Technical Note

In-Office Needle Arthroscopy for Superior Labral Tear Debridement

Babatunde Fariyike, M.D., William H. E. Neal, M.D., Andrew S. Bi, M.D., Stephane Owusu-Sarpong, M.D., Christopher A. Colasanti, M.D., Noah Kirschner, M.D., Mohammad T. Azam, B.S., James J. Butler, M.B., B.Ch., James W. Stone, M.D., and John G. Kennedy, M.D., M.Ch., M.M.Sc., F.F.S.E.M., F.R.C.S.(Orth)

Abstract: SLAP tears are a common cause of shoulder pain in overhead athletes. The benefits of in-office nano-arthroscopy include the ability to diagnosis and treat biceps tendinopathy, quicker patient recovery, reduced health care costs, and improved patient satisfaction. This technique can be particularly advantageous in the management of SLAP tears given that magnetic resonance imaging has poor sensitivity without the use of an invasive arthrogram. The purpose of this technical report is to describe our technique for performing in-office nano-arthroscopy for SLAP tears with special consideration of the technique for obtaining adequate local anesthesia, proper indications, and adequate visualization, as well as the advantages of performing these procedures in the office rather than the operating room.

SLAP tears are entities commonly seen in overhead athletes that may impair shoulder function.[1] If nonoperative measures including rest, anti-inflammatory medications, physical therapy, and corticosteroid injections fail to relieve symptoms, then SLAP repair, SLAP debridement, and biceps tenotomy are surgical treatment options for relief of the pathology.[2] In young patients, SLAP repair has been a successful option; however, in the middle-aged and older population, the results are worse, with higher revision rates.[3] This population is better served with SLAP debridement with biceps tenotomy or tenodesis. Snyder et al.[4] divided SLAP lesions into 4 distinct types depending on the extent of the labral lesion and the stability of the biceps anchor (Table 1). This classification was later expanded by Maffet et al.[5] with an additional 3 types and by Modarresi et al.,[6] who expanded it to 10 types total. Type I and III lesions are best treated with debridement with possible labral repair, whereas type II and IV lesions are generally treated by SLAP repair versus biceps tenotomy or tenodesis depending on the degree of degeneration of the biceps tendon anchor.[7] Recently, advances with in-office nano-arthroscopy (IONA) have allowed for awake arthroscopic procedures in the office setting without the need for either an operating room, nerve blocks, or general anesthesia.[8-15] Not only has this resulted in high patient satisfaction, but there has also been a high rate of return to work and sport.[10]

Improving on previous IONA designs, the needle arthroscopy system uses an optic chip at the camera tip and no inner rod lenses, providing image quality that is similar to conventional arthroscopy. This 1.9-mm arthroscope allows for a semi-rigid, durable combination of arthroscope and cannula that has the ability to visualize into the glenohumeral joint and perform procedures with the patient under a local anesthetic in an office or bedside setting. This IONA technology includes various burrs, punches, graspers, scissors, probes, shavers, and resectors that permit direct treatment of identified pathology. The purpose of this technical report is to describe a reproducible and effective method for using IONA for the treatment of SLAP tears with special consideration of the technique for obtaining adequate local anesthesia, proper indications, and

From NYU Langone Health, NYU Langone Orthopedic Hospital, New York, New York, U.S.A. (B.F., W.H.E.N., A.S.B., S.O-S., C.A.C., N.K., M.T.A., J.J.B., J.G.K.); and Medical College of Wisconsin, Milwaukee, Wisconsin, U.S.A. (J.W.S.).

Received February 6, 2023; accepted January 15, 2024.

Address correspondence to John G. Kennedy, M.D., M.Ch., M.M.Sc., F.F.S.E.M., F.R.C.S.(Orth), NYU Langone Health, NYU Langone Orthopedic Hospital, 171 Delancey St, Ste 259, New York, NY 10002, U.S.A. E-mail: john.kennedy@nyulangone.org

2212-6287/23181
https://doi.org/10.1016/j.eats.2024.102956

Table 1. SLAP Tear Classification as Described by Snyder et al.[4]

Type	Description
I	Frayed and degenerated superior labrum with no biceps tendon detachment
II	Detachment of superior labrum and biceps tendon from glenoid rim
III	Bucket-handle tear of superior labrum, labral tissue remains anchored to glenoid rim including biceps tendon anchor
IV	Extension of bucket-handle superior labral tear involving biceps anchor

adequate visualization, as well as the advantages of performing these procedures in the office rather than the operating room (Video 1). Indications and contraindications of this procedure can be found in Tables 2 and 3. Additionally, a step-by-step guide can be found in Table 4.

Surgical Technique

Preoperative Planning and Positioning

The patient is positioned comfortably in a sitting position on an examination table with the posterior, lateral, and anterior aspects of the shoulder exposed and clear from any obstruction (Fig 1). The arm can be supported with a rest in approximately 30° of forward flexion. It is paramount that the patient remains relaxed to ensure the rotator cuff muscles do not prevent entry into the glenohumeral joint. Standard arthroscopic landmarks are marked on the skin, including the anterior, lateral, and posterolateral borders of the acromion; the anterior and posterior borders of the clavicle; the acromioclavicular joint; the coracoid process; and standard posterior and anterior arthroscopic portal sites (Fig 2). Owing to the 0° view a needle arthroscope provides, the posterior portal may need to be placed more laterally and proximally for better visualization of the posterior labrum. An additional lateral portal may be needed to further visualize the labrum and any rotator cuff pathology. A cannula can also be passed through the supraspinatus for further visualization of the superior labrum. Prior to the procedure, all portal sites are infiltrated with 20 mL of 1% lidocaine (10 mL in each). An additional 20-mL mixture of 1% lidocaine and 0.5% ropivacaine at a 1:1 ratio is injected into the shoulder joint through the posterior portal after 10 minutes to confirm the correct portal position and to achieve additional anesthesia. In the case of subacromial impingement and the need for arthroscopic debridement, the subacromial space is also infiltrated with an additional 10 mL of lidocaine with epinephrine and ropivacaine at a 1:1 ratio. The surgeon and any assistants then prepare and drape the extremity using sterile technique, and a pre-procedure timeout is performed while visualizing the surgeon's initials on the affected extremity, confirming the correct side.

Table 2. Advantages and Disadvantages of Proposed Technique

Advantages
Reduced operating room utilization and avoidance of anesthesia complications
Potential for true patient-physician education and shared decision making
Potential for improved patient satisfaction, with real-time assessment of pathology
Improved ability to diagnose anatomic variants compared with MRI
Reduced cost and resource utilization
Less swelling and pain, as well as faster recovery
Disadvantages
Potential for patient pain or discomfort
Learning curve with presence of wide-awake patient and use of 0° camera

MRI, magnetic resonance imaging.

Table 3. Pearls and Pitfalls of Proposed Technique

Pearls
Patient selection is critical
At least 10 min between portal and intra-articular local anesthetic injection and procedure
Familiarity of office staff with room setup, instrument turnover, and workflow
Thorough pre-procedure discussion with patient regarding mental readiness and expectations for wide-awake procedure
Use of 5 mL of epinephrine in 1 L of normal saline solution for hemostasis and visualization
Pitfalls
Failure to provide adequate pre-procedural local anesthesia or adequate time for anesthesia to take effect
Improper placement of trocar, leading to articular cartilage damage
Poor indications of patients with excessive expectations
Inadequate time between local anesthetic administration and procedure
Poor portal placement given 0° needle scope

Portal Placement

By use of a No. 11 blade, a posterior arthroscopic portal is made (Fig 3). A 2-mm stab incision is made using just the width of the blade, pointing toward the coracoid process and the glenohumeral joint. Care is taken not to incise the deltoid fibers because this will lead to bleeding, which will hinder visualization. If there is a suspected rotator cuff tear, it is again often beneficial to place the posterior portal incision slightly lateral and proximal to the soft spot to allow better visualization of the rotator cuff and subacromial bursa.

Operative Technique

A 2.2-mm cannula is inserted into the glenohumeral joint through the posterior portal, and the blunt trocar

Table 4. Step-by-Step Guide to Performing Proposed Technique

Step 1: The patient should be positioned while comfortably seated on an examination table, with the back of the bed set to approximately 70° to 80°; the ipsilateral shoulder is positioned so that the posterior, lateral, and anterior aspects of the shoulder are unobstructed (Fig 1).
Step 2: The ipsilateral arm should be supported on a padded Mayo stand in slight forward flexion and abduction to allow for optimum entry in the glenohumeral joint. The relevant surface anatomy and anticipated portals, including the anterior, posterior, and lateral portals, are marked (Fig 2).
Step 3: Prior to the procedure, the planned arthroscopy portal sites are injected with 5 mL of a 1:1 ratio of 0.5% bupivicaine and 1% lidocaine with epinephrine. After 5-10 min, another 20 mL of lidocaine with epinephrine and ropivacaine at a 1:1 ratio is used to infiltrate the joint one more time and establish that the portals can adequately gain access to the joint.
Step 4: A standard posterior arthroscopy portal is made using a No. 11 blade. A small 2-mm stab incision is made (Fig 3).
Step 5: Under direct visualization, the anterosuperior portal is established by passing a spinal needle just inferior to the biceps tendon in the rotator interval. By use of an 18-gauge spinal needle, a diagnostic arthroscopy is performed, viewing the rotator interval, biceps tendon, and superior labrum; the superior, middle, and inferior glenohumeral ligaments and subscapularis; the anterior, anteroinferior, posterior, and posterosuperior labra; the rotator cuff and its insertion; and the articular surface (Fig 4).
Step 6: Once it is confirmed that the anterosuperior portal site (working portal) is adequate, a small 2-mm stab incision is made. A probe is used to assess for signs of inflammation or degeneration of the biceps tendon (Fig 4D). Additionally, the integrity and stability of the labrum are assessed by the probe.
Step 6: The SLAP tear is identified and debrided with a 2.0-mm shaver until there are stable flaps (Fig 5).
Step 7: Wound closure strips and soft dressing are applied as indicated.

is exchanged for a 1.9-mm 0° viewing needle arthroscope (NanoScope; Arthrex, Naples, FL). The cannula is then connected to the integrated inflow and outflow fluid management system (DualWave; Arthrex). In the experience of the senior author (J.G.K.), visualization is best obtained at a pressure of 35 mm Hg. The fluid inflow consists of 0.9% normal saline solution mixed with 5 mL of epinephrine. We have found that adding epinephrine diminishes intraoperative bleeding. A diagnostic arthroscopy is then performed, viewing the rotator interval, biceps tendon, and superior labrum; the superior, middle, and inferior glenohumeral ligaments and subscapularis; the anterior, anteroinferior, posterior, and posterosuperior labra; the rotator cuff and its insertion; and the articular surface (Fig 4). Once diagnostic arthroscopy is completed, the anterior portal is made under direct visualization by use of a spinal needle to ensure needle passage just inferior to the biceps tendon in the rotator interval. A 2-mm stab incision is used, without undercutting the capsule or blunt spreading. Through the anterior portal, a probe is used to assess for signs of inflammation or degeneration of the biceps tendon (Fig 4D). Additionally, the integrity and stability of the labrum are assessed by the probe. The probe is then exchanged for a 2.0-mm shaver that is used to debride the superior labrum until it is returned to a stable margin (Fig 5). A NanoGrasper (Arthrex) can also be used to remove any loose bodies. If there is a significant tear or compromise of the biceps tendon anchor and the patient is a poor candidate for isolated SLAP debridement or repair, biceps tenotomy can be performed using a 2-mm NanoBiter (Arthrex), ensuring that the biter is perpendicular to the tendon. After completion of the procedure, the portals can be sealed primarily using adhesive wound closure strips (Steri-Strip; 3M, Saint Paul, MN) or with simple nylon sutures if the surgeon believes they are necessary. A dry, sterile dressing is applied that facilitates early shoulder range of motion.

Fig 1. Standard shoulder setup for in-office nano-arthroscopy. The patient is comfortably seated with the back of the examination table positioned at approximately 70° to 80° of inclination to mimic the beach-chair position. The ipsilateral shoulder (right) is positioned so that the posterior, lateral, and anterior aspects of the shoulder are unobstructed. The arm of the operative shoulder is resting on a well-padded Mayo stand and is positioned in slight forward flexion and abduction in an effort to help facilitate ease of entry into the glenohumeral joint.

Postoperative Protocol

Postoperatively, patients are allowed to actively mobilize the shoulder as tolerated; they are encouraged to actively range the wrist and fingers and to supinate and pronate the forearm postoperatively as well. Patients are also encouraged to apply ice and use a sling for comfort for the first 24 to 72 hours. After returning

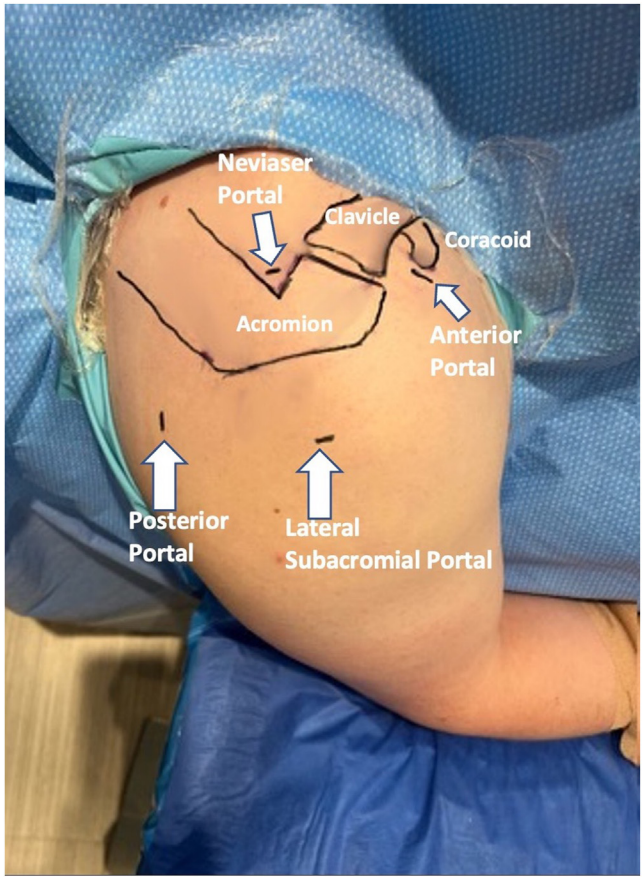

Fig 2. The patient is comfortably seated with the back of the examination table positioned at approximately 70° to 80° of inclination to mimic the beach-chair position. Via sterile technique, a mixture of chlorhexidine gluconate with isopropyl alcohol is used to prepare the patient's right shoulder, which is subsequently draped. Standard portal sites are marked with respect to relevant surface anatomy markings, which include the clavicle, acromion, and coracoid. The posterior portal, which is the primary viewing portal, is made approximately 2 cm inferior and 2 cm medial to the posterolateral border of the acromion. The anterior (working) portal is made 1 cm lateral to the coracoid process.

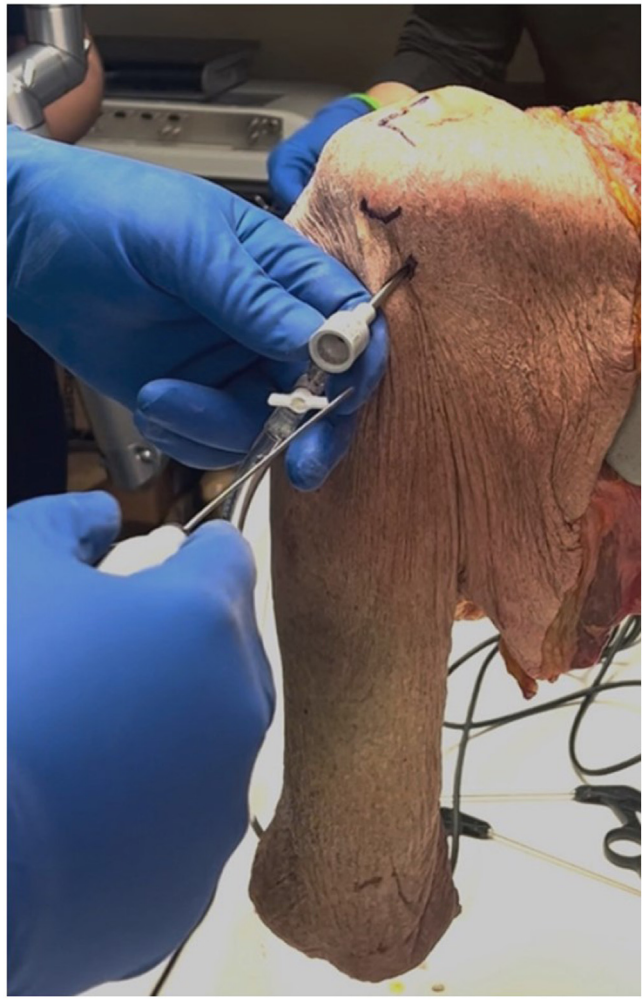

Fig 3. A 2.2-mm cannula is inserted into the left glenohumeral joint through the posterior portal in a cadaveric specimen. The blunt trocar will subsequently be exchanged for a 1.9-mm 0° viewing needle arthroscope.

for a wound check on post-procedure day 5, patients begin formal physical therapy. Acetaminophen and anti-inflammatories are sufficient for postoperative pain control.

Discussion

This technique shows that with improved technology and with advancement of needle arthroscopy technique, physicians can now use local anesthesia in the outpatient setting to perform diagnostic and arthroscopic surgical procedures. This simple technique has proved effective at allowing the senior author to perform in-office debridement of SLAP tears in a safe and reproducible manner. Our patients have also expressed gratification that they are able to visualize the treatment of their pathology while remaining awake and comfortable.[11]

With the evolving capability of needle arthroscopy, a number of techniques have been reported. Peach et al.[16] have recently shown the functionality and versatility of nano-arthroscopy in the operating room in a wide-awake patient undergoing biceps tenotomy. McMillan et al.[17] have also performed a number of procedures in both the knee and shoulder. Needle arthroscopy can be particularly advantageous in the diagnosis of SLAP tears. Bhatnagar et al.[18] showed that magnetic resonance imaging had a sensitivity as low as 15% in the diagnosis of SLAP tears. With the advancement of nano-arthroscopy, suspected SLAP tears can be reliably diagnosed in a timely manner. We have witnessed that these procedures can also be performed in the office, resulting in faster diagnosis, better patient satisfaction, decreased patient morbidity

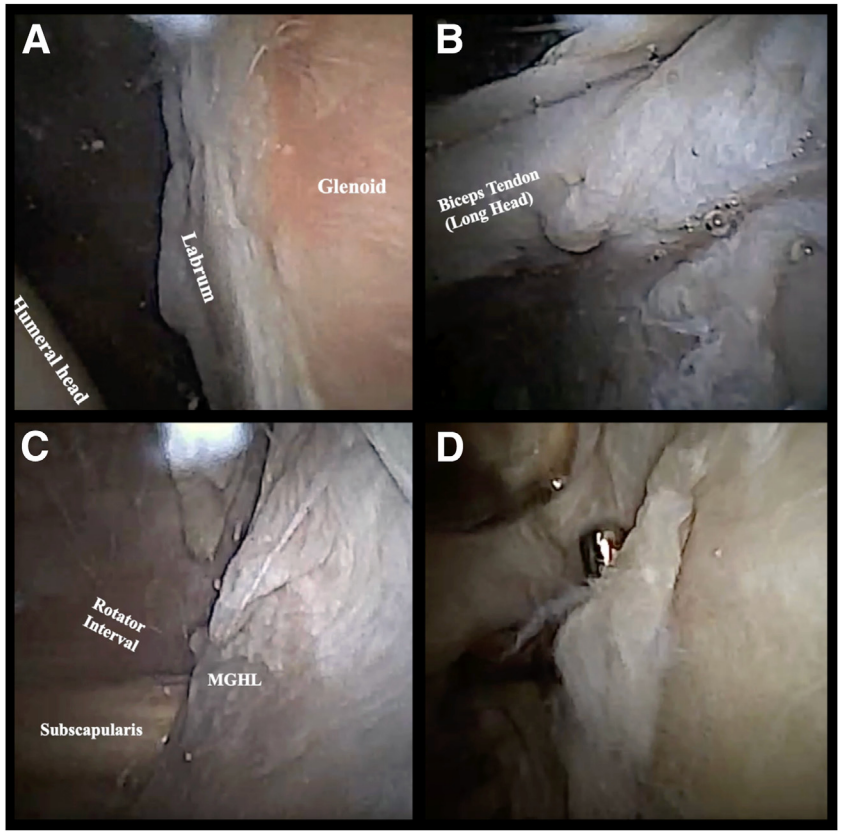

Fig 4. (A) Arthroscopic view of left shoulder through posterior portal. The 1.9-mm arthroscope is used to visualize the ipsilateral glenoid, labrum, and humeral head. (B) Arthroscopic view of left shoulder through posterior portal. The 1.9-mm arthroscope is used to visualize the long head of the biceps at its insertion. (C) Arthroscopic view of left shoulder through posterior portal. The 1.9-mm arthroscope is used to visualize the subscapularis, rotator interval, and middle glenohumeral ligament (MGHL). (D) Arthroscopic view of left shoulder through anterior portal. Initially, a spinal needle is used to ensure correct passage just inferior to the biceps tendon in the rotator interval. A 2-mm stab incision is used, without undercutting the capsule or blunt spreading. Through the anterior portal, a probe is used to assess for signs of inflammation or degeneration of the biceps tendon. Additionally, the integrity and stability of the labrum are assessed by the probe.

and complications, and a high rate of return to work and sport when used in the appropriate setting.

Patient-reported outcomes after IONA have been promising in the recent literature. In a study performed by Colasanti et al.,[11] 84% of patients achieved the minimal clinically important difference in the Foot and Ankle Outcome Score (FAOS) for pain; 77%, FAOS for symptoms; 75%, FAOS for quality of life; 74%, FAOS for sports activities; 65%, Patient-Reported Outcomes Measurement Information System (PROMIS) Pain

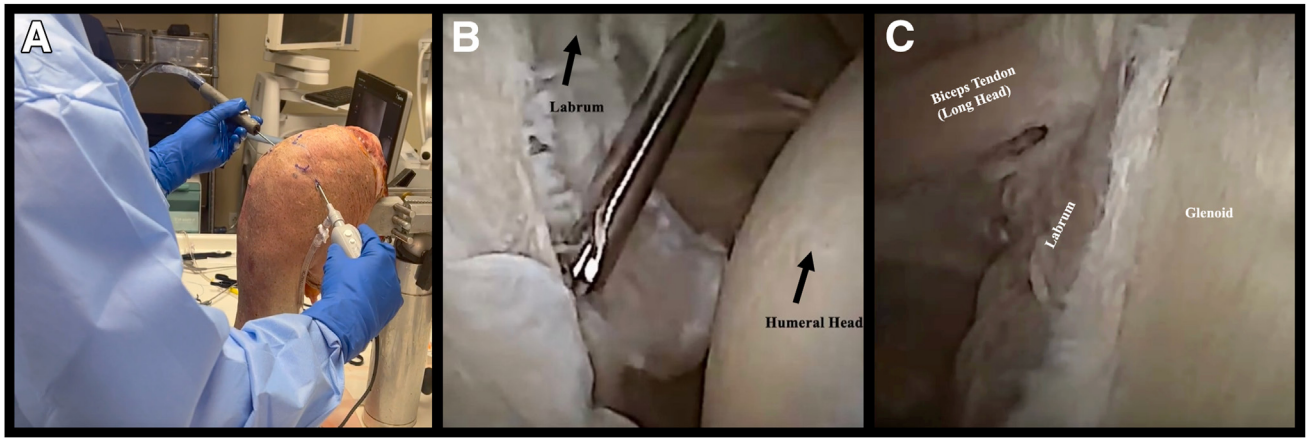

Fig 5. (A) A 1.9-mm arthroscope is inserted into the posterior portal; in addition, a 2.0-mm shaver is inserted into the anterior portal. (B) Arthroscopic view of left shoulder through posterior portal. The 1.9-mm arthroscope is used to visualize the SLAP tear. The 2.0-mm shaver is inserted into the anterior portal and is used to debride the SLAP tear until there is a stable margin. (C) Arthroscopic view of left shoulder through posterior portal. The previous SLAP tear has been successfully debrided using the 2.0-mm shaver. The portals can be sealed primarily using adhesive wound closure strips or with simple nylon sutures if the surgeon believes they are necessary. A dry, sterile dressing is applied that facilitates early shoulder range of motion.

Interference score; and 61%, FAOS for activities of daily living. Additionally, Mercer et al.[19] performed IONA for the treatment of posterior ankle impingement and found improvements in the FAOS values for symptoms, pain, activities of daily living, and sports activities. Of the 7 patients who participated in sports prior to the procedure, all were able to return to play at a median time of 4.1 weeks, with a median return to work at 4 days. When rating their overall experience, the patients reported a mean rating scale score of 9.5 ± 1.5. Nano-arthroscopy allows patients to undergo both diagnostic and therapeutic procedures in the office setting and, importantly, to actively participate in the understanding of their condition. We recently showed that more than 94% of our cohort of patients who underwent IONA expressed a willingness to undergo the same procedure again because they believed that being awake and coherent allowed them to ask questions and learn about their condition from the operative surgeon in real time.[11] In the case of SLAP lesions, the benefit of the 1.9-mm arthroscope as opposed to the standard 4-mm arthroscope is that it reduces the risk of causing iatrogenic rotator cuff injury and chondral damage when entering the joint. Additionally, there is less damage to the skin and subcutaneous tissue, reducing postoperative pain, and it theoretically has the advantage of limiting bacterial entry and possible postoperative infection.

Finally, the use of IONA has the potential to lessen health care costs by reducing the expenses pertaining to the operating room and staff, as well as costs associated with advanced imaging. Previous studies have shown that IONA saved $961.98 and $554.62 to $1,097.62 per patient for knee and shoulder evaluations, respectively.[17] In another study, Colasanti et al.[10] have shown that IONA has significantly higher sensitivity and specificity than magnetic resonance imaging regarding the diagnosis of ankle pathology. Although further studies would be needed, this is likely true with needle arthroscopy as well, particularly regarding SLAP tears.

The advantages and disadvantages of IONA are summarized in Table 2. The main advantages are the avoidance of general or regional anesthesia, reducing potential complications associated with its use. The disadvantage is the learning curve when using a 0° scope. However, this is generally short, and the technique can be learned while performing standard shoulder arthroscopic procedures. Because of the smaller size of the instrumentation, there are increasing possibilities for other shoulder soft-tissue procedures to be carried out under a local anesthetic while improving patient satisfaction and rapport.

In conclusion, the latest advances in IONA technology have now made it possible to perform diagnostic and therapeutic procedures in the wide-awake office setting under local anesthesia. This has given patients the opportunity to actively participate in their procedure and learn about the pathology in real time. Patients have reported experiencing a stronger patient-physician relationship. Furthermore, IONA has the potential to reduce costs and decrease utilization of hospital resources. The ability to treat SLAP pathology in the office provides a unique tool for orthopaedic surgeons.

Disclosures

The authors report the following potential conflicts of interest or sources of funding: J.W.S. is a board or committee member of Arthroscopy Association of North America. J.G.K. is a consultant for Isto Biologics, Arthrex, and In2Bone, outside the submitted work, and receives support from Ohnell Family Foundation and Winston Fisher. Full ICMJE author disclosure forms are available for this article online, as supplementary material.

References

1. Tooth C, Gofflot A, Schwartz C, et al. Risk factors of overuse shoulder injuries in overhead athletes: A systematic review. *Sports Health* 2020;12:478-487.
2. Brockmeyer M, Tompkins M, Kohn DM, Lorbach O. SLAP lesions: A treatment algorithm. *Knee Surg Sports Traumatol Arthrosc* 2016;24:447-455.
3. Charles MD, Christian DR, Cole BJ. An age and activity algorithm for treatment of type II SLAP tears. *Open Orthop J* 2018;12:271-281.
4. Snyder SJ, Karzel RP, Del Pizzo W, Ferkel RD, Friedman MJ. SLAP lesions of the shoulder. *Arthroscopy* 1990;6:274-279.
5. Maffet MW, Gartsman GM, Moseley B. Superior labrum—biceps tendon complex lesions of the shoulder. *Am J Sports Med* 1995;23:93-98.
6. Modarresi S, Motamedi D, Jude CM. Superior labral anteroposterior lesions of the shoulder: Part 2, mechanisms and classification. *AJR Am J Roentgenol* 2011;197:604-611.
7. Stathellis A, Brilakis E, Georgoulis JD, Antonogiannakis E, Georgoulis A. Treatment of SLAP lesions. *Open Orthop J* 2018;12:288-294.
8. Mercer NP, Gianakos AL, Kaplan DJ, et al. Achilles paratenon needle tendoscopy in the office setting. *Arthrosc Tech* 2022;11:e315-e320.
9. Mercer NP, Azam MT, Davalos N, et al. Anterior talofibular ligament augmentation with internal brace in the office setting. *Arthrosc Tech* 2022;11:e545-e550.
10. Colasanti CA, Kaplan DJ, Chen JS, et al. In-office needle arthroscopy for anterior ankle impingement. *Arthrosc Tech* 2022;11:e327-e331.
11. Colasanti CA, Mercer NP, Garcia JV, Kerkhoffs G, Kennedy JG. In-office needle arthroscopy for the treatment of anterior ankle impingement yields high patient

satisfaction with high rates of return to work and sport. *Arthroscopy* 2022;38:1302-1311.
12. Kanakamedala A, Chen JS, Kaplan DJ, et al. In-office needle tendoscopy of the peroneal tendons. *Arthrosc Tech* 2022;11:e365-e371.
13. Dankert JF, Mercer NP, Kaplan DJ, et al. In-office needle tendoscopy of the tibialis posterior tendon with concomitant intervention. *Arthrosc Tech* 2022;11:e339-e345.
14. Kaplan DJ, Chen JS, Colasanti CA, et al. Needle arthroscopy cheilectomy for hallux rigidus in the office setting. *Arthrosc Tech* 2022;11:e385-e390.
15. Chen JS, Kaplan DJ, Colasanti CA, et al. Posterior hindfoot needle endoscopy in the office setting. *Arthrosc Tech* 2022;11:e273-e278.
16. Peach C, Davies R, Phillips N. Wide-awake shoulder nanoscopic long head of biceps tenotomy. *Arthrosc Tech* 2021;10:e909-e912.
17. McMillan S, Schwartz M, Jennings B, Faucett S, Owens T, Ford E. In-office diagnostic needle arthroscopy: Understanding the potential value for the US healthcare system. *Am J Orthop (Belle Mead NJ)* 2017;46:252-256.
18. Bhatnagar A, Bhonsle S, Mehta S. Correlation between MRI and arthroscopy in diagnosis of shoulder pathology. *J Clin Diagn Res* 2016;10:RC18-RC21.
19. Mercer NP, Samsonov AP, Dankert JF, et al. Improved clinical outcomes and patient satisfaction of in-office needle arthroscopy for the treatment of posterior ankle impingement. *Arthrosc Sports Med Rehabil* 2022;4:e629-e638.