Ankle Fracture Displacement on Three dimensional CT ScanAnkle Fracture Displacement on Three dimensional CT Scan

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INTRODUCTION:

Supination-external rotation (SER) ankle fractures are the most common Lauge-Hanse ankle fracture subtype. SERvariant ankle fractures are evaluated for instability commonly with the 2-dimensional radiographic measures such as medial clear space (MCS), valgus tilt, fracture displacement, and more recently lateral talar subluxation (LTS). Radiographic measurement validity is argued. We evaluated unstable SER-variant ankle fractures with CT scans to quantify 3-dimensional talar displacement and examine correlation and accuracy compared to standard 2-d measurements in addition to novel characterization of rotational ankle displacement.

METHODS: Retrospective review of acute, unstable bi or trimalleolar ankle fracture, or bimalleolar equivalent SER-variant isolated lateral malleolar fractures with injury radiographs and CT scans were performed on 115 patients. Standardized measurements of radiographic MCS and LTS were acquired as well as CT scan corollary measurements of the Axial MCS, Axial LTS, a novel measurement of Axial rotation angle, Coronal MCS, and Coronal LTS as illustrated in Figure 1. Regression analysis was performed to predict the amount of rotational displacement by MCS or LTS abnormalities.

RESULTS: Axial MCS, Axial LTS, Axial rotation angle, Coronal MCS, and Coronal LTS measurements were first obtained on 115 patients. Mean(+/- for 1 standard deviation) MCS, Axial LTS, Coronal LTS, and Axial rotation angle were 4.49 +/- 1.81, 2.19 +/- 2.34, 1.56 +/- 2.23, and 8.62 +/- 6.29 respectively. There were significant correlations between MCS and LTS (R=0.58 and 0.35, respectively. (Figure 2) which were statistically significant (p<0.00001). Regression analysis of the Axial MCS, Axial Rotation angle and Axial LTS were performed to predict rotational displacement per MCS or LTS value with regression coefficient 1.96 and 0.94 for MCS, LTS respectively. Each 1mm MCS increase = 2 degrees of talar external rotation displacement.

DISCUSSION AND CONCLUSION: 3-dimensional measurement of talus displacement in SER-variant ankle fractures confirms characteristic posterolateral talus translation and axial rotational displacement. Significant external rotation displacement is correlated to MCS and LTS increases in unstable ankle fractures which is unrecognized on standard radiographic assessment and can be predicted by increases in MCS or LTS. Rotational displacement is a new marker, and this study supports further evaluation with CT imaging.





Figure 1