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Comparison of Coracoid Graft Position and Fixation in the Open Versus Arthroscopic Latarjet Techniques

A Cadaveric Study

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Background: Since the description of the arthroscopic Latarjet technique, discussion about the superiority of the open or arthroscopic procedure has arisen. The appropriate placement of the coracoid graft (CG) on the anterior glenoid neck was reported to be the most important step of the Latarjet procedure.

Purpose: To verify if there are differences in the parameters that may affect the final position and fixation of CG obtained from the open and arthroscopic Latarjet techniques.

Study Design: Controlled laboratory study.

Methods: Twenty fresh-frozen human paired cadaveric shoulder specimens were randomly distributed in 2 surgery groups (open group [OG] and arthroscopic group [AG]) with 10 specimens in each. Two surgeons, each with experience performing open and arthroscopic Latarjet techniques, executed these procedures in each of the respective groups[AQ: 2]. After surgery, a computerized tomography scan was performed. The surgical time, the position of each CG, a series of variables that might affect the CG fixation, and the level of the subscapularis split were evaluated.

Results: The mean surgical time was significantly higher in the AG (mean, 26 minutes for OG and 57 minutes for AG). Three intraoperative complications (30%) were identified in the AG, consisting of graft fractures. The CG was determined to be in an optimal cranial-caudal position in 90% of specimens of the OG and 44% of the AG [AQ: 3](Fisher, $P = .057$). In both groups, the CG was placed in an optimal medial-lateral position in all specimens. In the OG, the degree of parallelism between the major axes of the glenoid surface and CG was significantly greater than in the AG (mean, 3.8° for OG and 15.1° for AG). No significant differences were observed in superior and inferior screw orientation between the groups. In the longitudinal and transversal directions, significant differences were found in the centering of the superior screw, being closer to the ideal point in the OG than in the AG[AQ: 4]. The location where the longitudinal subscapularis split was performed was significantly higher in the AG.

Conclusion: The open Latarjet technique requires less surgical time; presents a lower number of intraoperative complications; and allows more adequate placement of the CG, better centering of the screws, and a subscapularis split closer to the ideal position.

Clinical Relevance: The reported benefits of the arthroscopic Latarjet technique seem less clear if we take into account the added surgery time and complications.

Keywords: shoulder instability; open Latarjet technique; arthroscopic Latarjet technique; graft positioning; graft fixation; cadaveric study

The Latarjet coracoid bone block stabilization[28] is one of the main procedures used for the treatment of recurrent anterior shoulder instability, particularly with significant bone loss.[38] The results of this technique are excellent, with a low recurrence rate of instability in most series (<5%) and with optimal functional results.[4] Nevertheless,

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since the description of arthroscopic technique in 2007,[5,27] the number of arthroscopic Latarjet stabilizations has been increasing, and the discussion about superiority of one procedure over the other has arisen.

The appropriate placement of the coracoid graft (CG) on the anterior glenoid neck was consistently reported to be the most important step of the Latarjet procedure to achieve glenohumeral stability and to avoid any short- or long-term complications.[4,33] However, the effectiveness of the Latarjet technique does not depend only on the position of the CG. Screw placement is also believed to be critical and could influence the outcome.[37] Proper CG fixation is necessary to accommodate the axial and shear forces present in the glenohumeral joint and avoid fixation failure, which can lead to graft nonunion, migration, or recurrent instability.[9] However, no clear information exists about the efficacy of open and arthroscopic Latarjet procedures in terms of correct CG placement. To our knowledge, no reports have been published that relate the position of screws in the longitudinal and transverse axes of the CG with incidence of complications.

The goal of this study is to establish if there are differences in the parameters that may affect the position and fixation of the CG. We hypothesize that the open Latarjet technique, as compared with the arthroscopic Latarjet technique, allows a more adequate placement of the CG in relation to the glenoid cavity and a tendon tenorrhaphy of the subscapularis muscle closest to the ideal position. We also hypothesize that there are no significant differences between the techniques in terms of the orientation and centering of the screws.

METHODS

The study was performed in accordance with the Declaration of Helsinki. Twenty fresh-frozen human paired cadaveric shoulder specimens were used for this study (4 male and 6 female; aged between 69 and 85 years). The specimens belonged to the Department of Anatomy and Embryology of our institution and were obtained following the legal procedures governing the donation of bodies. None of the donors had a clinical history of medical or surgical pathology of the shoulder joint. The 20 shoulders were randomly divided into 2 surgical groups: (1) the open group (OG), labeled 1 to 10 (4 female and 6 male), underwent the open surgical technique; (2) the arthroscopic group (AG), labeled 11 to 20 (4 female and 6 male), underwent arthroscopic surgical technique (Table 1). All shoulders were placed in the simulated beach-chair position. To guarantee that the open and arthroscopic procedures were carried out in accordance with the standard technique, 1 surgeon (surgeon 1) performed all open procedures, and a different surgeon (surgeon 2)[AQ: 5] performed all arthroscopic procedures, each with proven experience in the technique performed. Surgeon 1, with 25 years of practical experience as an orthopaedic surgeon and with >250 open Latarjet procedures done before the study, performs >75 shoulder stabilizations per year and 25 to 30 open Latarjet procedures per year. Surgeon 2, with 17 years of practical experience as an orthopaedic surgeon and with >60 arthroscopic Latarjet procedures done before the study, performs >50 shoulder stabilizations per year and 15 to 20 arthroscopic Latarjet procedures per year. In both groups, two 3.75-mm fully threaded titanium cannulated screws[AQ: 6] were used.

TABLE 1
Epidemiology of the Specimens and Their Group Distribution

Open Latarjet			Arthroscopic Latarjet		
Specimen	Sex	Side	Specimen	Sex	Side
1	Female	Right	11	Male	Right
2	Female	Left	12	Female	Right
3	Female	Right	13	Male	Right
4	Male	Left	14	Male	Right
5	Male	Left	15	Male	Right
6	Female	Left	16	Female	Right
7	Male	Left	17	Male	Left
8	Male	Right	18	Female	Left
9	Male	Left	19	Male	Left
10	Male	Right	20	Female	Left

Open Latarjet Technique

The open Latarjet technique was performed on the OG by the same surgeon, [AQ: 7]with modifications to the classical technique described by Patte et al.[34] We used the basic surgical instruments in addition to specific ones designed by Dr Stephen Burkhart and distributed by Arthrex.

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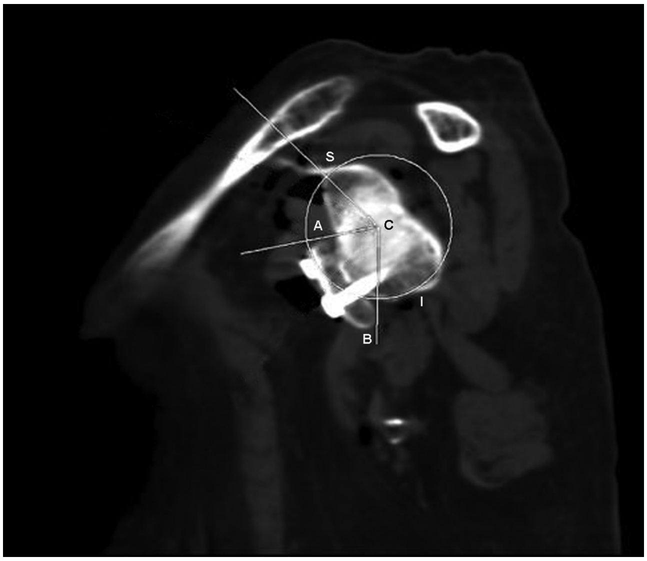

Figure 1. Measurement of the cranial-caudal position of the coracoid graft (CG). The CG presents a satisfactory height position between the 10- and 7-o'clock position on a left shoulder. The circle is around the glenoid. A, upper end of the CG; B, lower end of the CG; C, center; I, infraglenoid tubercle; S, supraglenoid tubercle.

Arthroscopic Latarjet Technique

The arthroscopic Latarjet technique was performed on the AG by the same surgeon,[AQ: 8] with modifications to the classical technique described by Lafosse and Boyle.[25] In addition to the equipment that was necessary to perform the arthroscopic approach, specific instruments designed by Dr Laurent Lafosse [AQ: 9]and distributed by DePuy Mitek were used for the arthroscopic Latarjet.

Surgical Time

The surgical time used to complete the procedure was measured from the first incision until the procedure was completed just before closing.

Radiological Analysis

During the first 24 hours after the intervention, a scan was performed with computed tomography (CT) with 64 detectors (TSX-101A; Toshiba Aquilion). A volumetric configuration was made in the axial plane with the bone and soft tissue reconstructions at a thickness of 0.5 mm (standardized diagnostic for this equipment). Subsequently, in postprocessing steps, orthogonal reconstructions were made in the coronal and sagittal planes, in addition to 3-dimensional reconstructions with a volume-rendering technique. Vitrea (v 4.1.14.0; Toshiba), Advantage Windows (v AW 4.3_05; General Electric Healthcare), and OsiriXTM (32-bit, v 7.0; OsiriX) were used to analyze the images.

The metric analysis of the radiological parameters was carried out by a radiologist outside the study, who did not know the type of technique applied to each specimen.

Position Measurements

Cranial-Caudal Position of the CG. This position was evaluated in a sagittal CT view of the glenoid (en face view) that was obtained coinciding with the greater length of the CG. The clock position system was used according to the technique described by Kraus et al[21] (Figure 1). The CG height position was determined to be optimal between 2 and 5 o'clock, with a right shoulder assumed. When the CG's upper end is above the 2-o'clock point, it is considered to be a superior position. Conversely, it is considered an inferior position when the lower end of the CG is below the 5-o'clock point.

Medial-Lateral Position of the CG. This position was evaluated according to the technique described by Kraus et al.[20] Initially, a sagittal CT view of the glenoid was obtained. Kraus et al defined the glenoid heights of 25%, 50%, and 75% starting from the most superior aspect of the glenoid. In our case, to be more precise, we divided the glenoid height into 10 equal parts. Measurements were then taken in the corresponding axial CT view. The most prominent point was used as the reference for the measurement. A line was drawn alongside the glenoid. The anterior and posterior subchondral rims of the glenoid were used as reference points. In relation to the line drawn between the reference points, the graft was judged to be lateral, flush, or medial (Figure 2). The value, in millimeters, was negative if the CG was medialized with respect to the glenoid and positive if lateralized. We considered that accurate positioning of the bone block was reached when values of medialization and lateralization were within –5 mm and +3 mm, respectively, as previously determined[AQ: 10] and discussed later.

Angle Between the Major Axes of the Glenoid and CG. This measurement indicates the degree of parallelism between the CG and the glenoid surface. In the sagittal plane, 2 images were superimposed: one taken at the level of the major axis of the glenoid and another taken at the level of the major axis of the CG. The superposition of these 2 images allowed us to measure this angle (Figure 3).

Fixation Measurements

All measurements of parameters that might affect the CG fixation were performed in a sagittal CT view, except the angle measurement of the superior and inferior screws with respect to the glenoid surface obtained in the axial view.

- Measurement of the angles of the superior ($\alpha 1$) and inferior ($\alpha 2$) screws with respect to the glenoid surface. The surface of the glenoid subchondral bone was taken as reference by drawing a line tangent to this surface that passed through the anterior and posterior rims of the glenoid. The angle of the superior and inferior screws was determined as the angle between the anterior line and the screw axis (Figure 4).

Figure 2. Measurement of the medial-lateral position of the coracoid graft.

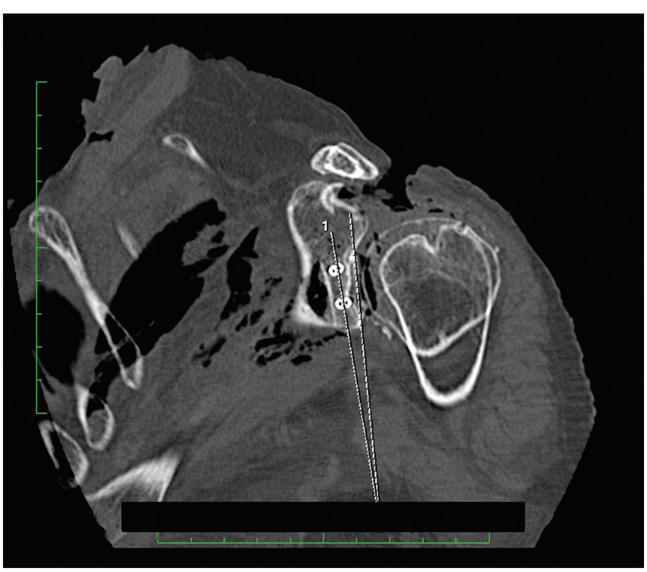

Figure 3. Superimposition of 2 sagittal computed tomography images to measure the angle between the major axes of the glenoid and the coracoid graft.

- Distances from the superior screw to the lateral and medial borders of the CG (Figure 5, A1 and A2)
- Width of the CG at the level of the superior screw (Figure 5, A)
- Distance from the inferior screw to the lateral and medial borders of the CG (Figure 5, B1 and B2)
- Width of the CG at the level of the inferior screw (Figure 5, B)

Figure 4. Measurement of the angle of the superior screw with respect to the surface of the glenoid subchondral bone.

- Distance from the superior screw to the osteotomy line (Figure 5, L1)
- Distance from the inferior screw to the CG tip (Figure 5, L2)

Level of the Subscapularis Split

The level of the subscapularis split was calculated by dividing the distance between the upper border of the subscapularis and the opening point by the total width of the tendon. This location, defined as optimal, corresponded to the junction of the middle and inferior thirds (60%).[39]

Statistical Analysis

The normality of the qualitative data distribution was studied with the Fisher exact test. The normality of the quantitative data distribution and the homogeneity of variances were studied first with the Shapiro-Wilk and Levene tests, respectively. After confirmation that both conditions were met, the comparison of means was statistically analyzed with the Student t test. For the statistical analysis of the data, SPSS Statistics Base (v 25.0; IBM) was used with statistical significance set at 95% ($P \leq .05$).

RESULTS

In the OG, 10 specimens were used, while in the AG, only 9. One of the AG specimens had a longitudinal fracture in the coracoid process when the osteotomy was performed, rendering it unusable for grafting (Figure 6A).

Surgical Time

The surgical time used to complete the procedure in the OG (mean, 26 minutes; range, 29-34.3) was significantly

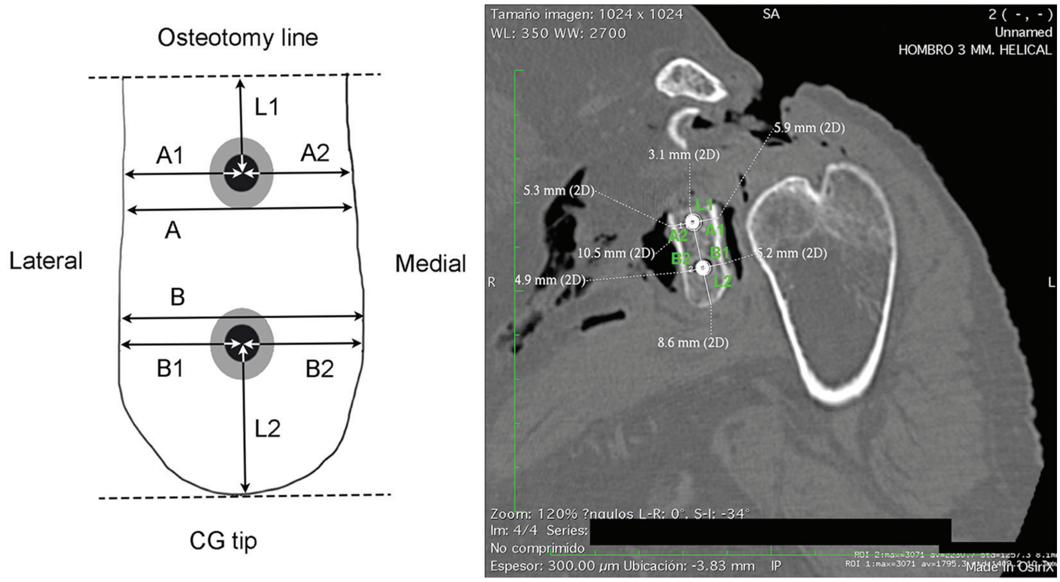

Figure 5. Measurement of the distances of the screws to the limits of the coracoid graft (CG). Width of the CG at the level of the superior (A) and inferior screws (B). Distances from the proximal screw to the lateral (A1) and medial (A2) borders of the CG. Distances from the distal screw to the lateral (B1) and medial (B2) borders of the CG. Distance from the proximal screw to the osteotomy line (L1). Distance from the distal screw to the vertex of the CG (L2).

lower (P = .001) than in the AG (mean, 57 minutes; range, 56-69).

Complications

There were no significant differences in the intraoperative complications (P = .211), which was 0 for the OG and 3 for the AG. The 3 intraoperative complications (30%) identified in the AG consisted of graft fractures.

Specimen 13: At the time of the coracoid osteotomy, a longitudinal fracture passed through the screws and reached the apex of the same. The procedure could not be completed (Figure 6A).
Specimen 18: A displaced fracture affecting the upper edge of the glenoid was seen in the CT scan and extended distally to the upper edge of the anchor area of the CG (Figure 6B).
Specimen 19: A longitudinal fracture was identified between the graft fixation screws (Figure 6C).

Fractures of specimens 18 and 19 were not identified during the arthroscopic procedure and were visualized during radiological analysis.

Cranial-Caudal Position of the CG

We observed differences between the groups that did not reach statistical significance (Fisher, P = .057). In the OG, 9 were in the optimal position and 1 was placed inferiorly. In the AG, 4 were optimal, 1 was superior, and 4 were inferior.

Medial-Lateral Position of the CG

In the medial-lateral position of the CG, no significant differences were found between the groups (P = .243). The CG was placed in a position flush with the glenoid rim in all operated specimens. However, there was a tendency to place the CG slightly lateral in the OG (mean, 1.1 mm; range, –0.07 to 1.6) versus the AG, in which it was placed discretely medial (mean, –1.67 mm; range, –2.8 to 2.24).

Angle Between the Major Axes of the Glenoid and the CG

There were significant differences between the groups (P = .001). The CGs placed in the AG presented a significantly greater degree of inclination with respect to the surface of the glenoid than those placed in the OG. In the OG it was 3.8° on average (range, 1-8), whereas in the AG it was 15.1° on average (range, 9.5°-21.5°).

Measurement of the Orientation and Distances of the Screws to the Limits of the CG

No significant difference was found in superior (P = .466) and inferior (P = .156) screw orientation between groups (Table 2). The mean angle of inclination of the superior screw in relation to the glenoid was 6.3° for the OG (range, 3.0°-11.3°) and 6.7° for the AG (range, 4.9°-14.3°). In the case of the inferior screw, the mean angle of inclination was 5.8° for the OG (range, 3.3°-9.9°) and 10° for the AG (range, 6.1°-16.4°).

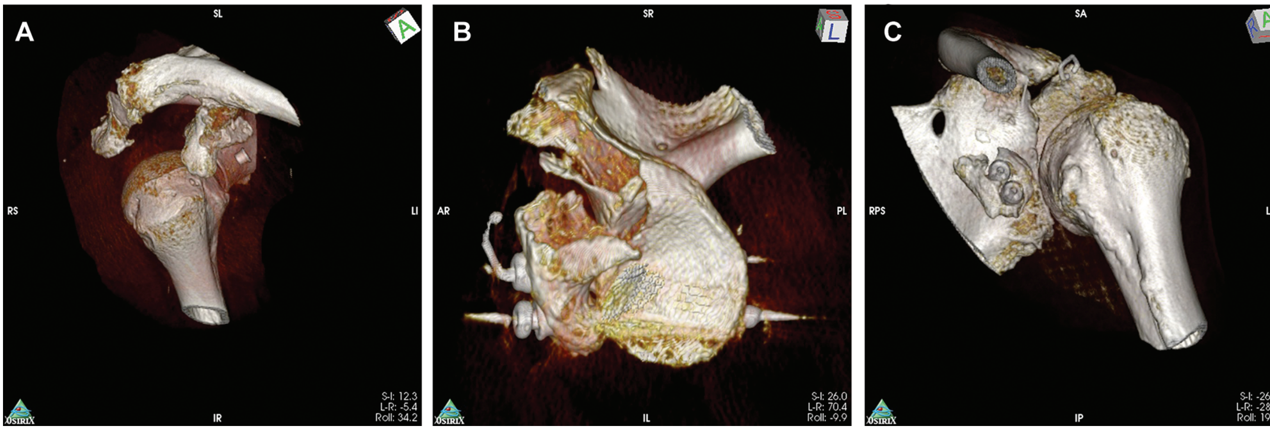

Figure 6. (A) Fracture of the coracoid process at the time of the osteotomy. (B) Fracture of the upper edge of the glenoid. (C) Longitudinal fracture of the coracoid graft between the fixation screws.[AQ: 11]

TABLE 2
Results of the Statistical Analysis of Quantitative Fixation Data Studied[a]

	Median (Interquartile Range)		
	Open Surgery	Arthroscopic Surgery	*P* Value
Angle of screw with respect to glenoid surface			
α1: superior screw	6.3 (3-11.3)	6.7 (4.9-14.3)	.466
α2: inferior screw	5.8 (3.3-9.9)	10 (6.1-16.4)	.156
Distance from superior screw to border of CG, mm			
A1: lateral border	0.5 (0.44-0.52)	0.58 (0.56-0.63)	**.002**
A2: medial border	0.5 (0.49-0.57)	0.42 (0.4-0.51)	**.022**
Distance from inferior screw to border of CG, mm			
B1: lateral border	0.5 (0.49-0.52)	0.53 (0.47-0.59)	.156
B2 : medial border	0.5 (0.48-0.51)	0.47 (0.41-0.53)	.156
Distance, mm			
L1: superior screw to osteotomy line	5.9 (4.63-6.5)	8.4 (7.15-11.8)	**.003**
L2: inferior screw to vertex of the CG	6 (5.8-7)	6 (4-9)	.672

[a]CG, coracoid graft. Bold indicates $P \leq .05$.[AQ: 12]

In the transverse direction, significant differences were found in the centering of the superior screw; in the AG, a significant tendency was observed to place the superior screw closer to the medial border of the CG (*P* = .022). No significant differences were found in the centering of the inferior screw with respect to the medial (*P* = .156) and lateral (*P* = .156) borders of the CG.

In the longitudinal direction, significant differences were found in the centering of the superior screw (*P* = .003), being closer to the ideal point in the OG than in the AG[AQ: 13]. In the AG, a significant tendency was observed to place the superior screw farther from the osteotomy line. No significant differences were found in the centering of the inferior screw, being closer to the ideal point.

Level of the Subscapularis Split

There were significant differences in the location where the longitudinal subscapularis split was performed (*P* = .001). In the OG, the subscapularis split was located in the optimal position in all specimens, with 60% being the average (range, 60%-66%). In the case of the AG, it was close to the midpoint of the tendon, with 53% being the average (range, 50%-55%).

DISCUSSION

Our results confirm our hypothesis that the open Latarjet technique allows a more adequate placement of the CG and a tendon tenorrhaphy of the subscapularis muscle closest to the ideal position. They also confirm that there are no significant differences between techniques in terms of the orientation of the screws. However, the open Latarjet technique allows a better centering of the screws with respect to the longitudinal and transverse directions.

Our results show that the mean surgical time used to complete the procedure in the OG (26 minutes) was significantly lower than in the AG (57 minutes). Gracitelli et al,[14] in a cadaveric study on the arthroscopic Latarjet technique, reported a mean surgical time of 137 minutes, more than twice the time used in our study. This difference may be partly due to the fact that 4 orthopaedic shoulder surgeons carried out the procedures, with experience in performing arthroscopies and in the open Latarjet surgery but without experience with the performance of the arthroscopic Latarjet procedure. In our study, surgeon 2, with proven experience in the arthroscopic Latarjet technique, performed all arthroscopic procedures.

In recent comparative studies between open and arthroscopic Latarjet techniques performed in patients,[13,40] the surgical time used in both procedures is greater than in our study in cadavers, although the time applied in the open Latarjet technique is still significantly lower. This greater surgical time used may be explained by the fact that there are fewer technical difficulties in using cadavers, such as bleeding or medical concerns owing to the spread of extravasated fluid to the neck and the hemithorax.

According to a systematic review of the literature,[29] several authors stressed that the long-term clinical and radiologic outcome of the Latarjet procedure largely depends on the accurate positioning of the CG in relation to the glenoid margin in the axial and sagittal planes.[4] Precise CG placement remains a challenging task.

In general, it is believed that in the sagittal plane, the optimal cranial-caudal position of the CG should be between 2 and 5 o'clock.[18,19,27] Too high or too low a CG positioning may lead to relapse, as dislocation may occur below or above the CG.[2]

With respect to the cranial-caudal position, of the 10 specimens from the OG in our study, the CG was considered misplaced in only 1, inferiorly (10%). This incidence corresponds to that of other published series in which a CT scan has been used to evaluate the position of the CG.[7,12] However, of the 9 specimens from the AG, 5 were considered misplaced in the cranial-caudal direction (55.6%), 4 inferiorly and 1 superiorly. This percentage is very high when compared with the 8.2% to 20% obtained in other series.[18,27,33,35,40] These discrepancies could be explained by several factors, such as sample size, protocol used for CT scan analysis, or difference in execution of surgical technique. Our results corroborate the fact that the cranial-caudal positioning of the CG with respect to the glenoid is more difficult by arthroscopic surgery.

The greatest difficulty in arthroscopic surgery is conditioned by the level of the subscapularis split and by the use of an anterior and medial portal vision. With an open approach, direct visualization of the subscapularis muscle fibers allows a precise horizontal split, typically performed at the inferior third of the muscle.[39] However, with an arthroscopic approach, visualization of the entire subscapularis is more challenging because of the arm position, the inability to see the subscapularis muscle belly intra-articularly, and the fact that the side view obtained with the 30° or 70° arthroscope may lead to distortion.[22]

In our study, there were significant differences in the location where the longitudinal subscapularis split was performed. In the OG, the subscapularis split was located in the optimal position in all operated specimens, 60% on average, whereas in the case of the AG, it was close to the midpoint of the tendon, 53% on average. A high split location makes the procedure more difficult.[1,15] Therefore, the level at which the subscapularis split is performed can condition the proper placement of the CG, justifying the differences found by us between the OG and AG.

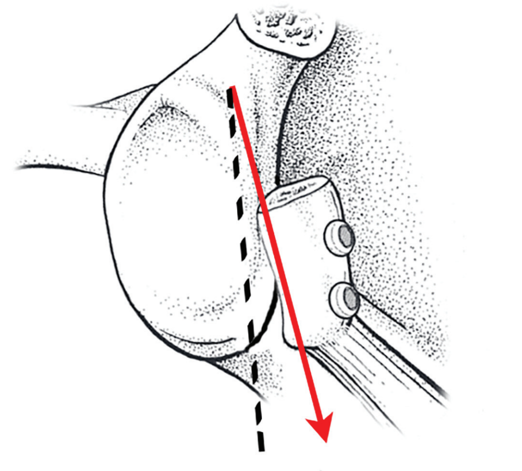

Figure 7. Specimen of the arthroscopy surgery group in which the coracoid graft presents an inclination of 13° with respect to the surface of the glenoid.[AQ: 14]

In the axial plane, it is believed that the accurate medial-lateral position of the CG should be within –4 or –5 mm medially and + 2 or + 3 mm laterally.[7,10,13,29,32,40] Placing the CG too medially could result in an increased rate of recurrence.[17,30] Conversely, too lateral CG placement is considered to be associated with a higher incidence of degenerative changes.[16,17,24]

The results found in the literature about the medial-lateral position of the CG as evaluated by CT scan are diverse.[11,18,19,31,32,40] In our study, the lateral-medial position of the CG in all specimens was within the margins considered acceptable by most authors. No significant differences were found between the OG and AG. However, there was a tendency to place the CG slightly lateral in the OG (mean, 1.1 mm) as compared with the AG, in which it was placed discretely medial (mean, –1.67 mm).

A parameter that has not been taken into account in published works thus far is the degree of parallelism of the CG with respect to the surface of the glenoid (Figure 7). We have not found any reference in the literature on how to measure this parameter. In our study, we verified that the degree of parallelism of the CG with respect to the glenoid is significantly greater in the OG ($P < .001$ [AQ: 15]). Given that the optimum degree of parallelism is 0°, in the OG it was 3.8° on average, whereas in the AG it averaged 15.1°. The greater angulation of the distal end of the CG in the AG may be due to the higher position and smaller amplitude of the subscapularis split, to which the retropulsion of the scapula is added. The medialized position of the distal end of the CG could decrease the dynamic reinforcement of the conjoined tendon of the anteroinferior part of the capsule (musculotendinous block), since the conjoined tendon would also see its position medialized with respect to the apex of the CG. In addition, the lack of flush at the anteroinferior level would decrease the effective surface area of the glenoid (bone block).

The effectiveness of the Latarjet technique does not depend only on the position of the CG. Screw placement is also believed to be critical and could influence the outcome.[37] The goal is to place the screws parallel to the glenoid articular surface to obtain the best compression and stability. Excessive screw obliquity may cause impingement with the humeral head, leading to rapid onset of osteoarthritis of the glenohumeral joint.[8] In an anatomic study, Lädermann et al[23] demonstrated that a safe zone for placement of screws to avoid iatrogenic injury was within 10° relative to the face of the glenoid. More recently, the position of the screw was defined as overangulated when the α angle was $>25°$.[6,11]

Here we show that there is no significant difference in superior and inferior screw orientation between the groups. The mean angle of the superior screw in relation to the glenoid was 6.3° for the OG and 6.7° for the AG. In the case of the inferior screw, the mean angle was 5.8° for the OG and 10° for the AG. These results are within the recommendation of Lädermann et al[23] of a $<10°$ angle.

The angles that we obtained in this work were slightly more parallel than the angles reported in recent studies on the open technique, arthroscopic technique, and comparative studies.[††] these results remained within the recommendations of Lädermann et al[23] (10°) and Boileau et al[6] (25°).

To our knowledge, no reports have been published that relate the position of screws in the longitudinal and transverse axes of the CG with incidence of complications. In our results, the open Latarjet technique allowed for a better centering of the screws with respect to the longitudinal and transverse directions. In the OG, the centering was closer to the ideal point than in the AG[AQ: 16].

In the longitudinal direction, a significant tendency to place the superior screw farther from the osteotomy line was observed in the AG. This placement could be justified since the holes in the AG were made when the coracoid was still attached to the rest of the scapula. This increase of distance was to avoid[AQ: 17] the risk of fracture-releasing stress between the osteotomy and the proximal screw. When there is a fixed distance between screws, trying to move the superior screw away from the osteotomy line causes a more distal position of the inferior screw. This position can influence the fixation of the CG. If the inferior screw is located too close to the vertex of the coracoid, it may not make enough compression, or in extreme cases, it may not obtain adequate fixation at the lower segment of the glenoid (Figure 8).

[††]References 11, 13, 18, 19, 26, 32, 35, 36, 40.

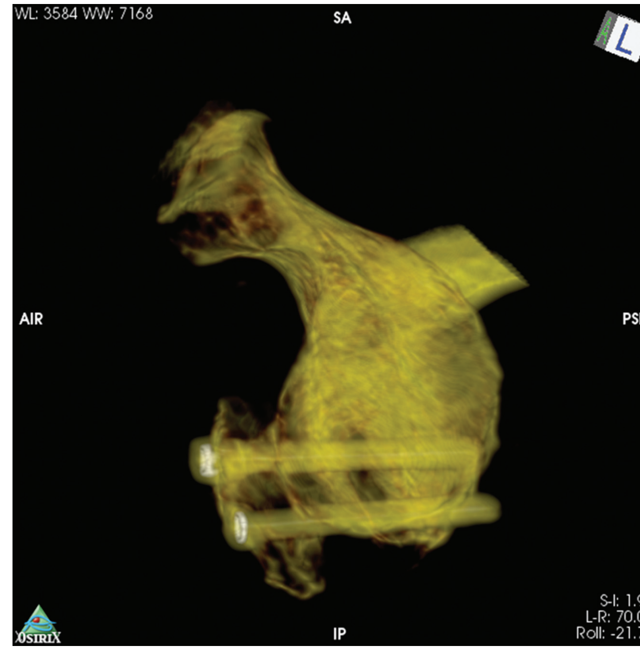

Figure 8. Three-dimensional reconstruction of the lower position of the coracoid graft in the specimen 17. Note that the inferior screw is barely fixed in the lower segment of the glenoid.[AQ: 18]

In the transverse plane, a significant tendency to place the superior screw closer to the medial border of the CG was observed in the AG. It seems that the tendency for medial placement of the screws, in our case the proximal screw, was a deliberate act on the part of the surgeon. Lafosse et al[27] recommend placing the guide discretely medial to avoid (1) protrusion of the head of the screw in its final placement in the neck of the scapula and (2) problems in mobility and rotation of the humeral head. This medial position of the screws increases the risk of a fracture when using a narrower band of the CG and transferring a rotating movement to the CG as the screws are tightened. In fact, Lafosse et al [AQ: 19]recommend not being very energetic when tightening the screws, because of the risk of fracture. In young patients with a wider coracoid process, a reasonable variation of position in the longitudinal and/or transversal axis does not likely suppose too many complications. However, there are objective data indicating that bone mineral density of the coracoid decreases with age.[3] In these cases, the correct centering of the screws seems much more important to avoid the possibility of fracturing CG or the absence of consolidation, as the screws cannot be tightened enough owing to the risk of fracture. In our study, the significant tendency to place the superior screw more medial, in addition to the age of the specimens used, may be related to the appearance of fractures in the AG (30%).

The main limitation of the present study, as it usually happens in anatomic studies on cadavers, lies in the small number of specimens used. In addition, each operation was performed by a different surgeon. This may have introduced performance bias. Finally, generalizability is uncertain, as the findings may be specific for the 2 surgeons performing the study.

In conclusion, the open Latarjet technique requires less surgical time; presents a lower number of intraoperative complications; and allows more adequate placement of the CG, better centering of the screws, and a subscapularis split closer to the ideal position. The reported benefits of the arthroscopic Latarjet technique seem less clear if we take into account the added surgery time and complications.

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