Picture This: A Novel Approach to Limb Donor Matching, Prosthetic Design and Bone Allografts

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Annually, over 1.5 million bone grafts occur in the United States, many that are specific to bone allografts. Computer-assisted surgeries leveraging the 3-dimensional (3D) features of graphically re-constructed pre-operative computed tomography (CT) scans are used to provide live details on where to transplant the allograft on the bone of the patient. The numerous benefits of using computer-assisted surgeries are unfortunately hindered by current limitations within the operating room. To reference pre-operative CT scans for the computer-assisted surgery, calibration must occur to compensate for potential deviations in positioning between the bone's position during the pre-operative CT scan and its position during the transplant. Traditionally, a contact coordinate measuring probe is used to measure the bone's position in the operating room, taking over 20 minutes, usually gathering under 15 reference points and generally presenting concerns of maintaining a sterile environment due to needing to come in physical contact with the bone. A low-cost alternative for computer-assisted surgery calibration in bone grafting scenarios was proposed using structured light 3D scanning techniques that leverage the power of sub-pixel resolution imaging. Compared to the contact coordinate measuring probes used today in these types of surgeries, the 3D scanner built averages over 200,000 times more points measured, in under 4% of the time, while never touching the patient and maintaining a cost affordable for use in developing nations. The project also explores the ability of creating low-cost 3D printed custom prosthetic limbs and creating donor-recipient matches for limb transplants using the same 3D scanning technology.

Awards Won:

Third Award of $1,000