

# ACS 2024 Surgeons and Engineers: A Dialogue on Surgical Simulation Meeting

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## Research Abstracts

### Computer Simulation Can Augment Preoperative Planning of Periacetabular Osteotomies

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**Introduction:** Periacetabular osteotomy (PAO) corrects developmental dysplasia of the hip (DDH) by reorienting the acetabulum while maintaining a functional hip joint. Pre-operative planning can be automated by computer optimization of a three-dimensional (3D) model. However, it is not known how well this approach compares to conventional plans created by experienced hip surgeons using two-dimensional (2D) images. In this study, we compare 3D planning to conventional planning after a PAO.

**Methods:** Computer models were prepared from CT scans of 22 hips and a Bernese osteotomy was simulated allowing the acetabular fragment to be mobilized in all anatomic planes. Pre-operative radiographs were digitally reconstructed from the models and presented to an experienced surgeon to create optimal plans. Three computer-generated plans were created by varying the position of the acetabular fragment. The algorithm for the plans individually optimized coverage area, joint motion, and a combination of both. The outcomes of computer-generated plans were compared to the manual 2D plan and statistically significant differences were determined.

**Results:** The accompanying image shows the results of automated planning routines compared to manual planning. No statistically significant differences between outcomes optimizing coverage area. Scenarios including range of motion produced significant differences in all outcomes ( $p < 0.001$ ).

**Conclusions:** Automated preoperative plans generated to guide acetabular reorientation in PAOs are similar to those created by expert evaluation of 2D images. Automated planning also allows the surgeon to vary their plan to weight head coverage vs. joint motion post PAO.

	Coverage Algorithm	Range of Motion Algorithm	Anterolateral Coverage Algorithm
Total Head Coverage	1.0±0.6%	-2.8±0.7%	-0.2±0.6%
Anterolateral quadrant coverage	6.6±3.6%	-14.0±3.0%	9.6±3.6%
Range of motion	-0.7±1.1°	5.6±1.1°	-3.0±1.1°
Acetabular Inclination	-1.5±0.8°	0.8±0.9°	-0.6±0.8°
Acetabular Flexion	1.6±1.2°	2.1±1.1°	3.1±1.4°
Acetabular Anteversion	-1.4±1.0°	1.5±0.9°	-2.5±0.8°