

Technical Note

Arthroscopic Intra-articular Disk Excision of the Sternoclavicular Joint

Graham Tytherleigh-Strong, F.R.C.S. (Orth.), F.F.E.S.M. (U.K.),
Abbas Rashid, F.R.C.S. (Tr. & Orth.), Christopher Lawrence, F.R.C.S. (Tr. & Orth.), and
David Morrissey, F.R.C.S. (Tr. & Orth.)

Abstract: The sternoclavicular joint (SCJ) has a complete intra-articular disk that can be damaged either as a result of trauma or as part of ongoing degenerative joint disease. Although often asymptomatic, SCJ disk tears may lead to mechanical symptoms and pain. Previously, isolated symptomatic SCJ disk tears have only occasionally been mentioned in the literature with a few associated case reports of discectomy by open arthrotomy. With improved imaging and availability of magnetic resonance imaging scans and the advent of SCJ arthroscopy it is now possible to treat symptomatic SCJ disk tears by arthroscopic excision. In this Technical Note, we describe the diagnosis of a torn SCJ disk and the technique of arthroscopic excision of a torn SCJ disk.

The sternoclavicular joint (SCJ) is a saddle-shaped diarthrodial joint with a central disk. It is the only true articulation between the upper limb and the axial skeleton. The SCJ is stabilized by a strong and complex soft-tissue envelope including its capsule, multiple ligaments, and surrounding muscle groups.

The SCJ intra-articular disk has been likened to the meniscus in the knee, in that it is vulnerable to damage by shearing forces. Injury to the SCJ in the form of a shearing load in compression, subluxation, or dislocation may lead to associated damage to the intra-articular disk.¹ This may result in acute or chronic ongoing pain and mechanical symptoms.

Because of its central location and strong soft-tissue stabilizers, the SCJ is rarely injured.² However, when injury does occur, associated intra-articular disk damage is common. A study of 41 patients with ongoing joint pain after SCJ injury found that more than 80% had an intra-articular disk injury on magnetic

resonance imaging (MRI).³ The underlying incidence of asymptomatic tears is not known although degenerate tears are commonly associated with SCJ degenerative arthritis.⁴

Until recently the awareness and treatment of SCJ intra-articular disk tears had been limited.^{3,5-7} However, advances in routine computed tomographic (CT) and MRI imaging and the advent of arthroscopic sternoclavicular surgery may allow for easier diagnosis and treatment of symptomatic disk tears.⁸⁻¹⁰

This Technical Note describes the diagnosis and arthroscopic surgical technique for the management of symptomatic SCJ intra-articular disk tears.

History and Diagnosis

Symptomatic SCJ disk problems are rare and maybe the result of a single isolated injury, a repetitive action or associated with degenerative joint disease. Patients may describe a specific incident, such as a cross-body forehand shot or a Vdirect axial load along the line of the clavicle, or a more insidious onset.

It is likely that disk tears occur either as an acute injury in a normal disk or as an acute or chronic injury on a background of degenerative joint disease. As with the menisci in the knee, the age of the patient at the time of injury is likely to be a key determinant.¹¹ A recent study looking at the prevalence of SCJ osteoarthritic change on CT found that no patients under the age of 30 years had any evidence of bony degenerative change, whereas more than 90% of patients over the age of 50 years did.⁴

From Addenbrooke's Hospital, Cambridge University Hospital Trust, Cambridge, United Kingdom.

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Address correspondence to Graham Tytherleigh-Strong, F.R.C.S. (Orth.), F.F.E.S.M. (U.K.), Division of Orthopaedics, Addenbrooke's Hospital, Cambridge University Hospital Trust, Hills Road, Cambridge CB2 2QQ, UK. E-mail: graham.tytherleigh-strong@addenbrookes.nhs.uk

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Patients usually complain of activity-related pain within the SCJ, and in some this may last as constant background ache. Most describe a clicking or grinding sensation within the joint on protraction and retraction of the scapula. Some patients “confuse” this as subluxation or translation of the joint.

On clinical inspection, the affected joint is not usually swollen or inflamed. If it is, particularly in an older patient, then the associated degenerative joint disease should be considered. Anterior joint line discomfort maybe present on palpation. Clicking or crepitus at the SCJ is usually present on protraction and retraction of the scapula. This maybe better appreciated if the examiner places his fingers over the SCJ during movement. Clicking and crepitus may also be present on rotation of the joint. This is best elicited with the patient’s shoulders abducted at 90°, elbows flexed to 90° and initially pointing forward. Dropping the elbows downward into internal rotation and then upward into external rotation will then rotate the medial end of the clavicle on the sternum. The clicking sensation can sometimes be mistaken as anterior joint subluxation (Fig 1).

The only imaging modality to reliably assess the SCJ disk is an MRI scan. Where possible the patient should lie

prone to minimize respiratory artifact. We prefer an oblique coronal proton density sequence with a small field of view to look for tears. This is combined with axial slices to look for any disk extrusion and capsular thickening (Fig 2).

Management

The nonoperative management options for a patient with a symptomatic SCJ disk tear are limited. Aside from activity modification and avoiding precipitating movements, an ultrasound-guided local anesthetic and cortisone injection may help. This may alleviate some of the pain but is often temporary and has no effect on mechanical symptoms.

Surgical management involves excision of the damaged disk. This can be done as an open or arthroscopic procedure. Previous descriptions of the surgical management of an SCJ intra-articular disk tear in the literature are limited.^{7,11} We describe our technique for arthroscopic excision of a torn SCJ disk.

Surgical Anatomy

When considering arthroscopic excision of a damaged SCJ disk, it is important to understand its anatomy and related structures. The intra-articular disk is actually a

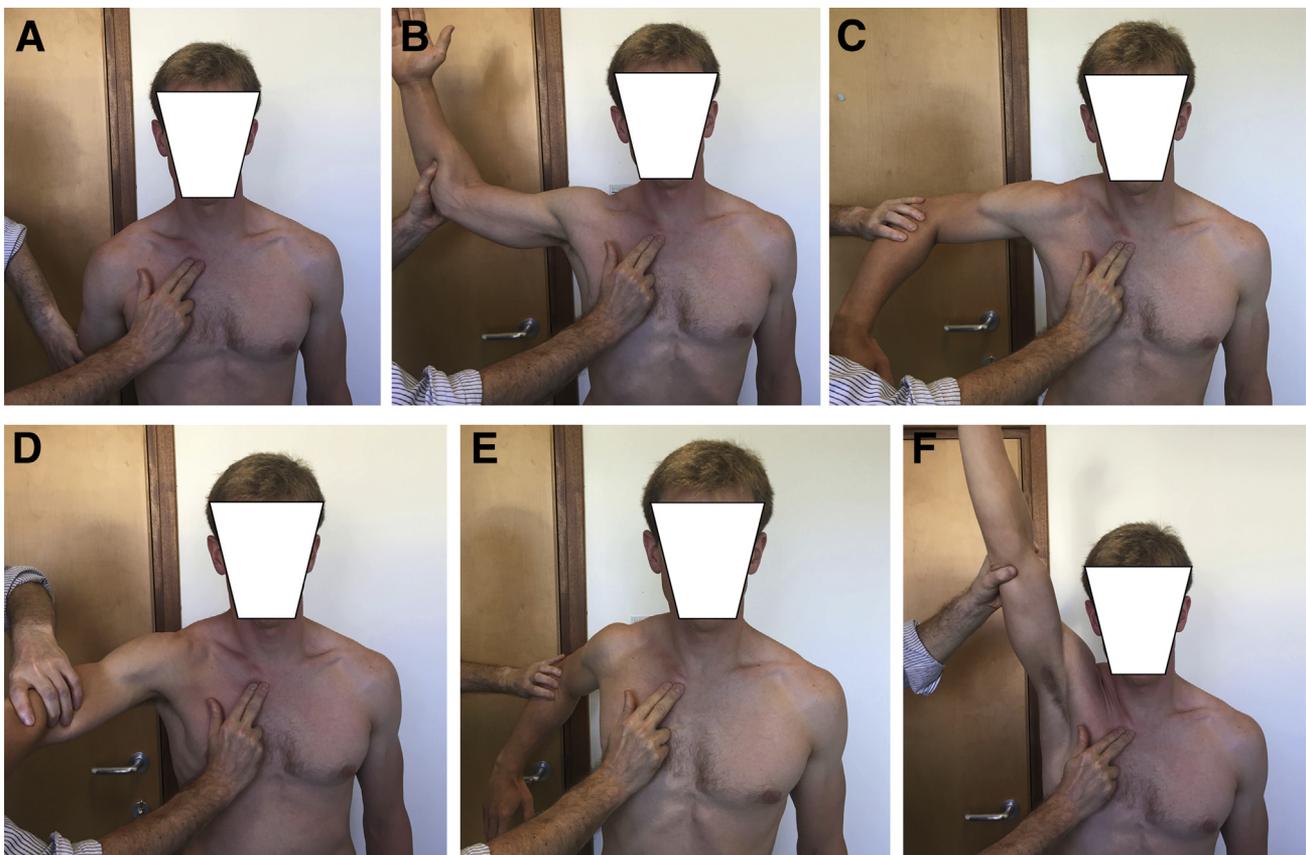


Fig 1. Examination of the sternoclavicular joint. (A) Palpation over the anterior joint line for pain and extruded disk. (B, C) External and internal rotation: with the elbow bent at 90° and the arm at 90° abduction, rotate the arm from external to internal rotation feeling for crepitus. (D, E) Protraction and retraction. (F) Elevation.

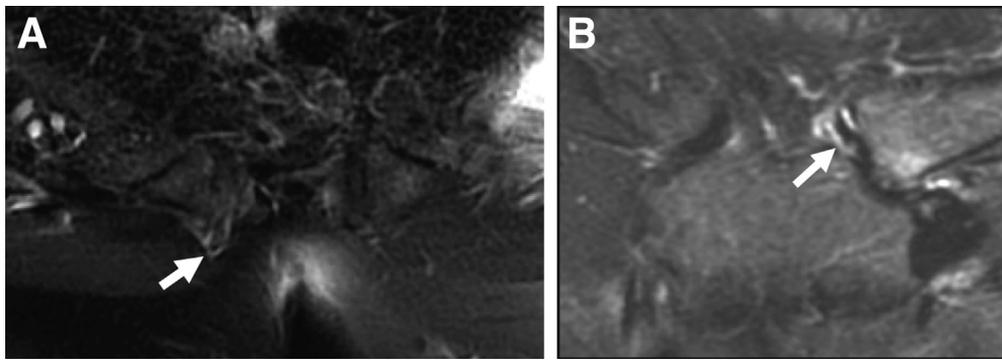


Fig 2. (A) MRI scan (T2 axial) at the mid-level of the SCJs showing a torn disk with anterior extrusion of the right SCJ (white arrow). (B) MRI scan (T2 coronal) of the SCJs showing a torn disk of the left SCJ (white arrow). There is characteristic wavy appearance of the torn disk with an associated effusion. (MRI, magnetic resonance imaging; SCJ, sternoclavicular joint.)

continuation of the intra-articular disk ligament, which arises from the chondral junction of the first rib.^{5,12} The disk divides the SC joint into 2 separate joint spaces. It covers the cartilaginous portion of the medial end of the clavicle and attaches superiorly and posteriorly to the articular cartilage.¹² Peripherally, it attaches to the SC joint capsule reinforcing the anterior and posterior ligaments.

The disk is usually thought to be complete. However, it has been reported that it may be incomplete in some patients, in one series over 50% of the time.¹³⁻¹⁵ Histologically, the intra-articular disk is formed from fibrocartilage and has a similar structure to the menisci in the knee and the acromioclavicular joint.¹⁶

There is a relatively small area of bony congruence at the inferior part of the joint between the sternum and medial end of the clavicle. Whereas the angle of inclination of the medial end clavicle in the axial plane is variable, the angle of inclination of the sternum has been found to be consistently 30° to the vertical.¹⁷

The aim of the arthroscopic procedure is to excise the intra-articular part of the disk leaving an intact, stable circumferential rim.

Surgical Technique

Equipment and Positioning

A standard arthroscopy stack with a pump, powered shavers, and radiofrequency unit is used. Standard 30° and 70° 2.9-mm-diameter arthroscopes (Smith & Nephew, Andover, MA) are used to allow for complete visualization of the SCJ. A minishaver and micro punches and scissors are required to resect the damaged disk. The arthroscopic monitor and stack are positioned at the head end of the bed (Fig 3). The operating surgeon stands at the side on the patient's affected side facing the monitor. The assistant stands on the opposite side.

The patient is positioned supine with a sandbag positioned between his scapulae. This allows for increased retraction of the scapulae, opening up the SCJ

anteriorly. The patient is intubated with his head on a head ring in slight extension. The anesthetic tubes pass superiorly over the patient's head.

Portal Placement

The SCJ and bony contours are palpated and a surgical marker is used to outline the medial end of the clavicle, the sternum, and sternal notch. The anterior sternoclavicular ligament, the small area of bony congruence, and the inclination of the sternal side of the SCJ are taken into consideration.^{9,17}

The bony contours of the joint are palpated and an initial inferior portal is positioned approximately 1 cm directly inferior to the joint line. An 18-gauge spinal needle is inserted and angled at 30° cephalad to the horizontal plane and 30° lateral to the midline to take into the inclination of the sternal side of the joint. An 8-mm longitudinal stab incision is made in the skin and a blunt trocar inserted. A distinct "pop" is felt as the trocar penetrates the capsule and the joint is entered. As a general rule, the trocar usually enters the sternal side of the joint on insertion. Having established an inferior

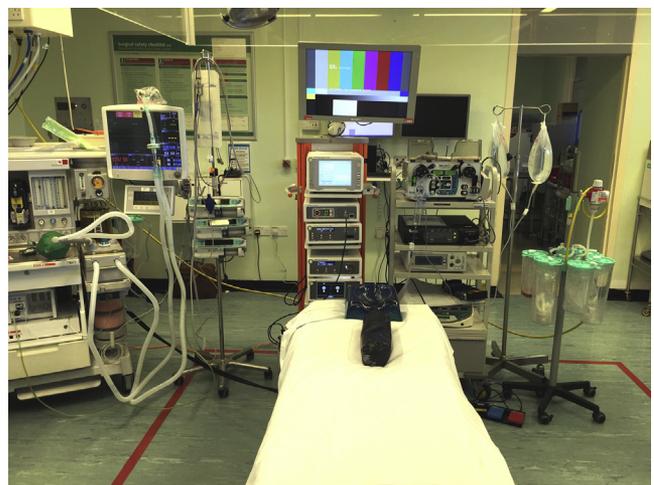


Fig 3. Theatre set-up with stack and equipment at the head end of the bed. A head ring a sandbag between the scapulae are used to position the patient.

viewing portal and assessed the joint a superior working portal is created. The spinal needle is then inserted with a 10-mm skin bridge superiorly, to protect the anterior SCJ ligament, and visualized as it enters the joint. The superior working portal is then created by an outside-to-inside technique (Fig 4).

Diagnostic Arthroscopy

Having created both portals a diagnostic arthroscopy is undertaken using a probe. Initially the posterior capsule is identified and then the scope rotated inferiorly to visualize the inferior capsule and joint. Rotating the scope medially allows for the sternal articular surface to be assessed. Rotating the scope laterally reveals the disk. Because of its strong attachments superiorly and anteriorly, degenerate disk tears are usually torn from the posterior and inferior capsular attachments. Acute tears tend to occur within the central part of the disk with the capsular attachments remaining intact. The disk tear can then be probed. In the case of a degenerate tear, it is sometimes possible to reflect the posterior torn edge of the disk to reveal the clavicular articular surface. With an acute tear it is sometimes possible to view the clavicle through the central tear (Fig 5). However, it is often only possible to view the medial end of the clavicle in its entirety once the disk has been resected.

Because arthroscopic access to the SCJ is restricted to 2 anterior portals, the angle of attack for resection of the damaged disk is limited. As a result resection often requires a combination of a punch, shaver, and a radiofrequency probe to remove the disk piecemeal back to a stable rim. On occasion swapping the scope into the superior portal and the instrument into the inferior portal can improve access.

In the case of a degenerate tear, resection of the disk can begin at its posterior free edge. The disk is generally detached from the posterior and inferior part of the capsule. Usually a combination of a punch and a shaver is able to resect the bulk of this disk volume working anteriorly and superiorly. It is often difficult to access the more superior and anterior part of the disk with standard instruments,

but we have found that a 90° radiofrequency probe angled backward is able to comfortably ablate the rest of the disk back to a stable anterior and superior rim.

Acute tears tend to occur in the center of the disk with the circumferential capsular attachments maintained. Starting with a combination of a punch and shaver, the central part of the disk is excised back toward its rim, circumferentially. Again the 90° radiofrequency probe can then be used to ablate the remnants of the disk, particularly the anterior part, back to a stable rim.

Having resected the damaged disk the joint should be assessed again, particularly noting the state of the articular cartilage on the medial clavicle. Occasionally, in older patients with degenerate tears, we have noted that the medial end of the clavicle has advanced grade 4 degenerative changes, more so than was suggested on the preoperative imaging. We discuss this possibility with patients before surgery and consent them for an additional excision of the medial end of the clavicle, if deemed necessary. We subsequently go on to do this in a couple of cases.

Once the resection has been completed and hemostasis achieved, the instruments are removed from the joint and the portal wounds closed with sutures. The shoulder does not need to be immobilized postoperatively, and the patient can usually be discharged to home on that day.

Diskectomy

Video 1 shows the external view of the inferior and superior SCJ portals being established and the insertion of the scope and instruments. An arthroscopic excision of a degenerate disk tear of a right SCJ is followed by an excision of an acute disk tear of a left SCJ.

Postoperative Rehabilitation

The patient does not need a sling and is encouraged to use his shoulder and arm as much as comfort permits immediately after surgery. At approximately 1 week, the patient can begin active mobilization exercises under the supervision of a physiotherapist. Most patients should expect to be able to return to their normal

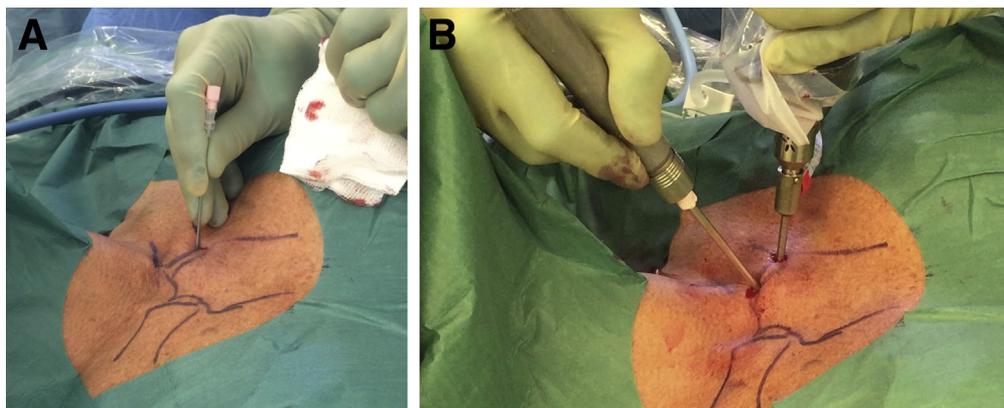


Fig 4. (A) Bony landmarks drawn out and the spinal needle inserted into the inferior joint at 30° to the vertical. (B) The arthroscope is positioned in the inferior portal with the shaver in the superior portal.

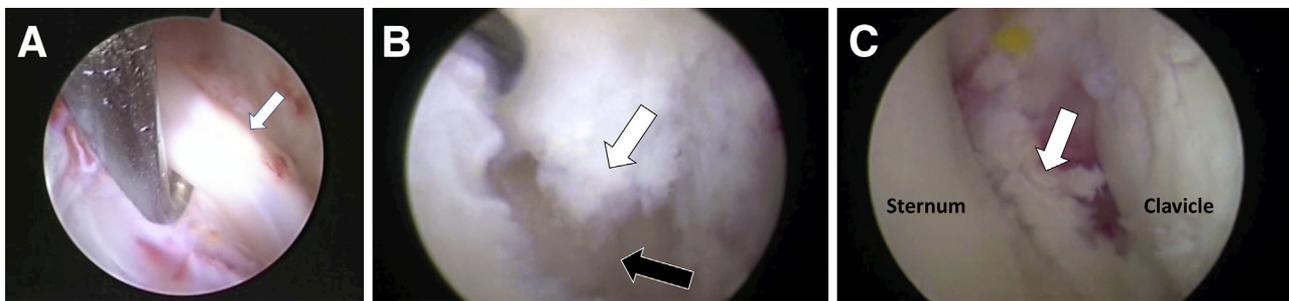


Fig 5. (A) Arthroscopic view of the right sternoclavicular joint (SCJ) showing the rolled edge of a degenerate disk tear (white arrow). The arthroscope is in the inferior portal and the probe is in the superior portal. (B) Arthroscopic view of the left SCJ showing an acute central disk tear (white arrow). The arthroscope is in the inferior portal and the probe is in the superior portal. The sternal articular surface can be seen through the center of the tear (black arrow). (C) Arthroscopic view of the same left SCJ after resection of the torn disk back to a stable rim (white arrow). The well-preserved articular surfaces on the sternal and clavicular sides of the joint are noted.

activities of daily living, including driving, within 2 to 4 weeks of surgery.

Pearls and Pitfalls

Table 1 lists some of the pearls and pitfalls in the diagnosis of SCJ disk tears, the operating theatre set-up, and some technical aspects for performing an SCJ arthroscopy.

Advantages and Disadvantages

Table 2 lists some of the advantages and disadvantages of undertaking an ACJ disk excision using an arthroscopic technique when compared with an open technique.

Discussion

Although SCJ degenerative disk tears are commonly associated with SCJ osteoarthritis and intra-articular disk damage is thought to often occur after SCJ injury, the contribution of disk damage to ongoing SCJ pain and symptoms has probably been underestimated.^{3,4} Previous descriptions in the literature of SCJ disk excision are limited.^{1,5,6}

A case report by Duggan⁶ in 1931 describes the finding of a damaged disk that herniated through a tear in the anterior SCJ capsule. The patient's symptoms settled after excision of the disk and repair of the

Table 1. Pearls and Pitfalls of Undertaking an Arthroscopic Sternoclavicular Discectomy

	Pearls	Pitfalls
Preoperative assessment	Crepitus on internal and external rotation of the SCJ	Usually no swelling Crepitus mistaken for subluxation
Preoperative imaging	MRI scan is the only reliable diagnostic investigation	Degenerate disk tears are almost always present with osteoarthritis and may not be the cause of the symptoms
Theatre set-up	Position the stack and all arthroscopic equipment at the head end of the bed Place a sandbag between the patient's scapulae with the head extended in a head ring	Nonergonomic positioning of the monitor and equipment Insufficient retraction of the patient's SCJ and extension of the patient's neck
Portal placement	Draw out bony landmarks of the sternum and medial end of the clavicle Use a spinal needle angled at 30° angulation and inject saline looking for a flashback, before inserting the cannula	The inferior recess of the SCJ is lower than the palpable medial end of the clavicle It is easy for the trocar to be deflected inferior to the SCJ if inserted incorrectly
Intraoperative technique	Assess which side of the disk the scope is in (clavicular/sternal side) Retract the torn edge of the disk to reveal the articular cartilage Disk can be resected piece-meal back to a stable rim using a combination of a punch, shaver, and radiofrequency probe	Do not confuse the disk for the articular surface Resect sufficient disk to obtain a stable circumferential rim
Postoperative rehabilitation	Allow for immediate immobilization with no restrictions on function	Do not immobilize the shoulder for any significant length of time to avoid stiffness

MRI, magnetic resonance imaging; SCJ, sternoclavicular joint.

Table 2. The Advantages and Disadvantages of an Arthroscopic Excision Compared With an Open Excision of a Torn Intra-articular Disk

	Arthroscopic Excision	Open Excision
Equipment	<i>Advantage:</i> miniscope, instruments, shaver and radiofrequency probe able to precisely excise the disk <i>Disadvantage:</i> initial capital outlay and ongoing consumable costs	<i>Advantage:</i> standard orthopaedic and surgical instruments <i>Disadvantage:</i> instruments insufficiently precise to excise the torn disk without collateral articular cartilage damage
Visualization and access	<i>Advantage:</i> visualization of the whole joint and torn disk with easy access to the whole joint <i>Disadvantage:</i> no extra-articular visualization or ability to assess and address any preoperative joint instability	<i>Advantage:</i> extra-articular visualization and ability to assess and address any preexisting joint instability <i>Disadvantage:</i> poor visualization of the posterior joint and difficult surgical access
Postoperative period	<i>Advantage:</i> day-case procedure, no sling, immediate mobilization, minimal incision scar <i>Disadvantage:</i> none	<i>Advantage:</i> none <i>Disadvantage:</i> in-patient procedure, sling required, 4-6 wk of immobilization, prominent incision scar
Risks and complications	<i>Advantage:</i> minimal risk to joint stability, minimal risk to posterior vascular structures, minimal risk of infection	<i>Advantage:</i> none <i>Disadvantage:</i> potential risk of joint instability, potential risk of infection
Surgeon requirements	<i>Advantage:</i> none <i>Disadvantage:</i> advanced arthroscopic experience, high volume SCJ practice	<i>Advantage:</i> competent and experienced upper limb surgeon <i>Disadvantage:</i> none

SCJ, sternoclavicular joint.

capsule. In 2010, Delos et al.⁵ reported on 2 cases of disk tears diagnosed by CT and MRI who underwent successful open “meniscectomy” and capsular repair. After surgery the patients required 6 weeks of immobilization in a sling. The senior author (G.T-S.) published a case report of 2 patients with acute disk tears in 2013. They underwent an arthroscopic SCJ discectomy using the technique described in this Technical Note. Postoperatively they were able to mobilize straight away with relief of their symptoms that had been maintained at follow-up over 2 years later.¹ Arthroscopic excision of the SCJ has been reported by a number of authors with no reported complications and no cases of instability.^{8,10,18}

Arthroscopic intra-articular disk excision of the SCJ is a safe and reproducible procedure. It has the advantage over an open procedure of not having to undertake a formal capsulotomy with the required capsular repair, subsequent period of immobilization, and risk of potential instability. However, arthroscopy of the SCJ is an uncommon procedure and should not be performed by an occasional surgeon. As a general rule, SCJ arthroscopy should only be performed in centers with a high volume of SCJ referrals and by surgeons with a familiarity and experience of all types of SCJ surgery.

References

1. Tytherleigh-Strong GM, Getgood A, Griffiths DJ. Arthroscopic intra-articular disk excision of the sternoclavicular joint. *Am J Sports Med* 2012;40:1172-1175.
2. Rockwood CA Jr, Wirth M. Disorders of the sternoclavicular joint. In: Rockwood Jr CA, Matsen F, eds. *The shoulder*. Philadelphia, PA: Saunders, 1998;555-610.
3. Benitez CL, Mintz DN, Potter HG. MR imaging of the sternoclavicular joint following trauma. *Clin Imaging* 2004;28:59-63.
4. Lawrence CR, East B, Rashid A, Tytherleigh-Strong GM. The prevalence of osteoarthritis of the sternoclavicular joint on computed tomography. *J Shoulder Elbow Surg* 2017;26:e18-e22.
5. Delos D, Shindle MK, Mintz DN, Warren RF. Meniscectomy of the sternoclavicular joint: A report of two cases. *J Shoulder Elbow Surg* 2010;19:e9-e12.
6. Duggan N. Recurrent dislocation of the sternoclavicular joint cartilage. *J Bone Joint Surg* 1931;13:365.
7. Emberg LA, Potter HG. Radiographic evaluation of the acromioclavicular and sternoclavicular joints. *Clin Sports Med* 2003;22:255-275.
8. Tavakkolizadeh A, Hales PF, Janes GC. Arthroscopic excision of the sternoclavicular joint. *Knee Surg Sports Traumatol Arthrosc* 2009;17:405-408.
9. Tytherleigh-Strong GM. Arthroscopy of the sternoclavicular joint. *Arthrosc Tech* 2013;2:e1-e5.
10. Warth RJ, Lee JT, Campbell KJ, Millett PJ. Arthroscopic sternoclavicular joint resection arthroplasty: A technical note and illustrated case report. *Arthrosc Tech* 2014;3:e165-e173.

11. Brinker MR, Bartz RL, Reardon PR, Reardon MJ. A method for open reduction and internal fixation of the unstable posterior sternoclavicular dislocation. *J Orthop Trauma* 2007;11:378-381.
12. Warth RJ, Campbell KJ, Michalski MP, et al. Surgical anatomy of the sternoclavicular joint. A qualitative and quantitative anatomical study. *J Bone Joint Am* 2014;96:e166.
13. De Palma AF. Surgical anatomy of acromioclavicular and sternoclavicular joints. *Surg Clin North Am* 1963;43:1541-1550.
14. Renfree KJ, Wright KJ. Anatomy and biomechanics of the acromioclavicular and sternoclavicular joint. *Clin Sports Med* 2003;22:219-237.
15. Emura K, Arakawa T, Terashima T, Miki A. Macroscopic and histological observations on the human sternoclavicular joint disc. *Anat Sci Int* 2009;84:182-188.
16. Barbaix E, Lapierre M, Van Roy P, Claris JP. The sternoclavicular joint: Variants of the discus articularis. *Clin Biochem (Bristol, Avon)* 2000;15:S3-S7 (suppl 1).
17. Wijeratna MD, Turmezei TD, Tytherleigh-Stron GM. Novel assessment of the sternoclavicular joint with computed tomography for planning interventional approach. *Skeletal Radiol* 2013;42:473-478.
18. Tytherleigh-Strong G, Griffith D. Arthroscopic excision of the sternoclavicular joint for the treatment of sternoclavicular osteoarthritis. *Arthroscopy* 2013;29:1478-1491.

Video 1. Arthroscopic intra-articular disk excision of the sternoclavicular joint (SCJ). The video shows the external view of the inferior and superior SCJ portals being established and the insertion of the scope and instruments. An arthroscopic excision of a degenerate disk tear of a right SCJ is followed by an excision of an acute disk tear of a left SCJ.