Surgical Repair of Posterolateral Rotatory Instability of the Elbow Using Surgilig/LockDown: A Novel Surgical Technique

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Abstract: Posterolateral rotatory instability (PLRI) of the elbow is the most common type of chronic elbow instability and is principally due to lateral ulnar collateral ligament injury. We describe a novel surgical technique for the treatment of PLRI using the Surgilig/LockDown. Using this tensioned double-braided polyester synthetic ligament to reconstruct the lateral ulnar collateral ligament it is possible to reconstitute elbow stability. Through a global posterior midline incision, a Surgilig/LockDown synthetic ligament is first secured to the proximal ulnar and then passed through a bone tunnel from the isometric point of the lateral epicondyle, along the lateral column, exiting the posterior aspect of the supracondylar ridge where it is tensioned and secured with bicortical screw fixation. We present 2 cases where Surgilig has been used to treat PLRI in a primary and revision scenario. Our early findings have found that this method confers good elbow stability and immediate motion without the need for allograft harvesting or multiple tendon routing in both primary and revision reconstruction of the elbow.

Key Words: Surgilig, LockDown, elbow instability, lateral ulna collateral ligament, posterolateral rotatory instability

Posterolateral rotatory instability (PLRI) of the elbow is the most common type of symptomatic chronic instability of the elbow and is due to abnormal external rotation of the forearm complex in relation to the distal humerus. Disruption of the lateral ulnar collateral, and annular ligaments allows for abnormal supination of the ulnar, and posterior subluxation of the radial head forcing the forearm into external rotation and valgus during flexion. Instability most commonly occurs following trauma; most frequently posterolateral subluxation or dislocation of the elbow, or via iatrogenic injury; commonly release of the lateral epicondyle and lateral surgical approaches to the elbow. The diagnosis of PLRI may be missed if not suspected and suitably investigated. Stability may be classified from stage 1 to stage 3 using the lateral pivot-shift, posterolateral drawer, and apprehension maneuvers together with radiologic or arthroscopic evidence of posterolateral rotatory subluxation. The condition typically presents with recurrent dislocation, painful locking, clicking or catching of the elbow, and is most pronounced during extension of the elbow with the forearm in supination.

The lateral ulnar collateral ligament (LUCL) is the principal stabilizer of the posterolateral elbow, and its stabilization or reconstruction is the principle method for the management of symptomatic PLRI. Outcomes of surgical reconstruction are dependent upon the effective clinical staging of the injury; with stage 1 or 2 instability having better functional outcomes than those with stage 3 instability. In asymptomatic patients, or in those where surgery is contraindicated, nonoperative techniques such as avoidance of activities that cause instability, elbow bracing or application of a sugar tong cast, and physical therapy may be considered. Where surgery is indicated the aim of reconstruction is to achieve anatomic and isometric continuity of the ligament with a number of techniques having been described utilizing both open and arthroscopic approaches.

The avascular and hypocellular physiology of ligamentous tissue, and its need for specific mechanical function makes it difficult to form a complete and long-term functional repair once damaged. Over the past years a number of biological and synthetic scaffolds and augments have therefore been developed to aid with the surgical management of ligamentous injuries. The use of synthetic scaffolds have been described in the treatment of a wide range of ligamentous injuries including those of the rotator cuff, anterior and posterior cruciate ligaments, medial and collateral ligaments of the knee, the Achilles tendon, and also the hip abductors. The use of synthetic materials has been shown to lead to good clinical and functional outcomes, however, is also associated with some specific complications including abnormal immunologic responses, breakage, debris dispersion, synovitis, and chronic joint effusion; indeed there is still no synthetic material that is ideal in mimicking natural human tissue.

With regard to the acromioclavicular joint (ACJ) there is anecdotal evidence of aseptic foreign body reactions causing a periosteal reaction or osteolysis with polydioxanone suture corocococlavicular slings, GoreTex, and Dacron grafts. There is a single report in the literature of osteolysis following the use of Surgilig/LockDown to reconstruct the ACJ and would appear to be a very safe and effective method of gaining immediate stability and return of function in extra-articular reconstructions.

Tawari et al have recently described using a synthetic polyester Ligament Advanced Reinforcement System to reconstruct the LUCL in chronic PLRI. They found that synthetic graft was well tolerated and provided satisfactory stability while avoiding the associated morbidity of using an autograft. Surgilig/LockDown (Surgicraft Ltd., Redditch, UK) is a double-braided polyester (polyethyleneeterephthalate or PET) synthetic ligament that aims to promote tissue ingrowth via...
bicompatible fixation. First introduced in 2001 it has been demonstrated to be a safe, simple, and reproducible method of reducing and stabilizing ACJ disruption with good functional outcomes and reduced complication rates.\textsuperscript{19–21} Carlos and colleagues found in 50 patients followed up for an average of 26.9 months that there were no untoward reaction to the synthetic material and in 7 patients where the screw was removed for screw prominence the synthetic ligament appeared to allow tissue ingrowth. The ACJ remained stable after its removal. They reported that 91\% of patients were completely happy with the procedure.\textsuperscript{22} Reconstructing the LUCL like the ACJ relies on accurate tensioning and this can be easily achieved with the Sugilig/LockDown by adjusting the length of the final implant and with positioning of the final screw and avoids the need for autologous graft harvesting. It also avoids the potential for late instability that has been described following elongation of autologous tendon graft or allograft.\textsuperscript{23,24}

In this paper we describe a novel technique in which the Sugilig synthetic ligament can be used to reconstruct the LUCL and report the early outcomes when used in a primary and revision scenario.

MATERIALS AND METHODS

The patient may be positioned as per the individual surgeons’ preference; however, the senior authors’ preference is a lazy lateral position with a high tourniquet applied.

Through a midline posterior incision a flap is raised laterally to expose the Kocher intermuscular posterolateral interval between anconeus (radial nerve) and the extensor carpi ulnaris (posterior interosseous nerve) allowing good access proximally to the lateral epicondyle and lateral column of the humerus and distally to the subcutaneous border of the ulnar.

A 6-mm drill hole is made at right angles to the long axis of the ulnar just distal to the insertion of the ulnar and distal aspect of the lateral collateral ligament at the supinator ridge. A guidewire for a 6-mm cannulated drill is passed from the isometric point of the lateral collateral ligament at the supinator ridge to the posterior aspect of the humerus at the level of the supracondylar ridge. Once happy with the guidewire position the 6-mm cannulated drill is used over the guidewire.

The Sugilig/LockDown system includes a measuring device with a metal leader shown in Figure 1. This metal leader is passed through the drill hole in the ulnar and looped back on itself (Fig. 2). The leader is then passed through the second hole from the isometric point of the lateral epicondyle and the length of Sugilig/LockDown ligament required can be measured to the desired point of screw placement on the posterior cortex of the humerus using the coded markers on the leader in a similar manner to that described in the ACJ reconstruction technique\textsuperscript{25} (Fig. 3).

The Sugilig/Lockdown tape is shown in Figure 1. The correctly sized implant graft is then passed though the bone tunnel in the ulnar and looped through itself to secure it distally using the soft loop. The measuring guide and leader is used to assist passage through the bone tunnels by looping the hard loop of the implant onto the measuring device in a similar manner as described in the ACJ reconstruction technique.\textsuperscript{25} It can then be passed through the predrilled bone tunnel in lateral epicondyle. The metal leader is then used to apply tension to the graft (Fig. 4). The elbow is then mobilized through a full range of motion and enough tension is applied to prevent PLRI of the radial head from the capitellum. The posterior cortex of the humerus is then marked with monopolar diathermy at the point where the proximal end of the hard loop of the implant extends, and where screw fixation is desired.

A 2.5-mm bicortical hole is drilled in the posterior cortex of the humerus in a posteroanterior direction and tapped with a 3.5-mm cortical tap; 4 mm is added to the measured length of the fixation screw to ensure that the screw is bicortical and to allow for use of a washer (Fig. 5). The screw should not compress the implant against the posterior cortex of the humerus. The measure tape is then released from the implant with a surgical blade. Elbow stability may be tested intraoperatively clinically and using an image intensifier if desired. The final position is shown in Figure 6.

Postoperatively the elbow is not splinted or immobilized and the use of hinged elbow braces is avoided. Immediate gentle active range of motion exercises are started on day 1 postoperatively under the supervision of the physiotherapist. Full active and passive elbow flexion and prosupination of the forearm should be initiated immediately. The senior author avoids aggressive passive supination and terminal extension in the first 4 weeks as this may create tissue trauma and promote heterotrophic ossification (HO). Extension blocks and braces are avoided to encourage a full range of motion and so not to
limit range recovery. Loading of the elbow should be avoided during this initial period. Full range should be achieved by 6 weeks and return to all sporting activities at 4 months.

RESULTS

Case 1: Primary Surgery for PLRI

A 24-year-old female student sustained an elbow dislocation while playing netball. Imaging confirmed a posterolateral dislocation with no associated bony injury. This injury was managed nonoperatively. Of note, the patient had suffered a previous ipsilateral distal humeral fracture in childhood.

She presented 2 years later with PLRI. At presentation her QuickDASH score was 47.7, Mayo Elbow performance score of 50, and Oxford elbow score of 27.

Reconstruction of the LUCL was performed using Surgilig and the described technique. A radiograph 2 years post-reconstruction is shown in Figure 7. Her postoperative scores at 1 year were QuickDASH 9.1 score, Mayo Elbow performance score 100, and Oxford elbow score of 45 demonstrating that she had a stable elbow with excellent pain-free function. She returned to full sporting activity at 4 months.

Case Report 2: Revision Procedure for Recurrent Dislocation

A 30-year-old gentleman attended the Emergency Department as a polytrauma haven fallen 60 foot. His injuries included, LC3 pelvic ring fracture, both column acetabular fracture bilateral calcaneal fractures (left compound), right talar fracture, left open fracture dislocation of the elbow, traumatic brain injury, mandibular fracture, bilateral pneumothorax, flail chest, and C1 and C7 fractures.
In relation to his elbow injury this was reduced and immobilized in the emergency department. He had a wound debridement, radial head fixation, and repair of his lateral ulnar collateral ligament using bone anchors the following day. His elbow was screened and stable. Wounds were closed primarily.

He required multiple procedures and a prolonged stay in ICU of over 6 weeks. He eventually had a slow respiratory wean via a trachostomy. On weaning his sedation he had decrease power and sensation in his left arm in particular in the ulnar nerve distribution. Radiographs revealed a recurrent chronic dislocation of the elbow with significant HO (Fig. 8). His elbow was explored and the radial ulnar collateral ligament was repaired using the above Surgilig technique shortly after (Fig. 9).

At 4-month follow-up the patient has bilateral upper and lower limb flexion contractions following his head injury. His ulnar nerve shows signs of recovery with a Tinel sign 20 cm distal to the injury and improving sensation. He has a passive range of movement from 20 to 100 degrees, has full pronation, and 30 degrees loss of supination.

Given the nature of his traumatic brain injury we were unable to score him accurately. The HO around the reconstruction has not worsened, but does contribute to his stiffness and along with his complex rehabilitation needs, limited his ability to regain a full range of movement. He does report a stable and pain-free elbow through which he can weight-bear and rehabilitate.

**DISCUSSION**

LUCL ligament reconstruction using this Surgilig/LockDown technique is indicated in patients with symptomatic PLRI (grades 1 to 3). It can be used as a primary or revision techniques as shown in the 2 cases. PLRI typically presents with clicking, recurrent pain, locking, and functional impairment.

The use of a synthetic ligament graft would be contraindicated in case of insufficient quantity or quality of bone, blood supply limitations, infection (acute or previous), pediatric patients with open physis, advanced osteoarthritis with deformity, and foreign body sensitivity.

Reconstruction of the LUCL has complications such as infection, graft failure/loosening, fracture of the distal humerus, stiffness, and recurrent instability which would be common for an autologous graft or a synthetic graft. Synthetic graft to reconstruct the LUCL could result in a local tissue reaction, bone debris, and osteolysis although this has not been shown to have caused a significant problem when Surgilig has been used to reconstruct the ACJ.

We have found this novel technique to be both safe and effective with a straightforward and reproducible surgical technique. A synthetic ligament graft has a number of potential benefits. It avoids the morbidity, added time, and technical difficulty associated with the harvesting of a ligamentous allograft or the need for more complex tendon routing. The Surgilig/LockDown provides strong biocompatible fixation.
that develops good tissue ingrowth allowing immediate mobilization and early return of function mobilization. The operative technique described allows for a simple method of tensioning the graft interopatively and the excellent immediate bone fixation allows for gentle immediate range of motion to be achieved.

We present our early experience using a synthetic ligament graft (Surgilig) to reconstruct the UCL repair. We have found this technique to be an effective method of LCL repair and restoration of elbow stability. Further follow-up and wider experience of the technique is required to assess its long-term functional outcome in comparison with more established surgical techniques for stabilization of posterolateral elbow instability.

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REFERENCES