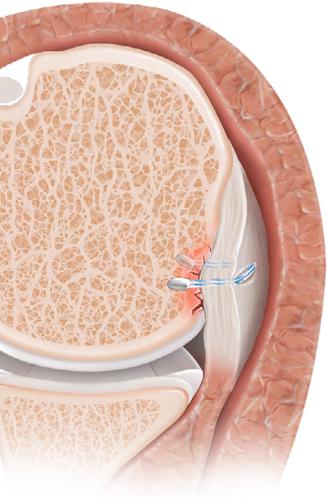


Remplissage for Anterior Instability Scientific Update



Di Giacomo G,
Itoi E,
Burkhart SS

Remplissage, which is used in combination with arthroscopic Bankart repair, addresses anterior instability associated with bone loss. Biomechanical studies indicate that inseting the posterior capsule and tendon into a Hill-Sachs defect improves joint stability. With recent innovations in knotless products and techniques, the addition of remplissage is more reproducible and efficient. A knotless technique—with two tensionable, knotless anchors and interconnected repair sutures—creates a reliably strong repair that minimizes the risk of knot impingement and migration.

Clinical studies have consistently demonstrated that the addition of remplissage reduces recurrence rates, with minimal change to range of motion, compared to an isolated arthroscopic Bankart repair. When compared to Latarjet, remplissage appears to equally prevent recurrence but with a lower complication rate.

Foundations

Evolving concept of bipolar bone loss and the Hill-Sachs lesion: from “engaging/non-engaging” lesion to “on-track/off-track” lesion. *Arthroscopy*. 2014;30(1):90-98. doi:10.1016/j.arthro.2013.10.004

- Reviews the impact of bipolar bone loss in anterior instability and treatment recommendations
- In abduction and external rotation, the contact zone of the humeral head with the glenoid—termed the glenoid track—is approximately 83% of the glenoid width
- Reduced both by glenoid bone loss and a Hill-Sachs lesion
 - Calculate the width of the glenoid track with the following formula: $0.83D$ (normal glenoid diameter) – d (glenoid bone loss)
 - Measure the width of the Hill-Sachs lesion to determine if the lesion is “on-track” (within the remaining glenoid track) or “off-track” (exceeds the remaining glenoid track)
 - Authors recommend adding remplissage to off-track lesions with <25% glenoid bone loss

Takeaways

- **The normal glenohumeral joint has a glenoid track of 83% of the glenoid width in abduction and external rotation, which is reduced with glenoid bone loss or a Hill-Sachs lesion**
- **These concepts provide a paradigm of treatment for the average population but should be taken in the context of the individual patient (ie, an individual with laxity will have a reduced glenoid track due to increased likelihood of anterior subluxation while a low-demand, stiffer patient will have a lower likelihood)**

Shaha JS,
Cook JB,
Rowles DJ,
Bottoni CR,
Shaha SH,
Tokish JM

[Clinical validation of the glenoid track concept in anterior glenohumeral instability.](#) *J Bone Joint Surg Am.* 2016;98(22):1918-1923. doi:10.2106/JBJS.15.01099

- Retrospective study of 57 patients who underwent Bankart repair were evaluated at a mean follow-up of 48 months
- Hill-Sachs lesions were categorized as on-track or off-track based on MRI evaluation
- Recurrence was 8% in the on-track group compared to 75% in the off-track group (P = .0001)

Takeaway

- **Patients with off-track Hill-Sachs lesions have a high risk of recurrence with isolated Bankart repair**

Biomechanical Studies

[The effect of a combined glenoid and Hill-Sachs defect on glenohumeral stability: a biomechanical cadaveric study using 3-dimensional modeling of 142 patients.](#) *Am J Sports Med.* 2015;43(6):1422-1429. doi:10.1177/0363546515574677

- Hill-Sachs lesions were created in 21 cadaveric shoulders based on modeling from CT scans in 142 patients with recurrent anterior instability
- Anterior translation was examined before and after Bankart repair in models with small and medium Hill-Sachs lesions with the following glenoid bone loss:
 - Intact glenoid
 - 2 mm bone loss (approximately 8% glenoid bone loss)
 - 4 mm bone loss (approximately 15% glenoid bone loss)
 - 6 mm bone loss (approximately 23% glenoid bone loss)
- Results showed that anterior translation persisted after isolated Bankart repair:
 - With an 8% glenoid defect and a medium Hill-Sachs lesion
 - With a 15% glenoid defect and a small Hill-Sachs lesion

Takeaways

- **Stability after bone loss is related to the combined effects of glenoid bone loss and the size of the Hill-Sachs lesion**
- **Isolated Bankart repairs may be compromised with as little as 2 mm to 4 mm of bone loss, or 8% to 15% of the glenoid width**

Arciero RA,
Parrino A,
Bernhardson AS,
et al



Hartzler RU,
Bui CN,
Jeong WK,
et al

[Remplissage of an off-track Hill-Sachs lesion is necessary to restore biomechanical glenohumeral joint stability in a bipolar bone loss model.](#) *Arthroscopy*. 2016;32(12):2466-2476. doi:10.1016/j.arthro.2016.04.030

- 8 cadaveric shoulders were placed in a custom apparatus to evaluate passive axial rotation followed by progressive translational loading
- A 15% glenoid bone loss model was used to evaluate on-track (15%) and off-track (30%) Hill-Sachs lesions
- Repair conditions included isolated Bankart repair and Bankart combined with remplissage
- Results showed that engagement occurred:
 - With 1 on-track lesion, which was prevented with isolated Bankart repair alone
 - With all 8 off-track lesions, which was only prevented in mid-range rotation with isolated Bankart repair; prevention of engagement at end-range rotation was prevented in all specimens with the addition of remplissage

Takeaways

- **Isolated Bankart alone results in persistent engagement of an off-track lesion in a bipolar bone loss model**
- **“Remplissage was necessary to prevent engagement of off-track bipolar lesions”**

Funakoshi T,
Hartzler R,
Stewien E,
Burkhart S

[Remplissage using interconnected knotless anchors: superior biomechanical properties to a knotted technique?](#) *Arthroscopy*. 2018;34(11):2954-2959. doi:10.1016/j.arthro.2018.06.030

- Cadaveric study of remplissage with 2 different techniques:
 - Knotted technique with 2 anchors
 - Knotless technique with sutures interconnected between the anchors (3.9 mm Knotless Corkscrew® anchors)
- Load to failure was higher with the knotless technique (788 N vs 488 N; $P = .003$)
- Most common mode of failure for the knotted technique was tendon tearing or knot failure
- No failures in the knotless group occurred via suture slippage

Takeaways

- **Constructs interconnecting knotless repair sutures between 2 anchors are superior to knotted techniques**
- **The knotless construct evaluated in this study can be reproduced with other anchors containing the same mechanism, including Knotless FiberTak® (1.8 mm or 2.6 mm) and 3.0 mm Knotless SutureTak® anchors**



Garcia GH,
Wu HH,
Liu JN,
Huffman GR,
Kelly JD 4th

Clinical Studies

[Outcomes of the remplissage procedure and its effects on return to sports: average 5-year follow-up.](#) *Am J Sports Med.* 2016;44(5):1124-1130. doi:10.1177/0363546515626199

- Retrospective review of 51 combined Bankart and remplissage repairs with large, off-track lesions and <20% glenoid bone loss
- Functional outcome and recurrence were reviewed at a mean of 5 years postoperative
- Six shoulders had dislocation events (11.8%) postoperatively
- Average loss of external rotation was 5°
- Rate of return to sport was 95.5%
 - Of those engaged in throwing, difficulty doing so was reported by 65.5%

Takeaways

- **High return to sport with minimal loss in range of motion and low chance of recurrence with addition of remplissage**
- **Throwing difficulty is common after remplissage, but should be examined in the context that throwing difficulty is common in the setting of bipolar bone loss**

[Arthroscopic Bankart repair with remplissage for non-engaging Hill-Sachs lesion in professional collision athletes.](#) *Shoulder Elbow.* 2019;11(1):17-25. doi:10.1177/1758573217728414

- Retrospective review of contact athletes with anterior instability and <20% glenoid bone loss evaluated at a mean follow-up of 26 months
 - 20 athletes were treated with combined Bankart and remplissage
 - Matched group was treated isolated Bankart
- There was no difference in postoperative range of motion
- Recurrence was 5% in the remplissage group compared to 30% in the isolated Bankart group ($P = .015$)

Takeaway

- **Recurrence in contact athletes is reduced with the addition of remplissage**

Domos P,
Ascione F,
Wallace AL



Haroun HK,
Sobhy MH,
Abdelrahman AA

[Arthroscopic Bankart repair with remplissage versus Latarjet procedure for management of engaging Hill-Sachs lesions with subcritical glenoid bone loss in traumatic anterior shoulder instability: a systematic review and meta-analysis. *J Shoulder Elbow Surg.* 2020;29\(10\):2163-2174. doi:10.1016/j.jse.2020.04.032](#)

- Systematic review of 379 patients (from 4 studies) who underwent combined Bankart with remplissage or Latarjet for <20% glenoid bone loss
 - 194 Bankart and remplissage procedures
 - 185 Latarjet procedures
- There was no difference in postoperative range of motion, functional outcome scores, or recurrence between remplissage and Latarjet groups (9.8% vs 7%)
- Risk of complication was 7 times higher in the Latarjet group (9% vs 1%; $P = .003$)

Takeaway

- **Remplissage and Latarjet results in comparable rates of recurrence for subcritical bone loss, but complications are higher with Latarjet**

Hurley ET,
Toale JP,
Davey MS,
et al

[Remplissage for anterior shoulder instability with Hill-Sachs lesions: a systematic review and meta-analysis. *J Shoulder Elbow Surg.* 2020;29\(12\):2487-2494. doi:10.1016/j.jse.2020.06.021](#)

- Literature review of 12 clinical trials comparing arthroscopic Bankart repair and remplissage vs arthroscopic Bankart repair alone or the Latarjet procedure performed in patients with anterior shoulder instability with Hill-Sachs lesions
- Statistical results
 - Remplissage plus Bankart repair had a significantly lower recurrence rate compared to Bankart alone (3.2% vs 16.8% $P < .05$)
 - Complication rate was significantly lower for remplissage plus Bankart procedures compared to Latarjet procedures (0.5% vs 8.6% $P = .003$)
 - No significant difference in revision rate of Bankart alone
 - Compared to Latarjet procedures, no significant difference in recurrence rate, revision rate, or revision due to recurrence rate

Takeaway

- **Patients with subcritical glenoid bone loss have a lower risk for recurrence with remplissage with arthroscopic Bankart repair compared to Bankart repair alone. Latarjet has comparable rates of recurrence and revision but the risk of complications is significantly higher.**

Supporting Literature

[Redefining “critical” bone loss in shoulder instability: functional outcomes worsen with “subcritical” bone loss. *Am J Sports Med.* 2015;43\(7\):1719-1725. doi:10.1177/0363546515578250](#)

Shaha JS,
Cook JB,
Song DJ,
et al.