



Free Bone Block

Scientific Update

Bony glenoid defects frequently occur in patients with recurrent anterior shoulder instability. Free bone block procedures aim to restore the glenoid concavity and anatomy of the glenohumeral joint to re-establish stability. In cases with substantial anterior-inferior glenoid osseous defects, isolated soft tissue repair techniques have been shown inadequate in restoring shoulder stability, since they have been related to high postoperative recurrence rates of up to 40 %.¹⁻³ Recently, several modifications regarding the surgical approach, graft positioning, and fixation of the graft have been introduced. Newer free bone block techniques can be described using an iliac crest bone block fixed with “low-profile” implants (buttons, sutures, J-shaped implant-free bone graft) through minimized open or arthroscopic procedures.

Type of Fixation and Graft

Iliac crest bone grafting is a common treatment for cases with recurrent anterior instability and substantial glenoid bone loss and results in a low all-cause reoperation rate. Regardless of the graft type (bicortical or tricortical autograft, J-shaped autograft, or allograft), nonunion, osteolysis of the graft, and graft fractures are very rarely reported. Several fixation techniques for iliac crest bone grafting have been described using BioCompression Screws, FiberTape cerclage, buttons, and J-bone graft.⁴⁻⁹

Arthroscopic Implant-Free Bone Grafting for Shoulder Instability With Glenoid Bone Loss⁶

- J-shaped iliac-crest bone graft is an implant-free arthroscopic press-fit fixation using Arthrex instrumentation from a low anteriorinferior portal and subscapularis split
- A glenoid osteotomy is performed 5 mm medial to the chondral edge of the glenoid surface at an angle of 20° to 30° using pre-defined chisels
- Metal trials are inserted to determine final width and final height of the iliac crest bone graft before impaction using a graft inserter
- The bicortical j-shaped iliac-crest graft undergoes a physiological remodeling process that follows the law of bone adaptation to mechanical stresses described by Wolff, which results in the restoration of a near-native anterior scapular neck morphology
- A final capsular-labral repair with a knotless PushLock suture anchor is performed

Takeaway

All-arthroscopic metal-free anatomical reconstruction using a bicortical j-shaped iliac crest bone graft. An oblique glenoid osteotomy at an angle of 20° to 30° and 5 mm medial to the glenoid surface and the use of the graft inserter to apply axial forces during impaction are strongly recommended.

Arthroscopic Glenoid Reconstruction for Chronic Anteroinferior Shoulder Instability Using a Tricortical Iliac Crest Bone Graft⁷

- A twist-drill guide (Arthrex) is used to drill under visualization and Bio-Compression screws are used to obtain fixation of the graft
- Requires a deep anteroinferior portal through the flat tendinous parts of the subscapularis muscle

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- Uses tricortical iliac crest bone graft from the ipsilateral side; the size and length of the graft depend on the superoinferior and anteroposterior dimensions of the glenoid defect

Takeaway

All-arthroscopic anatomical technique using a tricortical iliac crest bone graft with Bio-Compression screw fixation. A FiberTak all-suture anchor medial to the scapular neck is inserted for suture guidance to ease graft insertion through the rotator cuff interval and positioning of the graft at the scapular neck.

Arthroscopic Iliac Crest Bone Block for Reconstruction of the Glenoid: A Fixation Technique Using an Adjustable-Length Loop Cortical Suspensory Fixation Device⁸

- Technique uses a posterior guide (Arthrex) and 2 ACL TightRopes, avoiding the use of metal screws
- The tricortical iliac crest is inserted through the rotator cuff interval
- FiberSticks are recommended as shuttling sutures for the passage of the Arthrex TightRope RT devices
- TightRopes are tensioned, bringing the posterior buttons on the cortex of the posterior glenoid neck; further compression of the graft on the anterior glenoid neck is achieved with a suture tensioner
- The capsularlabral repair is completed using a knotless PushLock

Takeaway

The procedure allows an anatomic reconstruction of the glenoid and the integrity of the subscapularis is not affected. It is an all-arthroscopic tricortical iliac crest augmentation technique with drilling from posterior and using adjustable loop constructs for final graft fixation.

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Arthroscopic Bone Block Cerclage: A Fixation Method for Glenoid Bone Loss Reconstruction Without Metal Implants⁹

- Anatomical arthroscopic reconstruction technique that uses a tricortical iliac crest bone allograft with a nonmetal fixation method using 2 FiberTape cerclages
- Posterior glenoid drilling using two 2.4 mm cannulated DogBone drills through the glenoid 10 mm apart
- The graft is inserted through the rotator cuff interval by pulling all FiberTape cerclage sutures from posterior
- The sutures are interconnected to create a continuous loop, which allows symmetrical tensioning of the construct; once the stability is maintained, 2 knots are tensioned and locked by applying a mechanical force equal to 80 N with a suture tensioner
- Capsularlabral repair using 3 - 4 Knotless FiberTaks

Takeaway

All-arthroscopic anatomical reconstruction technique with a metal-free fixation method for tricortical iliac crest bone grafts using the FiberTape cerclage system. This technique provides substantial stability to the graft and avoids any hardware-related complications.



Clinical Outcomes

With the advancements of arthroscopic techniques and instruments, all-arthroscopic bone-grafting procedures for glenoid reconstruction have been performed for several years now. Authors have reported favorable clinical and radiologic mid- to long-term data using arthroscopic iliac crest bone grafting in patients with recurrent anterior shoulder instability.^{10,11}

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Arthroscopic Iliac Crest Bone Grafting in Recurrent Anterior Shoulder Instability: Minimum 5-Year Clinical and Radiologic Follow-Up¹⁰

- 5-year clinical and radiologic follow-up for Bio-Compression screws used for anatomic glenoid reconstruction
- 14 patients, mean age 31.1 (range 18 - 50) years, were available after a follow-up period of 78.7 (range 60 - 110) months. The SSV averaged 87 (range 65 - 100) %, CS 94 (range 83 - 100) points, RS 89 (range 30 - 100) points, WD 87 (range 25 - 100) points, and WOSI 70 (range 47 - 87) %
- Autologous tricortical iliac crest bone-grafting technique yields satisfying clinical and radiologic results after a mid- to long-term follow-up period. Postoperative re-dislocation was experienced in 1 (7.1 %) of the patients due to a trauma

Takeaway

This technique preserves the integrity of the subscapularis tendon. The clinical and radiologic outcomes of the study align with the reported short- to mid-term results in the literature. A reconstruction of the anatomic pear-shaped glenoid configuration was observed during radiologic CT-based evaluation.

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Arthroscopic Implant-Free Bone Grafting for Shoulder Instability With Glenoid Bone Loss: Clinical and Radiological Outcome at a Minimum 2-Year Follow-up¹¹

- 14 patients with recurrent anteroinferior shoulder instability were prospectively followed; glenoid reconstruction with a modified arthroscopic, implant-free J-bone graft
- All preoperative scores (Rowe score: 57.6 ± 14.4 ; Constant score: 70.9 ± 8.9 ; VAS: 4.4 ± 2.6 ; SSVS: $31.4 \% \pm 19.5 \%$) were significantly ($P \leq .02$) improved at final follow-up (Rowe score: 98.6 ± 1.5 ; Constant score: 96.3 ± 3.9 ; VAS: 0.2 ± 0.6 ; SSVS: $95.6 \% \pm 3.8 \%$)
- The preoperative glenoid area ($82.1 \% \pm 4.5 \%$) was significantly increased immediately after surgery to $99.2 \% \pm 6.6 \%$ ($P < .001$). After a physiological remodeling process, the glenoid area remained significantly increased at the latest follow-up ($89.5 \pm 3.2 \%$, $P < .001$)
- J-bone grafting successfully restored glenoid concavity by significantly increasing concavity extent and depth from preoperative (19.8 ± 2.1 and 0.9 ± 0.6 mm, respectively) to postoperative (24.0 ± 2.1 and 2.1 ± 0.8 mm, respectively)

Takeaway

The arthroscopic J-bone graft technique permits minimally invasive reconstruction of anteroinferior glenoid defects and provided excellent early clinical outcome without recurrent instability in posttraumatic shoulder dislocations. A physiological remodeling process leads to restoration of a more natural glenoid anatomy.



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Del Carmen-
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Rius X.
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Arthroscopic Bone Block Metal-Free Fixation for Anterior Shoulder Instability. Short-Term Functional and Radiological Outcomes¹²

- The objective of this study is to evaluate the safety and the short-term functional and radiological results of an arthroscopic bone block metal-free fixation or bone block cerclage
- Retrospective study of patients with glenohumeral instability and >15% glenoid bone loss operated during 2019 with follow-up of at least 12 months
- A total of 21 patients with a median age of 30.6 (SD 7.1) were included. All showed radiographic consolidation at 3 months follow-up
- The median glenoid estimated surface went from 79.3 % before surgery to 98.4 % at 12 months
- Functional scores were statically significant ($P < .001$) for Western Ontario Shoulder Instability Index (35.6 - 86.9) and Rowe score (25.2 to 96.4); no serious complications were reported

Takeaway

The bone block cerclage is a safe, metal-free technique that achieves total consolidation of the bone graft and favorable functional and radiological outcomes at 12 months follow-up.

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Iliac Crest Bone Block Versus Coracoid Transfer Technique

Latarjet Procedure vs. Iliac Crest Bone Graft Transfer for Treatment of Anterior Shoulder Instability With Glenoid Bone Loss: A Prospective Randomized Trial¹³

- Prospective randomized study, 60 patients with anterior shoulder instability and glenoid bone loss were included and randomized to either an open Latarjet or open ICBGT (J-bone graft) procedure
- No significant differences in the failure rates of the Latarjet group and the iliac crest graft group
- The 2 procedures did not differ significantly in WOSI, Rowe score, SSV, or ASOSS score at any follow-up time point, while internal rotation was significantly higher in the iliac crest graft group compared to the Latarjet group

Takeaway

No significant differences between the Latarjet group and iliac crest group in postoperative pain, satisfaction, strength, abduction, and external rotation at the final follow-up.

Iliac Crest Bone Autograft Versus Iliac Crest Bone Allograft in Glenoid Reconstruction

No studies were found to compare the clinical outcomes of iliac crest bone autograft versus iliac crest bone allograft in the treatment of anterior shoulder instability with glenoid bone loss.



Biomechanics

[A Comparative Study of FiberTape® Cerclage vs Endobutton Constructs¹⁴](#)

- Metal-free fixation with 2.4 mm tunnels and 2 interconnected FiberTape cerclage sutures
- Suture-button fixation using round endobuttons, 1 hole and 2 hole with post, with 2.8 mm tunnels
- The FiberTape cerclage fixation technique shows significantly less initial minimum elongation, as well as higher loads at 3 and 5 mm displacement, respectively. Therefore, it can be concluded that the FiberTape Cerclage fixation can better withstand construct displacement at higher loads
- The FiberTape cerclage fixation and suture-button fixation techniques show a statistically equal contact pressure between the small bone block and the glenoid, which leads us to conclude that the suture-only technique is clinically safe with regards to the contact pressure

Takeaway

Metal screws have been reported to be a large contributor to intraoperative and postoperative complications. Therefore, given the results of the current study, a FiberTape cerclage construct can be an alternative to suture button technique. However, further clinical studies are warranted.

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[Biomechanical Comparison of Screw Fixation Versus a Cortical Button and Self-Tensioning Suture for the Latarjet Procedure¹⁵](#)

- Mean ultimate load to failure for screw fixation (226 ± 114 N; 95 % CI, 147 - 305 N) was not significantly different from that for no-button ACL TightRope with Dog Bone fixation (266 ± 73 N; 95% CI, 216-317 N) ($P = .257$)
- The mean strain at failure for screw fixation ($63\% \pm 21\%$; 95 % CI, 48 - 77 %) was not significantly different from that for suture button fixation ($86\% \pm 26\%$; 95% CI, 69%-104%) ($P = .060$)

Takeaway

The screw and suture button fixation techniques exhibited comparable biomechanical strength for coracoid bone block fixation of the Latarjet procedure.

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[Biomechanical Evaluation of Glenoid Reconstruction With an Implant-Free J-Bone Graft for Anterior Glenoid Bone Loss¹⁶](#)

- 30 % glenoid defect significantly decreases glenohumeral contact areas but significantly increases contact pressures at all abduction and rotation positions
- J-bone graft technique restores the contact area and contact pressure back to levels of near-native glenohumeral joint in all tested positions
- J-bone graft technique proves secure initial graft fixation, and demonstrates excellent osseous glenohumeral stability at time zero

Takeaway

J-bone graft is a viable alternative surgical technique providing excellent graft fixation and glenohumeral stability immediately postoperatively and restores glenohumeral contact patterns.

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Cartilage Morphology and Histology of Iliac Crest Bone Grafts

Cartilage Morphological and Histological Findings After Reconstruction of the Glenoid With an Iliac Crest Bone Graft¹⁷

- Patients underwent MRI 1 year after the J-bone graft procedures
- Biopsy specimens of J-bone grafts were harvested for descriptive histological analysis

Takeaway

J-bone grafts are covered by soft tissue that can differentiate into fibrous and potentially hyaline cartilage. This feature may prove beneficial for delaying the onset of dislocation arthropathy of the shoulder.

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