The Natural History of Bone Remodeling Following Arthroscopic Distal Tibial Allograft with Suture Buttons for Recurrent Anterior Shoulder Instability – Up to 5-year Radiological Outcome

Mamarelis G, More KD, Meredyk D, Rashid M, Leblanc J, Bouliane M, Lo IK

Introduction

Glenoid bone loss has been increasingly recognized as a cause of failure of a soft tissue Bankart repair. Recently, anatomic glenoid reconstruction using distal tibial allograft has gained popularity. However, the overall healing and survivability of the bone graft is unclear. The purpose of this study was therefore to evaluate the healing and remodelling of the distal tibial allograft over time using suture button fixation.

Methods

A prospective study was conducted on 31 patients with glenoid bone loss >13.5% who underwent arthroscopic bony reconstruction of the glenoid with distal tibial allograft using a suture button fixation. All patients underwent computed tomography (CT) scan evaluation preoperatively, at 6 months post-operatively, and at 2 years post-operatively. A subset of 10 patients had CT scans at 5 years post-operatively.

Healing and graft remodelling was assessed in both the sagittal (enface) and axial CT planes dividing each interface into multiple zones. Sagittal views were divided into 3 zones at the graft-glenoid interface (superior = zone 1, middle = zone 2, inferior = zone 3) (Figure 1A). Axial views were divided into 3 zones (superior = zone 1 /middle = zone 2/inferior = zone 3) and then 2 subzones (e.g articular (A) and extra-articular (E)) (Figure 1B). Grafts that were healed in 2 zones or more on the sagittal and axial (articular zone) view were considered healed. Grafts that were healed on 1 zone on the sagittal and axial views were considered partially healed. Glenoid articular reconstruction was evaluated using the PICO surface area method (mm^3).

To determine if graft positioning affected healing, graft position on CT scans was evaluated for medial to lateral position, superior -inferior position, glenoid-graft articular surface angle and graft rotation (in the coronal plane).

Results

Pre-operatively the mean amount of bone loss was 20.4% (range: 13.5 – 34.3%). No patient experienced a dislocation or subluxation episode post-operatively. Overall at 6 months 96.7% of grafts demonstrated partial or full healing of the graft on sagittal and axial CT. The overall healing rate and distribution is summarized in Table 1. The distribution of pre-operative bone loss is listed in Table 1. Using the best fit circle as a template for complete reconstruction of the inferior aspect of glenoid, the amount of surface area reconstructed by the graft is summarized in Table 1. In most cases, a small amount of bone loss was still present within the circle superiorly or inferiorly. There was a significant improvement in glenoid surface area when comparing pre-operative to 6 months, 2 yrs and 5 yrs ($p<0.001$). However, there was no significant change in glenoid surface area after 6 months ($p>0.05$). When evaluating glenoid surface area with the entire bone graft including that outside the best-fit circle, the mean amount of bone loss was 110% (SD 9.4%) (e.g oversized) at 6 months and 94% (SD 19.0) at 2 yrs. This was significantly different than pre-operatively and between 6 months a 2 yrs ($p<0.001$). Overall there was no significant change in glenoid surface area using either method between 2 and 5 yrs ($p>0.05$).

With respect to graft positioning, 4/31 (12.9%) grafts were angulated more than 30° towards the humerus compared to the glenoid articular surface. Nine grafts (29%) of the grafts were medialized more than 2.5mm or lateralized more than 1mm. Ten of the grafts (32.2%) were positioned 6 mm or more superiorly from the inferior part of the graft to the inferior glenoid. Three of the grafts (9.6%) had a rotation of more than 10° in the coronal plane. The healing rate was affected by graft position. Patients with grafts positioned > 2.5 mm medial or with >10° of rotation in the coronal plane had lower healing rates ($p=0.02$).

Discussion

Arthroscopic anatomic glenoid reconstruction with distal tibial allograft, employing suture buttons, demonstrated high rates of healing with adequate reconstruction of the glenoid articular surface. Grafts continued to remodel up to 2 yrs following surgery but did not remodel between 2 and 5 yrs. Graft positioning was variable when using suture button fixation. Graft positioned > 2.5 mm medial to the articular surface or with >10° of rotation in the coronal plane had lower healing rates. Care must be taken when positioning the graft using suture button fixation to optimize healing rates and reconstruction of the glenoid articular surface.

Figure 1

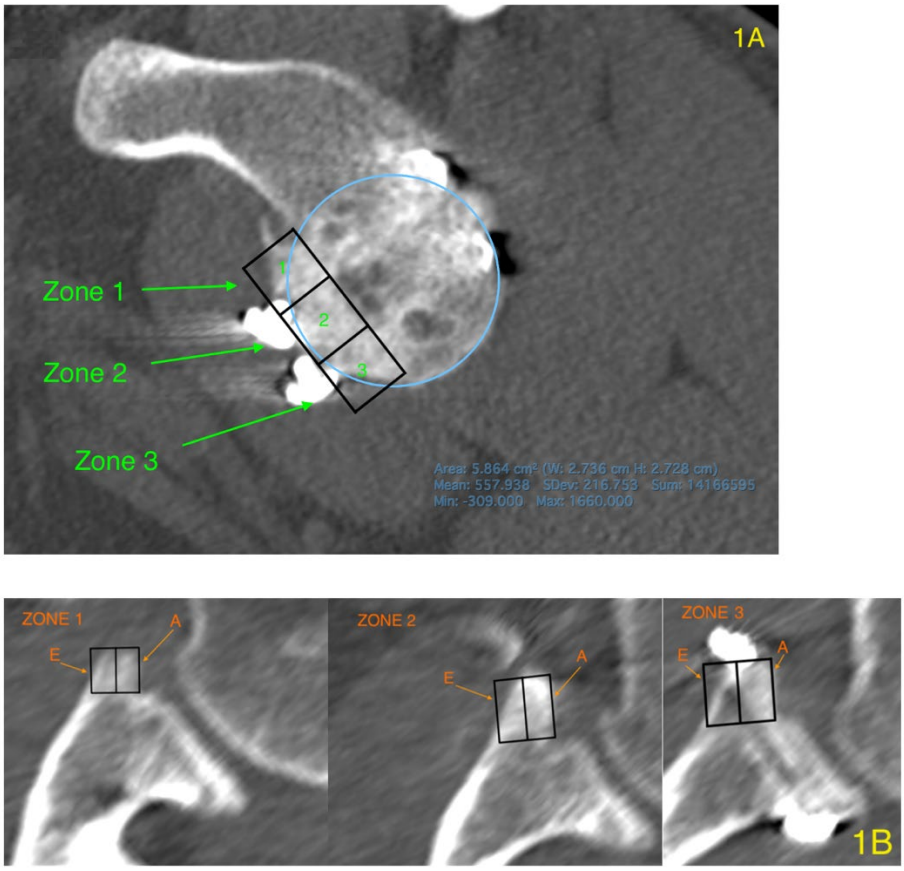

Table 1

	Pre op	**6 months**	**2 yrs**	**5 yrs**
Healing Rate				
None	N/A	1 (3.3%)	5 (16.6%)	0
Partial	N/A	10 (32.2%)	4 (13.3%)	0
Fully	N/A	20 (64.5%)	20 (66.6%)	10 (100%)
Bone Loss				
0-13.5%	0	28 (90.3%)	25 (83.2%)	10 (100%)
13.5-20%	16 (48.4%)	0	4 (13.3%)	0
>20 %	15 (51.6%)	3 (9.7%)	1 (3.3%)	0