AbstractID: 3493 Title: Human and system error analysis of a 3D optical laser scanning system for image-guided patient positioning

Purpose:
The final goal of this research is to develop a patient repositioning system using a 3D optical laser scanner. We investigated the magnitude of human and system errors, which determines the accuracy of the patient repositioning system. We also scanned four breast patients to test the efficacy of this system.

Method and Materials:
A handheld 3D surface scanning system acquires patient surface images, which are registered to a reference image using a rigid body transformation. The resultant image registration generates the patient position adjustment to match the images. We evaluated human and system error associated with this positioning technique. To measure human error, ten operators performed ten experiments to acquire the same reference point. To evaluate the system error, we attached the receiver (serving as the origin of the surface image data) to the X-Y-Z positioning system and measured the discrepancy between the measured physical position and the scanner reported distance in three axes. We also scanned four breast patients and analyzed the repositioning errors.

Results:
The mean human error and standard deviation were evaluated to be 1.86mm and 0.66mm, respectively. The system mean error and standard deviation were found to be 0.4mm and 0.32mm (n=45), respectively. Image translation and rotational shifts from the patient study ranged from 5mm to 15mm and –6° to 11°, respectively.

Conclusion:
We have experimentally evaluated human and system error associated with a new 3D hand-held laser scanner positioning system. As shown in the result, human error was much more significant than system error. This handheld 3D optical scanning system has proved its capability as a tool for patient repositioning between fractions. Future investigations will examine the relation between surface images and internal target localization.