

Bone Density Analysis of the Sacroiliac Joint Along Two Alternative Trajectories

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Introduction

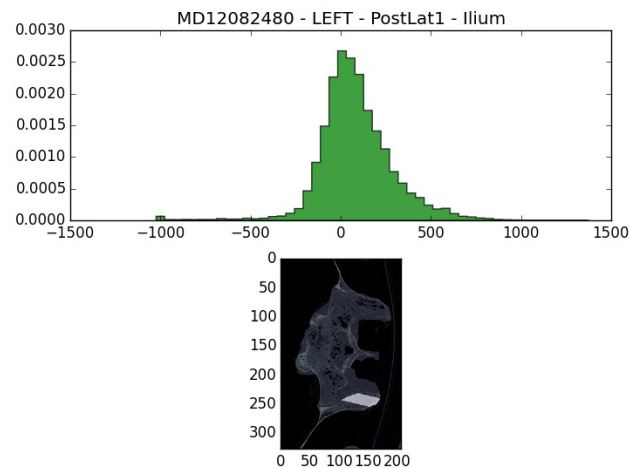
The surgical trajectory within the CT scan of human cadaveric specimens of three laterally (L) and two posterior-laterally (PL) placed implants were simulated to compare bone density along them.

Methods

Nine human cadaveric specimens were CT scanned using a clinical CT scanner (Somatom, Siemens, Munich, Germany).

The sacrum and ilia of each specimen were segmented using ScanIP (Synopsys, Mountain View, CA). Cylindrical volumes approximating each trajectory were defined. The voxels in each CT scan lying within these volumes were identified, and the voxels lying within the intersection of these volumes and each sacrum and ilium volume were identified. The Hounsfield Units (HU) of the voxels within each of these intersecting volumes were then used for analysis.

Bone Density along Posterior Lateral Trajectory



A histogram of voxel HU is shown for voxels lying within the posterior lateral trajectory and the ilium of a single specimen along with an axial slice of the CT scan.

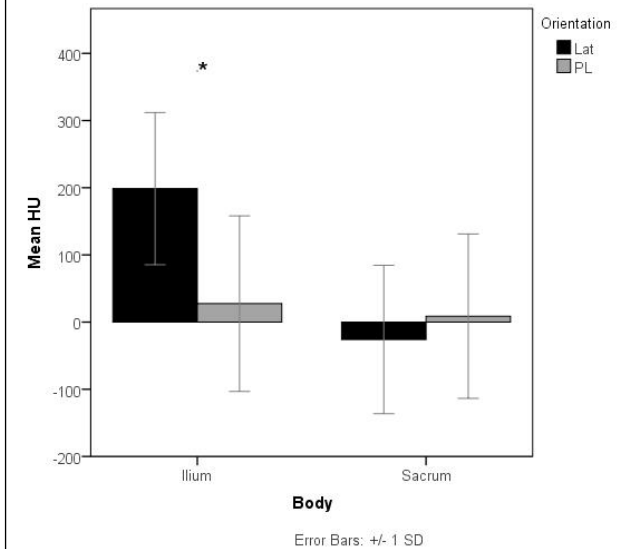
Results

A 2-Way MANOVA on Mean, Median, Cortical Volume, Bone Density, Cortical Density, Cancellous Density and Bone Fraction was conducted over Body (Sacrum/Ilium) and Orientation (L/PL) with Bonferroni-corrected post hoc analysis.

All measures except cancellous density were found to be significantly greater in the Ilium for the L trajectories compared to PL ($p < 0.001$). No significant differences were detected between orientations within the Sacrum.

All seven outcome measures were significantly greater in the Ilium compared to the Sacrum when compared irrespective of orientation ($p < 0.001$).

Mean HU Between Trajectories



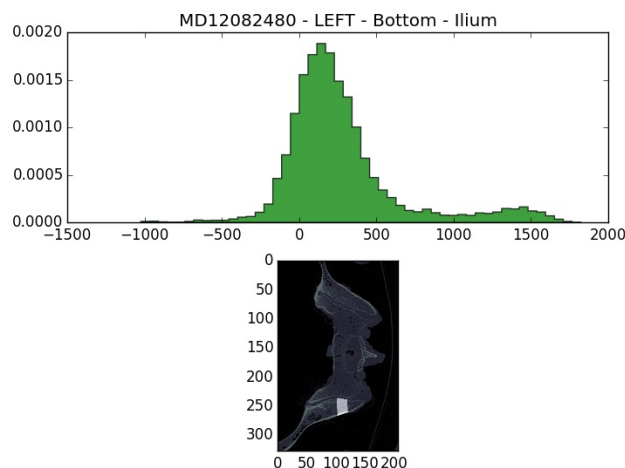
The mean HU of voxels lying within each bone and along each trajectory are shown. *A statistically significant difference was detected between trajectories within the ilium.

Conclusions

The results of this study indicate greater density of bone in the Ilium along the L trajectory compared to the PL trajectory. The finding of greater density along this trajectory is driven not only by a greater volume of cortical bone in the lateral region, but also by a greater mean density of the cortical bone found there. These findings indicate a potential for superior fixation within the lateral ilium compared to the posterior.

This study also indicates greater measures of bone density in the ilium compared to the sacrum.

Bone Density Along Lateral Trajectory



A histogram of voxel HU is shown for voxels lying within the lateral trajectory of an ilium specimen along with an axial slice of the CT scan.