INTRODUCTION Hills-Sachs lesions are commonly associated with anterior shoulder dislocations and can be a source for recurrent instability. Studies have shown that even after soft tissue reconstruction and repair of a Bankart labral tear there still may be a risk for recurrent instability and dislocations. These events are thought to be due to significant bony defects. Many authors have described surgical techniques to address the bony defect in the humeral head. These techniques are typically through open approaches and thus add to the invasiveness of the procedure. Reduction of vertebral body compression fractures has been described and the use of a percutaneous balloon is FDA approved. We wanted to apply this technique in the humeral head to demonstrate a potential use to reduce a Hill-Sachs lesion. We have defined this technique as humeroplasty. The purpose of this study is to ascertain if balloon humeroplasty is an effective technique of reducing acute Hill-Sachs defect in a human cadaveric model. We hypothesize that this balloon technique will effectively reduce an acutely created Hill-Sachs lesion in human cadaver humeri.

METHODS Eighteen cadaveric humeri dissected free of soft tissue were used for this study. Computed tomography (CT) scans were used to determine the volume of native humeral head, post Hill-Sachs lesion, and after the balloon humeroplasty. Hill-Sachs lesions were created in a reproducible manner with a mallet edge. (Fig 1) These were created at the anatomic location on the posterolateral aspect of the humeral head typically seen after anterior glenohumeral dislocations. A small transcortical window was created along the posterolateral humeral shaft and inferior to the Hill-Sachs lesion with a trochar. (Fig 2) A transosseous tunnel was created and ended juxtaposed to the Hill-Sachs lesion. This was visually guided and confirmed with fluoroscopy. (Fig 3) A collapsed balloon (Medtronic, Memphis, TN) was passed through this tunnel and inflated under fluoroscopy to reduce the Hill-Sachs lesion. The reduction was confirmed with direct vision and with fluoroscopy. The balloon was deflated and removed. Bone cement, PMMA, (Stryker-Howmedica, Mahway, NJ ) was percutaneously placed through the bone tunnel to fill the void created after the balloon was removed. CT scan volume data and percent corrected were calculated. (Fig 5) Paired ANOVA t-test was performed to analyze the data with significance placed at p<0.05.

RESULTS The results are summarized in the table. The average volume of the created Hill-Sachs defect was 1515.5mm³. The average defect volume after balloon humeroplasty was -31mm³ with 99.3% reduction to the original humeral head volume. The reduced Hill-Sachs lesion was found to be statistically significant with p=0.0004. It was not uncommon to over-reduce the lesion which led a non-congruent surface and at rare times PMMA cement leakage. This novel technique may be used to address large Hill-Sachs lesions in the clinical presentation of shoulder instability. This technique may be potentially used as an adjunct to Bankart labral repair surgery and could be performed arthroscopically or with a mini-open technique. The use of bone graft to fill the balloon created void instead of PMMA should be considered to prevent thermal injury or the extravasations of PMMA cement into the joint and to allow for a more biologic substance. The authors are currently considering this technique in the surgical setting.

DISCUSSION Balloon humeroplasty proved to be an effective technique for reducing an acute Hill-Sachs lesion created in a cadaveric model. Although this study was in a controlled environment with direct visualization and in human cadaveric humeri we believe this technique may be used to address large Hill-Sachs lesions in the clinical presentation of shoulder instability.

SIGNIFICANCE This novel technique has potential to be used in the arthroscopic clinical setting to help reduce Hill-Sachs lesions in order to potentially reduced recurrence of glenohumeral instability.

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