

IN BRIEF

Traumatic Anterior Shoulder Instability: A Systematic Review and Proposed Modern Classification System

Al-Achraf Khoriaty, FRCS (Orth); Zien A. Fozo, MRCS; Tony Antonios, FRCS (Orth); Richard Dimock, MRCS; Mohamed Imam, FRCS (Orth); Ali Narvani, FRCS (Orth)

Research performed at Ashford and St Peters Hospital NHS Trust, Fortius Clinic, Surrey, London, UK

Received: 10 March 2024

Accepted: 12 June 2024

Abstract

Numerous surgical techniques have been developed to address recurrent anterior shoulder instability, with the Bankart repair and the Latarjet procedure emerging as dominant. With recent advancements in keyhole surgery, there's been a surge in popularity for all-arthroscopic procedures. Our systematic review aims to determine if there's justification for incorporating these techniques into a classification system for guiding treatment of traumatic anterior recurrent instability. We identified and analysed a variety of key studies, including 12 systematic reviews, three prospective studies, seven non-randomized prospective and retrospective studies, along with one biomechanical study. Our study sheds light on the wide range of procedures available to shoulder surgeons dealing with traumatic anterior recurrent instability. We introduce a novel classification system (BoTH) designed to simplify the decision-making process in this context.

Level of evidence: I

Keywords: Classification, Instability, Shoulder

Introduction

Traumatic anterior shoulder instability presents with two main surgical options: Bankart repair and Latarjet procedure.¹ Additional techniques like Remplissage [Figure 1], free glenoid bone block (FGBB) [Figure 2], and dynamic anterior stabilization (DAS) [Figure 3] are also used.^{2,3} FGBB offers advantages over Latarjet, including anatomical reconstruction and reduced complications.⁴

Remplissage, combined with Bankart repair, has shown success rates of 85-93%,⁵ and DAS involves fixing the intra-articular part of the long head of the biceps through the subscapularis to the anterior glenoid, providing stability augmentation through a sling effect.⁶ Our systematic review over the past 7 years aims to justify incorporating these treatments into a classification system for managing traumatic anterior recurrent instability.

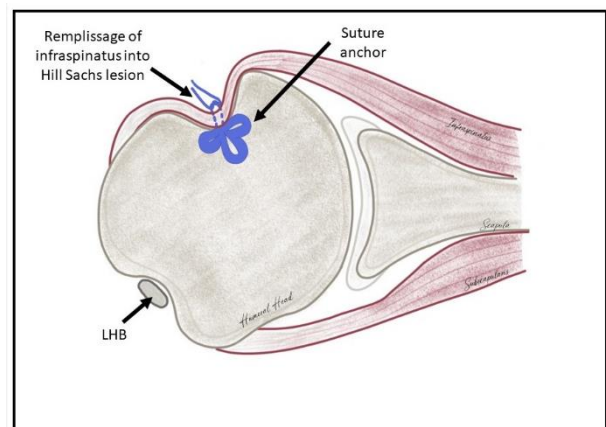


Figure 1. Remplissage

Corresponding Author: Ali Narvani, Ashford St. Peters and Chertsey Hospital, Chertsey, UK

Email: alinarvani@shoulder-elbowsurgery.com



THE ONLINE VERSION OF THIS ARTICLE
ABJS.MUMS.AC.IR



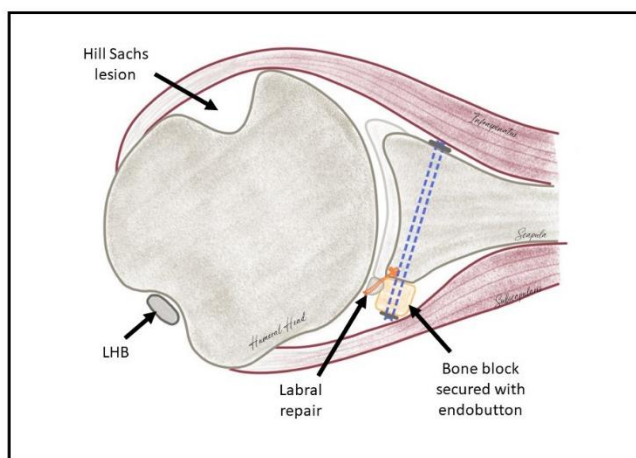


Figure 2. Free bone block reconstruction of the glenoid

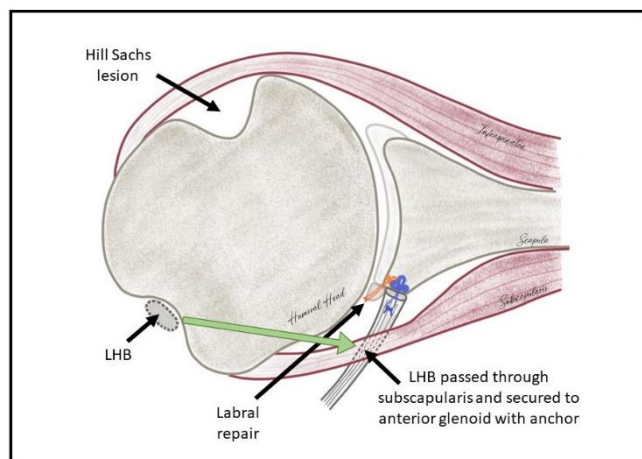


Figure 3. Dynamic anterior Stabilisation using LHB

Main body/ Search Methodology

Eligibility Criteria

We conducted a comprehensive review of literature spanning the past 7 years on the treatment methods of Traumatic Anterior Shoulder instability, including cadaveric and biomechanical studies.

Literature Search

From January 2017 to March 2023, PubMed, OVID Medline, and Embase were searched between March 14th and 28th, 2023, using predefined search terms.

Study Selection

Titles and abstracts of identified studies were screened initially to exclude unrelated topics. Exclusions included general reviews, financial outcome studies, posterior shoulder instability, and revision surgery. Biomechanical studies were limited to comparisons of surgical techniques.

Risk of Bias

Given potential reporting bias and heterogeneous data collection, there may be inherent limitations in the included

studies.

Results

The search yielded 860 studies, with 837 excluded due to duplication or irrelevance. Twenty-three full-text articles met the inclusion criteria [Figure 4].

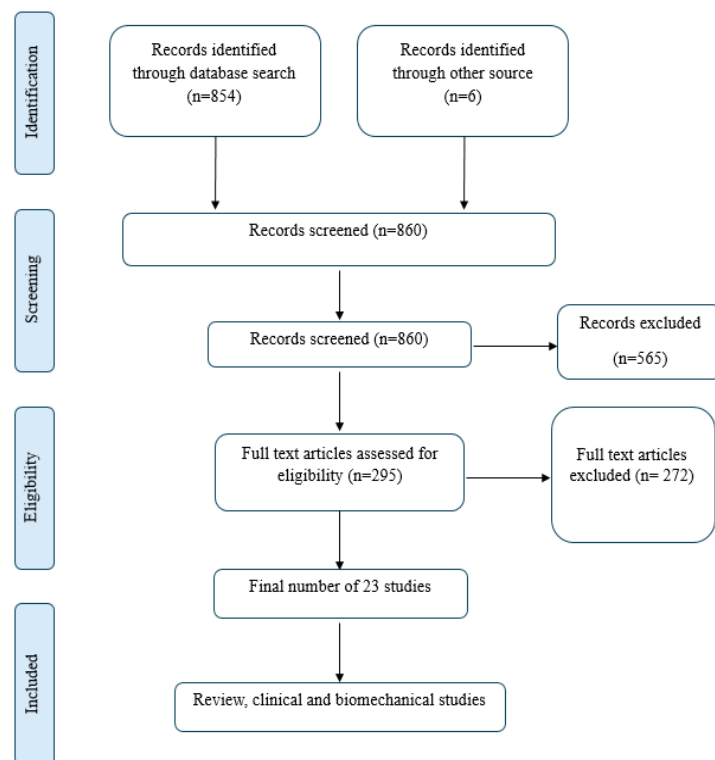


Figure 4. PRISMA Diagram

Results

In our study, we reviewed 12 systematic reviews. Bliven et al. favoured Latarjet [Figure 5] over Bankart repair,⁷ while Imam et al. noted lower recurrence rates with Latarjet but lower infection risk with Bankart repair.⁸ Goodrich et al. noted higher recurrence rates in males after arthroscopic Bankart repair.⁹ Verweij et al. identified risk factors for recurrence after arthroscopic Bankart repair.¹⁰ In prospective studies, Kukkonen et al. found higher short-term redislocation risk with arthroscopic Bankart repair versus open Latarjet.¹¹ Non-randomized studies by Bah et al. found various surgical techniques reliable for shoulder instability,¹² while biomechanical studies by Nicholson et al. explored reducing dislocation frequency and restoring stability.¹³

Discussion

Our study underscores the variety of procedures for treating traumatic anterior recurrent shoulder instability,⁷ what is less clear is which procedure to perform and when.¹⁴ Determining which patients should undergo a Bankart repair remains unclear. Verweij et al.¹⁰ highlighted the

importance of risk factors, such as the instability severity index (ISI) score popularized by Boileau.¹⁵⁻¹⁷

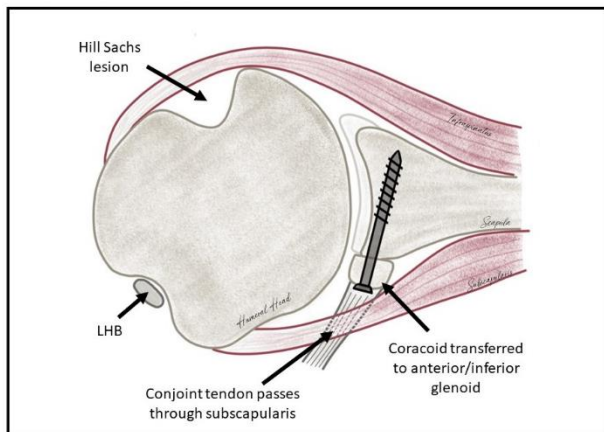


Figure 5. Laterjet procedure

Comparing procedures favoured in cases with bone loss (FGBB, Latarjet, or Bristow), there's minimal differentiation in success rates.^{11,18,19} Taverna et al²⁰ suggested FGBB is most effective in patients with good-quality soft tissues. Their indications for FBGG as opposed to Latarjet excludes those who have had more than five dislocations and in those whom the first dislocation was more than 3 years prior to surgery as they felt that quality of soft tissue would be significantly compromised. In these patients, the sling effect of the conjoint tendon in Latarjet becomes very relevant. It does appear perfectly reasonable to argue for FBGG instead of Latarjet in a subset of patients if there is no compromise in recurrence rate as Latarjet is a non-anatomical procedure which has a learning curve and as associated with significant complications rates.

Remplissage remains pivotal in treating anterior shoulder instability. Meta-analyses suggest its superiority when added to isolated Bankart repair for managing instability with engaging Hill-Sachs lesions and up to 25% glenoid bone loss, reducing redislocation rates and improving functional scores.^{21,22} Itoi et al. proposed Remplissage for off-track lesions with less than 25% glenoid bone loss.²³

The evidence supporting Dynamic Anterior Stabilization (DAS) is promising.^{24,25} Combining DAS with a FGBB procedure may prove beneficial for cases with glenoid bone loss exceeding 15%.²⁴ Biomechanical evidence suggests a role for DAS alongside arthroscopic Bankart repair in patients with less than 15-20% bone loss (subcritical bone loss). DAS may compensate for subcritical bone loss and recurrent instability in patients with poor soft tissue, producing a sling/hammock effect similar to that seen in a Latarjet procedure. Therefore, it may also be the case that the sling effect of LHB or conjoint tendon²⁶ may result in good outcomes in patients with subcritical bone loss and poor-

quality soft tissue.

Our classification system, named BoTH (Bo=bone loss, T=Tissue for the condition of soft tissue, H=Hill Sachs lesion), provides a structured approach to treating shoulder instability, considering the severity of shoulder injury. Based on the evidence gathered, it accounts for both degrees of bone loss and the condition of soft tissue.

For cases with subcritical bone loss (<15-20%) and good quality soft tissue, a Bankart repair alone may suffice. However, if there's an off-track Hill Sachs lesion, Remplissage becomes necessary, as suggested by Itoi et al.²²

In individuals with subcritical bone loss and poor-quality soft tissue due to recurrent dislocations or lax capsule, Dynamic Anterior Stabilization (DAS) may suffice. Additionally, if there's an off-track Hill Sachs lesion, Remplissage may be performed simultaneously.

When glenoid bone loss exceeds 15-20%, a bone block procedure (either Latarjet or FGBB) is recommended. Latarjet may be preferable in cases with compromised soft tissue, as it offers the sling effect. However, in patients with critical glenoid bone loss but good soft tissue quality, FGBB may be suitable, avoiding the risks associated with Latarjet. Since FBGG lacks the sling effect, Remplissage may be necessary for off-track lesions.²⁷ In cases with critical glenoid bone loss, compromised soft tissue quality, and an off-track Hill Sachs lesion, Latarjet may be justified, with additional consideration for Remplissage in those with large Hill Sachs lesions and significant glenoid bone loss [Figure 6].

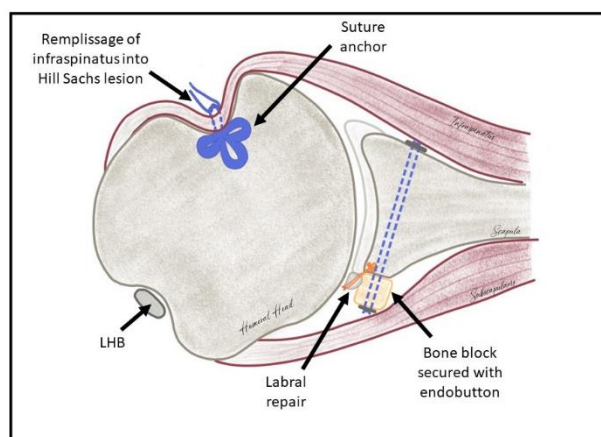


Figure 6. Free bone block reconstruction with Remplissage

Conclusion

Various surgical options exist for managing unstable shoulders, each tailored to specific patient groups based on anatomical damage. The authors propose a classification system (BoTH) to aid in decision-making [Table 1].

Table 1 - Proposed BoTH classification (Bo=bone loss, T=Tissue for the condition of soft tissue, H=Hill Sachs lesion).				
Type	Glenoid Bone Loss	Labrum/capsule Quality	HS Lesion	Treatment
1	<15-20%	Good	No/on-track	Bankart Repair
1+			Off-track	Bankart Repair + Remplissage
2	<15-20%	Poor	No/on-track	Dynamic Anterior Stabilization
2+			Off-track	Dynamic Anterior Stabilization + Remplissage
3	>15-20%	Good	No/on-track	Free Glenoid Bone Grafting
3+			Off-track	Free Glenoid Bone Grafting + Remplissage
4	>15-20%	Poor	No/on-track	Latarjet
4+			Off-track	Latarjet +/- Remplissage

Acknowledgement

N/A

Authors Contribution:

Mr. Al-Achraf Khoriaty FRCS (Orth): Data curation, formal analysis, investigation, methodology, writing original draft and editing.

Mr. Zien A. Fozo MRCS: Data curation, investigation, visualisation, methodology, writing original draft, project administration.

Mr. Tony Antonios FRCS (Orth): supervision, writing original draft and editing.

Mr. Richard Dimock MRCS: Visualisation.

Prof. Mohamed Imam FRCS (Orth): Conceptualisation, investigation, supervision, writing, revision of manuscript.

Mr. Ali Narvani FRCS (Orth): Conceptualisation, investigation, supervision, writing, revision of manuscript.

Declaration of Conflict of Interest: The authors do NOT have any potential conflicts of interest for this manuscript.

Declaration of Funding: The authors received NO financial support for the preparation, research, authorship, and publication of this manuscript.

Declaration of Ethical Approval for Study: ethical approval was not required.

Declaration of Informed Consent: There is no information (names, initials, hospital identification numbers, or photographs) in the submitted manuscript that can be used to identify patients.

Al-Achraf Khoriaty FRCS (Orth) ¹

Zien A. Fozo MRCS ²

Tony Antonios FRCS (Orth) ¹

Richard Dimock MRCS ³

Mohamed Imam FRCS (Orth) ^{1,5}

Ali Narvani FRCS (Orth) ^{1,4}

1 Ashford and St Peters Hospital NHS Trust, Surrey, UK

2 Ysbyty Gwynedd Hospital, Wales, UK

3 Maidstone & Tunbridge Wells Hospitals NHS Trust, Kent, UK

4 Fortius Clinic, London, UK

5 Smart Health Centre, University of East London, London, UK

References

- Markatos K, Karamanou M, Tsourouflis G, Androutsos G, Mavrogenis AF. Ambrose Paré (1510-1590): on the diagnosis and treatment of shoulder dislocations. *Int Orthop*. 2018; 42(1):215-218. doi:10.1007/s00264-017-3585-0.
- Rashid MS, Arner JW, Millett PJ, Sugaya H, Emery R. The Bankart repair: past, present, and future. *Journal of Shoulder and Elbow Surgery*. 2020; 29(12):e491-e498. doi:10.1016/j.jse.2020.06.012.
- Zhang M, Liu J, Jia Y, et al. Risk factors for recurrence after Bankart repair: a systematic review and meta-analysis. *J Orthop Surg Res*. 2022; 17:113. doi:10.1186/s13018-022-03011-w.
- Ekhtiari S, Horner NS, Bedi A, Ayeni OR, Khan M. The Learning Curve for the Latarjet Procedure: A Systematic Review. *Orthop J Sports Med*. 2018; 6(7):2325967118786930. doi:10.1177/2325967118786930.
- Gupta A, Delaney R, Petkin K, Lafosse L. Complications of the Latarjet procedure. *Curr Rev Musculoskelet Med*. 2015;

- 8(1):59-66. doi:10.1007/s12178-015-9258-y.
6. Ernstbrunner L, Waltenspül M, Suter C, El-Nashar R, Scherr J, Wieser K. Primary Open Latarjet Procedure Results in Functional Differences but No Structural Changes in Subscapularis Muscle Quality vs the Healthy Contralateral Shoulder at Long-term Follow-up. *Am J Sports Med.* 2022; 50(6):1495-1502. doi:10.1177/03635465221079858.
 7. Bliven KCH, Parr GP. Outcomes of the Latarjet Procedure Compared With Bankart Repair for Recurrent Traumatic meta-analysis and systematic review of literature. *JSES Int.* 2021; 6(1):123-131. doi:10.1016/j.jseint.2021.10.002.
 10. Verweij LPE, van Spanning SH, Grillo A, et al. Age, participation in competitive sports, bony lesions, ALPSA lesions, > 1 preoperative dislocations, surgical delay and ISIS score > 3 are risk factors for recurrence following arthroscopic Bankart repair: a systematic review and meta-analysis of 4584 shoulders. *Knee Surg Sports Traumatol Arthrosc.* 2021; 29(12):4004-4014. doi:10.1007/s00167-021-06704-7.
 11. Tahir M, Malik S, Jordan R, Kronberga M, D'Alessandro P, Saithna A. Arthroscopic bone block stabilisation procedures for glenoid bone loss in anterior glenohumeral instability: A systematic review of clinical and radiological outcomes. *Orthop Traumatol Surg Res.* 2021; 107(5):102949. doi:10.1016/j.otsr.2021.102949.
 12. Bah A, Lateur GM, Kouevidjin BT, et al. Chronic anterior shoulder instability with significant Hill-Sachs lesion: Arthroscopic Bankart with remplissage versus open Latarjet procedure. *Orthop Traumatol Surg Res.* 2018; 104(1):17-22. doi:10.1016/j.otsr.2017.11.009.
 13. Nicholson AD, Carey EG, Mathew JI, et al. Biomechanical analysis of anterior stability after 15% glenoid bone loss: comparison of Bankart repair, dynamic anterior stabilization, dynamic anterior stabilization with Bankart repair, and Latarjet. *J Shoulder Elbow Surg.* 2022; 31(11):2358-2365. doi:10.1016/j.jse.2022.04.017.
 14. Polyzois I, Dattani R, Gupta R, Levy O, Narvani AA. Traumatic First Time Shoulder Dislocation: Surgery vs Non-Operative Treatment. *The Archives of Bone and Joint Surgery.* 2016; 4(2):104-108. doi:10.22038/abjs.2016.5305
 15. Rosenberg SI, Padanilam SJ, Pagni BA, Tjong VK, Sheth U. A lower Instability Severity Index score threshold may better predict recurrent anterior shoulder instability after arthroscopic Bankart repair: a systematic review. *J ISAKOS.* 2021; 6(5):295-301. doi:10.1136/jisakos-2020-000584.
 16. Dekker TJ, Peebles LA, Bernhardson AS, et al. Limited Predictive Value of the Instability Severity Index Score: Evaluation of 217 Consecutive Cases of Recurrent Anterior Shoulder Instability. *Arthroscopy.* 2021; 37(5):1381-1391. doi:10.1016/j.arthro.2020.12.185.
 17. Xu Y, Wu K, Ma Q, et al. Comparison of clinical and patient-reported outcomes of three procedures for recurrent anterior shoulder instability: arthroscopic Bankart repair, capsular shift, and open Latarjet. *J Orthop Surg Res.* 2019; 14:326. doi:10.1186/s13018-019-1340-5.
 18. Moroder P, Schulz E, Wierer G, et al. Neer Award 2019: Latarjet procedure vs. iliac crest bone graft transfer for treatment of anterior shoulder instability with glenoid bone loss: a prospective randomized trial. *Journal of Shoulder and Anterior Shoulder Instability.* *J Athl Train.* 2018; 53(2):181-183. doi:10.4085/1062-6050-232-16.
 8. Imam MA, Shehata MSA, Martin A, et al. Bankart Repair Versus Latarjet Procedure for Recurrent Anterior Shoulder Instability: A Systematic Review and Meta-analysis of 3275 Shoulders. *Am J Sports Med.* 2021; 49(7):1945-1953. doi:10.1177/0363546520962082.
 9. Goodrich E, Wolf M, Vopat M, et al. Sex-specific differences in outcomes after anterior shoulder surgical stabilization: a Elbow Surgery. 2019; 28(7):1298-1307. doi:10.1016/j.jse.2019.03.035.
 19. Garcia JC, do Amaral FM, Belchior RJ, de Carvalho LQ, Markarian GG, Montero EF de S. Comparative Systematic Review of Fixation Methods of the Coracoid and Conjoined Tendon in the Anterior Glenoid to Treat Anterior Shoulder Instability. *Orthop J Sports Med.* 2019; 7(1):2325967118820539. doi:10.1177/2325967118820539.
 20. Taverna E, Garavaglia G, Perfetti C, Ufenast H, Sconfienza LM, Guarrella V. An arthroscopic bone block procedure is effective in restoring stability, allowing return to sports in cases of glenohumeral instability with glenoid bone deficiency. *Knee Surg Sports Traumatol Arthrosc.* 2018;26(12):3780-3787. doi:10.1007/s00167-018-4921-7.
 21. Camus D, Domos P, Berard E, Toulemonde J, Mansat P, Bonnevalle N. Isolated arthroscopic Bankart repair vs. Bankart repair with "remplissage" for anterior shoulder instability with engaging Hill-Sachs lesion: A meta-analysis. *Orthop Traumatol Surg Res.* 2018; 104(6):803-809. doi:10.1016/j.otsr.2018.05.011.
 22. Miyamoto R, Yamamoto A, Shitara H, et al. Clinical Outcome of Arthroscopic Remplissage as Augmentation During Arthroscopic Bankart Repair for Recurrent Anterior Shoulder Instability. *Open Orthop J.* 2017; 11:1268-1276. doi:10.2174/1874325001711011268.
 23. Itoi E. 'On-track' and 'off-track' shoulder lesions. *EFORT Open Reviews.* 2017; 2(8):343-351. doi:10.1302/2058-5241.2.170007.
 24. Wu C, Xu J, Fang Z, et al. Clinical and Radiological Outcomes in Patients With Anterior Shoulder Instability and Glenoid Bone Loss after Arthroscopic Free Bone Block Combined With Dynamic Anterior Stabilization. *Am J Sports Med.* 2023; 51(1):187-197. doi:10.1177/03635465221137883.
 25. de Campos Azevedo C, Ângelo AC. Onlay Dynamic Anterior Stabilization with Biceps Transfer for the Treatment of Anterior Glenohumeral Instability Produces Good Clinical Outcomes and Successful Healing at a Minimum 1 Year of Follow-Up. *Arthrosc Sports Med Rehabil.* 2023; 5(2):e445-e457. doi: 10.1016/j.asmr.2023.01.012.
 26. Wu C, Xu J, Fang Z, et al. Arthroscopic Dynamic Anterior Stabilization Using Either Long Head of the Biceps or Conjoined Tendon Transfer for Anterior Shoulder Instability Results in a Similarly Low Recurrence Rate. *Arthroscopy.* 2023; 39(7):1618-1627. doi: 10.1016/j.arthro.2022.12.040.
 27. Memon SD, Dimock RAC, Shah J, Ajami S, Imam M, Narvani AA. Arthroscopic Allograft Bone Block Procedure with Remplissage for Bipolar Lesions. *Arch Bone Jt Surg.* 2022; 10(10):899-910. doi: 10.22038/ABJS.2022.64126.3085.

