability in all directions is assessed intraoperatively clinically and radiologically on AP (C) and lateral (D) views before wound closure.

favorable functional outcome scores with lower complication rates compared with HEF. In a subsequent series of 24 patients with persistent or recurrent elbow instability, Orbay et al¹⁸ concluded that the IJS is as effective as external fixation at reproducing concentric elbow reduction. At the same time, their series displayed lower rates of persistent subluxation, heterotopic ossification, and ulnar neuropathy compared to HEF. IJS devices also avoid notorious pin problems associated with external fixation, including infection, breakage, and pin fracture. Sochol et al²⁵ echoed these results and showed advantageous Disabilities of the Arm, Shoulder, and Hand and Mayo Elbow Performance scores using the IJS. Though secondary removal of an IJS is recommended at 6-8 weeks, their series also suggest that IJS devices have the added benefit of

not requiring removal unless patients request it, unlike external fixators.²⁵ Notably, there are no studies on the effects of permanent implantation of the IJS. Indications for IJS devices have been heterogeneous and subjective since its birth. The most recent study on IJS use by Pasternack et al¹⁹ recommended the IJS for both acute and chronic elbow instability. To the best of the authors' knowledge, an IJS has not been described in the management of chronic elbow dislocations. The IJS provides sufficient clinical stability to start early rehabilitation/motion, thus achieving two almost contradictory goals to obtain a satisfactory outcome following chronic elbow dislocation. IJS devices are also preferable to hinged external fixators, for they are less cumbersome for both the surgeon and patient. They can be easily used in complex patients requiring more

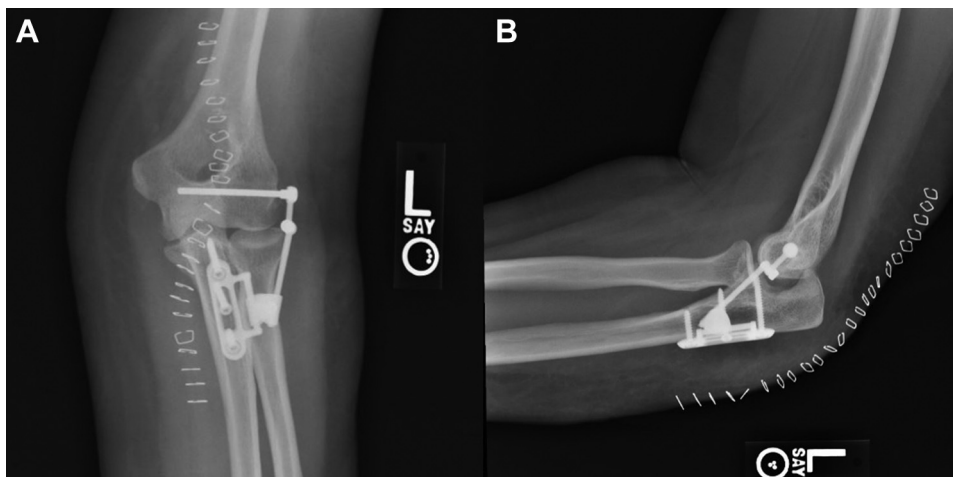


Figure 16 Two-week follow-up AP (A) and lateral (B) radiographs treated in the described surgical manner with the IJS. Successful reduction of the ulnohumeral and radiocapitellar joints. IJS, internal joint stabilizer.

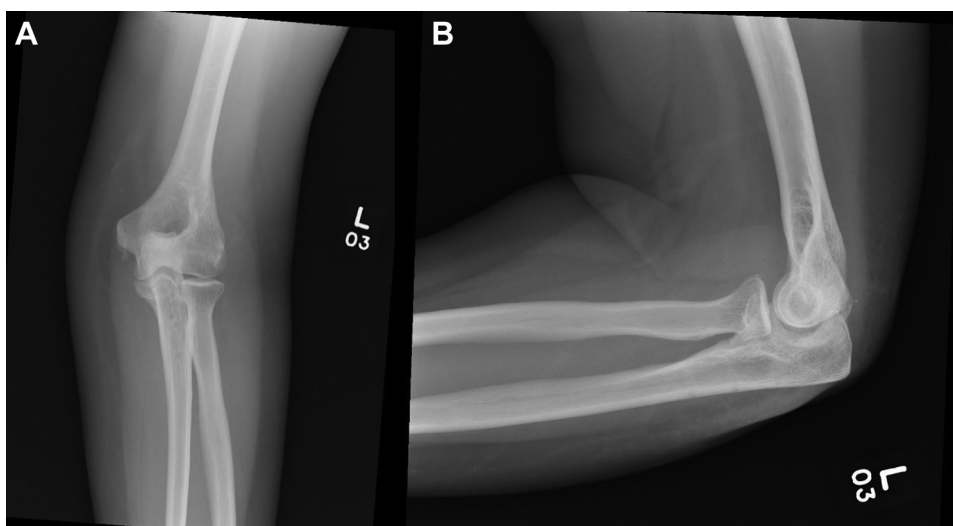


Figure 17 Follow-up AP (A) and lateral (B) radiographs demonstrating interval removal of the IJS device with normal alignment.

careful maintenance of elbow stability as seen in patients with autism spectrum disorder or cognitive dysfunction. Finally, as chronic elbow dislocation is more common in the developing world, IJS devices may serve as a more cost-effective alternative to HEF because there is less risk of further complications following index placement.

Conclusion

The IJS is an attractive modality of elbow stabilization that maintains a concentric reduction while permitting joint motion and early rehabilitation. The benefits of early motion with this device may outweigh the need for a secondary removal procedure. For the dreaded chronic elbow dislocation, many methods of elbow stabilization are associated with serious drawbacks. The IJS is easy to use and has favorable functional outcome scores and lower complication rates than HEF.

Disclaimers:

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Conflicts of interest: AKD used to serve on the speaker’s bureau for Skeletal Dynamics. The other authors, their immediate families, and any research foundation with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

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