AbstractID: 13192 Title: A fast subpixel resolution double Gaussian Winston Lutz algorithm

Purpose: To implement a fast algorithm (fWL) for accurate analysis of digital Winston Lutz isocenter test images without edge detection or center of mass calculations.

Methods and Materials: An algorithm has been developed to determine the centers of a ball and cone in Winston Lutz evaluation images. Images used for clinical assessment of mechanical/radiation isocenter agreement were imaged with an EPID. Based on the EPID images, a test set of images were created with true knowledge of the offsets of the ball and cone. The fWL algorithm employed the double convolution of two Gaussian blurred circles with the Winston Lutz test images such that the location of the maximum of the convolution was the location of the center of the ball or cone. A subpixel estimation subroutine was employed in the convolution calculation. Results of the algorithm were compared to human observer with template guidance and a Center of Mass (COM) algorithm for high resolution (0.05mm/px, film) and low resolution (0.78mm/px, EPID) image sets.

Results: The center locations were calculated with the fWL algorithm for the high-res test images with an accuracy of 0.002±0.061 mm compared to 0.042±0.294 mm for the human observer, and 0.003±0.038 mm for the COM. The fWL algorithm required 0.01 s per image compared to 5 s for the COM algorithm and 20 s for the human observer. For lower resolution images the fWL algorithm localized the centers with an accuracy of 0.083±0.12 mm compared to 0.03±0.5514 mm for the COM algorithm.

Conclusion: A faster (sub second) subpixel algorithm has been developed that can more accurately determine the center locations of the ball and cone in Winston Lutz test images without edge detection or COM calculations.

No Conflicts of Interest to Report.