Technical note

All arthroscopic augmented Vargas procedure: An option after failed acromioclavicular joint dislocation reconstruction. A technical note

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A B S T R A C T
Few salvage procedures have been described after a failed Weaver-Dunn procedure. We hypothesized that it was possible to perform an all-arthroscopic revision with a reflected vascularized conjoint tendon into the distal resected clavicle (Vargas procedure) augmented by an artificial coraco-clavicular ligament. Two patients were enrolled. A minimum of 3-cm proximal conjoint tendon was dissected under arthroscopic control. The half-longitudinal conjoint tendon split, leaving its proximal end attached to the coracoid process, was made and incised transversely near the muscles fibers. While being still vascularized with the tip of the coracoid process, the tendon was tubularized, reflected proximally and transferred into the distal part of the clavicle. An artificial coraco-clavicular ligament augmented the transfer. No complication was described. After a minimum of two-year follow-up, there was no recurrence of AC instability and there was normal ROM; two patients returned to sport.

Level of evidence: Level IV-a, case series.

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1. Introduction

A total of 20 to 40% of the patients treated conservatively after acute AC joint dislocations have unsatisfactory results [1–3]. More than 60 techniques have been described since the first open procedure, credited to Samuel Cooper in 1861 by Cadenat [4], including arthroscopic techniques since 2001 [5]. These techniques are supposed to pull the scapula up toward its physiological anatomic position under the clavicle. The Weaver-Dunn (WD) procedure [6] is the coraco-acromial (CA) ligament transfer into the distal part of the clavicle and was widely proposed. Nevertheless, few salvage procedures have been described in cases of failure. In 1942, Vargas [7] published an open technique with a half-longitudinal split of the short head of the biceps (conjoined tendon, CT), leaving its proximal end attached to the coracoid process. The distal half of the tendon was incised transversely near the muscle fibers and reflected proximally through the distal clavicle. We proposed an all-arthroscopic augmented Vargas procedure.

2. Materials and methods

Inclusion criteria for the study were persistent symptoms and recurrence of AC joint dislocation for at least a 6-month period after a failed primary operative technique. There was a minimum 24-month clinical and radiological follow-up.

An exclusion criterion was a previous Latarjet procedure as harvesting the lateral part of the CT is not possible in such cases.

2.1. Patient selection

Two men were enrolled. These patients complained about their right AC joint after a previous failed-open Dunn-Weaver procedure. Plain X-rays showed a fixed and dislocated AC joint, a distal resected clavicle and an increased distance between the coracoid process and the clavicle in comparison with the other side (Fig. 1).

2.2. Surgical technique

In the beach chair position, the arm was placed on an arm support with 30° of forward flexion and neutral rotation of the shoulder without any traction. A portal was made directly over the distal clavicle 2 to 3 cm medial to the AC joint. A 2.4-mm drill-tipped penetrated both clavicle corticals perpendicularly and was left in situ. A standard arthroscopic posterior portal was created just inferior and medial to the postero-lateral corner of the acromion. The 30°-arthroscope (Vims, Toulouse, France) was placed into the joint. Medial resection of the rotator interval was made using an outside-in technique to control the inferior surface of the coracoid process and the posterior surface of the conjoint tendon. Then, the arthroscope was placed into the sub-acromial space. A
lateral sub-acromial portal was made 1 cm distal to the lateral acromial edge in line with the posterior aspect of the AC joint. A 5.5-mm shaver (Smith & Nephew Endoscopy) was used to perform a bursectomy to enable adequate visualization. The arthroscope was transferred to the lateral portal. A 90°-tipped electro cautery device (Depuy Mitek, Raynham, MA) was used through a lateral portal to release the undersurface of the anterior deltoid from the CA ligament. Distal clavicle resection was performed. Anterior deltoid clavicle insertion was released to obtain a large view on the distal third of the clavicle and the K-wire through area. A 4.5-mm drill-cannula was made along the 2.4-mm drill-tipped for guidance and a shuttle relay (No. 2 looped polyester suture) was introduced through this tunnel (Fig. 2a). A socket was shaped into the distal resected clavicle with a motorized bur (StoneCutter; Smith & Nephew Endoscopy) and a second shuttle relay was introduced from the superior clavicle tunnel (Fig. 2b). The base of the coracoid, the conjoint tendon and the Pectoralis Minor (PM) were identified. Axillary and musculo-cutaneous (MC) nerves were visualized and the surrounding fatty atmosphere was preserved. Perfect visualization of all the coracoid processes was the key to prevent any fracture. An arthroscopic deltoid muscle elevator (switching stick) facilitated this step. A 2.4-mm drill-tipped was introduced through the coracoid process in a supero-medial to infero-lateral direction [8,9]. A 4.5-mm drill-cannulated was made along this drill-tipped and a third shuttle relay was introduced into this coracoid tunnel (Fig. 2c). Once the tip of the suture lasso was visualized in the inferior recess to the coracoid, the Twin-Bridge ligament (Smith & Nephew Endoscopy) was pulled from the anterior portal underneath and through to the coracoid process and through the clavicle as described by Boileau et al. [10]. A probe was placed through the anterior portal to assist in graft passage.

A clever hook was used to pass a No. 2 nonabsorbable suture through the 3-cm-lateral conjoint tendon (Fig. 3a). A half-lateral loop of the short head of the biceps leaving its proximal end attached to the coracoid process was made. The distal one-half of the tendon was incised transversely near the muscle fibers. This tendon slip was reflected proximally and shuttled from the anterior portal into the distal resected clavicle (Fig. 3b). It was still vascularized with its proximal part to the tip of the coracoid process. A suture grasper was then used to capture the No. 2 nonabsorbable suture and fixed into the superior titanium endobutton.

Pushing the arm from inferior to superior reduced the AC joint dislocation and the Twin Bridge was locked before the hemi-CT was attached. Arthroscopic control was mandatory to control a less than 5-mm coraco-clavicular distance (Fig. 4).
The results are summarized in the Table 1. All patients underwent an entirely arthroscopic procedure, with no conversion to open surgery. Neither intra-operative complication nor infection occurred. Nor implant migration, nor clavicle and no coracoid process fracture were noted. Cosmetically, a symmetric appearance of both shoulders without bony prominence was obtained in all three patients. After 24 months, there was no plain X-rays loss of reduction (Fig. 5) with normal ROM. Both patients could return to manual work after 3 months, and patients have returned to sport activities. The SSV score increased from 40 to 85, and the UCLA score was 18.3 at the final follow-up.

### 4. Discussion

One could suggest that the CT tendon is too short from the distal resected. In our 2 cases, it was possible to take a minimum length of 3 cm, and that was sufficient. In cases in which an excessive amount of distal clavicle has been previously resected and a longer length of graft tissue is required, a CT graft can be harvested that is significantly longer than the CA ligament as suggested by Vargas. We penetrated the reflected hemi-CT into the socket shaped into the lateral aspect of the clavicle, and then, tension could be perfectly adjusted. We did not observe any proximal CT rupture.

Others could suggest that the CB tendon is too weak. Sloan [12] studied the ultimate tensile strength of the lateral CT and found that it is stronger than the CA ligament, which is widely and routinely used in primary surgery. Some authors recommended an attractive alternative using a semitendinosus allograft or autograft, which appears to approximate the native CC ligaments more closely biomechanically [13–17]. Nevertheless, there may be some drawbacks: the allograft is not composed of living tissues, is cost effective, can induce donor-site morbidity and is not possible in cases of previous ACL reconstruction as most patients are sportsmen. Finally, either a large hole must be drilled in the clavicle and the coracoid process, increasing the risk of fracture due to the screws, or the graft is sutured to itself onto the clavicle with high risks of osteolysis and/or infection.

Perfect endoscopic MC and axillary nerve visualization were mandatory in our technique, and consequently, no

### 2.3. Outcome assessment

The patients underwent a detailed clinical examination with standard radiographs for joint reduction or any other complications at a minimum of 24 months postoperatively. The “Simple Shoulder Test” (SSV) is the patient’s self-rated subjective assessment of his shoulder function compared to a normal shoulder. A modified scale of University of Los Angeles for AC joint (UCLA) was also used to assess the overall function and patient satisfaction, which was expressed as a numeric value from 0 to 20 [11].

Plain radiographs were obtained with assessment of both AC joints looking for signs of loss of reduction or any other complications such as fracture, hardware migration, heterotopic ossification and CC distance in comparison with the opposite side.

### Table 1

<table>
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<th>No.</th>
<th>Age</th>
<th>Sex</th>
<th>Side</th>
<th>RW</th>
<th>PS</th>
<th>SSV preoperative</th>
<th>SSV postoperative</th>
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<td>M</td>
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<td>4</td>
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<td>30</td>
<td>90</td>
<td>18</td>
<td>Y</td>
<td>26</td>
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</table>

RW: Rockwood stage; PS: previous surgery; SSV: special shoulder value; UCLA: University California Los Angeles modified rating score; FU: follow-up; WD: Weaver-Dunn procedure.

Fig. 4. Arthroscopic modified augmented Vargas procedure (Draw).

Fig. 5. Plain and comparative X-ray. See symmetric CC distance.
musculocutaneous nerve injuries were experienced. As the MC nerve penetrates the CT in its muscular medial side to innervate the CB muscle [18], the hemi-lateral CT, which is entirely tendinous, can easily be harvested without putting this nerve at risk.

From a technical standpoint, this technique is less skill demanding than the WD or the WDC procedures, as it is easier to harvest the hemi-lateral CT in a wide space than to harvest the CA ligament. Moreover, the AC ligament attached to the apex of the acromion with many variations; it can be difficult to harvest it with a bone block from the tip of the acromion in type D. Gagey's classification (proximal CA ligament insertion at the inferior aspect of the acromion away from its apex), which represents 22.2% of the cases [19].

This technique could be an option in case of chronic and symptomatic dislocated AC joint in case of previous acromioplasty and/or rotator cuff repair when the CA ligament was sacrificed.

Disclosure of interest

The authors declare that they have no competing interest.

References