COMPARISON OF IMAGES BETWEEN UPRIGHT FONAR MRI AND SUPINE DYNAWELL MRI

Ehran Khan and Alan R. Hargens
Department of Orthopaedic Surgery, University of California, San Diego

Although the upright MRI has lower magnetic power and thus provides lower resolution imaging than supine MRI, it is thought to offer a more physiologically relevant representation of soft tissues, stemming from the fact that the weight bearing over the spine is in the upright position which is not present in the supine MRI.

To evaluate whether there is a difference between the upright and supine Dynawell MR images, 15 subjects completed both an unloaded and 40 percent body weight (BW) loaded MRI spine test using a Dynawell device, as well as an upright MRI spine test at the Vital Imaging facility.

For the supine MR images, a vest was connected to the compression device without axial load and MR images of the lumbar spine were acquired.
Then while subjects remained in supine position in the 1.5 Tesla MRI, their lumbar spines were loaded axially to a force equal to 40 percent BW using the compression device. The load was allowed to equilibrate for five minutes before MR images were captured.
For the upright MR images, subjects first rested 30 minutes prior to sagittal T2 imaging scans of their lumbar spine.
Then the subjects remained in an upright posture as the force is approximately equal to 40-50 percent BW on the lumbar spine when standing. After upright load was allowed to equilibrate for 5 minutes, sagittal T2 scans of the lumbar spine were obtained.

A hypothesis test was conducted for the difference in average global Cobb angle between upright and supine loaded MRI tests and between upright and supine preloaded supine MRI tests. The null hypothesis stated that there was no difference between the two tests. At the 5 percent significance level ($p<0.05$), the difference in means between upright and supine-loaded tests yielded test statistics of 1.408, 1.555, and 1.412 for T12-S1 global lordosis, L1-L5 global lordosis, and L1-L5 global lordosis (posterior tangent method), respectively.

The difference in means between upright and supine-preloaded tests yielded test statistics of 0.484, 0.316, and 0.186 for T12-S1 global lordosis, L1-L5 global lordosis, and L1-L5 global lordosis (posterior tangent method), respectively. These test statistics were all less than 1.96 (the critical value for $p<0.05$).
Therefore, the null hypothesis could not be rejected for either difference in means in any of the three cases.
There was no statistically-significant difference in average global Cobb angle between upright MRI and supine MRI (loaded or preloaded).

Thus, the Dynawell device for supine MR imaging can be used to replace upright MR imaging and maybe preferable if higher resolution images are needed.