Introduction: Recent advances in arthroscopic shoulder surgery have led to the detection of more subscapularis tendon tears, especially partial tears. To further our understanding of these tears and the subscapularis tendon, we revisited the footprint anatomy with a three dimensional perspective using MicroScribe 3 DLX. There are several footprint anatomy studies in previous literature; however, all have described the subscapularis tendon insertion footprint as a two dimensional area describing as “Comma shape” or “State of Nevada”. However, the subscapularis insertion is very broad and long on the anterior aspect of the humerus with different planes based on tendon fiber orientation. Therefore, the purpose of this study was to redefine the footprint anatomy in a 3-dimensional perspective relative to the supraspinatus footprint and humeral shaft axis.

Methods:
Footprint anatomy of the subscapularis was analyzed using 42 human cadaveric shoulders by digitizing the bony insertion using a MicroScribe 3DLX (Figure 1). Inclusion criterion for subscapularis footprint study was intact subscapularis tendon attached to the humerus with no visible subscapularis tendon tear. All other soft tissues were removed leaving only the subscapularis tendon and proximal humerus. Pilot studies revealed that 4 distinctive planes (termed facets) exist, therefore, these margins were outlined and digitized using a MicroScribe. The geometry of the humerus was divided into two parts: articular humeral head surface and the remaining surface of the humerus. The geometry of the humeral head articular surface was defined by 49 points. Starting from the circumferential edge of the humeral head, the rest of the humerus was divided into 6 cross-sections of the proximal humerus shaft. Each cross section was circumferentially divided into twelve points. The dimensions of each facet and the slope of each facet relative to the humeral shaft axis were evaluated. The first plane (1st facet) of the supraspinatus footprint was also digitized. All digitized data were reconstructed using a 3-D graphic tool.

Results:
Observation of the natural bony ridges revealed a subscapularis footprint divided into four distinct facets (Figure 1).

Figure 1-1) Coronal view of four distinctive footprint planes 2) Sagittal view of different footprint planes.

Figure 2. Reconstruction of the proximal humerus, four subscapularis facets and 1st supraspinatus facet.

The subscapularis tendon insertion areas of the four facets decreased from facet A superiorly to facet D inferiorly from 174.3 mm² (34% of footprint), to 145.8 mm² (28%), 115.7 mm² (22%), and 77.0 mm² (15%), respectively. With respect to the 1st facet of the supraspinatus (Supra A) the area was approximately equal to the 3rd facet of the subscapularis.

Discussion:
This study defined a more descriptive morphology of the subscapularis tendon footprint. The 1st facet is the largest compared to the other 3 facets. The first two facets represent more than 60% of the subscapularis insertion area. Also, since the plane of insertion is quite different, the 1st facet of subscapularis may be the main footprint that is visualized during arthroscopic exam. From the angle of insertion relative to the humeral shaft axis and first facet of supraspinatus, the role of the superior portion of the subscapularis appears to be abduction rather than rotation.

Significance:
This study defined a more descriptive morphology of the subscapularis tendon footprint, identifying the superior most portion of the subscapularis as the largest footprint with a facet angle that suggests it may provide more of an abduction force.

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References