

The Effect of 3-Dimension Printing Modeling for Treating Complex Acetabular Fractures: A Randomized Prospective Study

Hu Wang, MD; Kun Zhang, MD; Yan Zhuang;
Pelvis and Acetabular, CANADA

Background/Purpose: Treating complex acetabular fractures presents a risk of malreduction due to difficulty in conceptualizing the fracture orientation and recreating the normal anatomy. There is also a risk of inadvertent penetration of the joint by the screws used during instrumentation. Inadequate preoperative planning can increase the times and blood loss during the operation. Fracture modeling using 3-dimension printing can precisely replicate the 3-dimensional osseous structures. This is not only helpful in understanding the fracture configuration, but also preoperative templating and contouring of the plates and planning various screw trajectories. Using the 3-dimension printing modeling for preoperative planning and surgery simulation, our goal was to evaluate the effect of 3-dimension printing modeling for treating complex acetabular fractures through a randomized prospective study, especially focus on operating time, blood loss, reduction, and position of internal fixator.

Methods: This study tests the hypothesis that use of 3-dimension printing can significantly improve technical ability on complex acetabular fractures. Fifty cases with complex acetabular fractures were randomly and equal divided into two groups, with group 1 using conventional radiographs and 3-dimensional CT for preoperative planning, and group 2 using conventional radiographs, 3-dimensional CT, and 3-dimension printing modeling for preoperative planning and simulation surgery by the surgeon and the first assistant-recording operative time, blood loss, reduction, internal fixation position, and satisfaction of the surgeon by an investigator who did not attend the process from preoperative planning to the end of operating. The accuracy of reduction was evaluated with postoperative CT scans.

Results: All operations were completed by the same senior surgeon and assistant. Time of operation: Statistically significant difference was determined between group 1 and group 2, respectively: 202 ± 50 minutes, 179 ± 62 minutes. Blood loss: Statistically significant difference was determined between group 1 and group 2, respectively: 600 ± 200 mL, 450 ± 150 mL. According to the Matta classification radiographic grades were excellent in 12, good in 8, poor in 5 in group 1 and excellent in 16, good in 6, poor in 3 in group 2; in group 1 there was one case with screw into joint and two cases with one screw out of bone, five cases with screw that was short. In group 2, two cases with screw short. Satisfaction of the surgeon: Statistically significant difference was determined between group 1 and group 2, respectively: 19 (76%) cases, 23 (92%) cases.

Conclusion: 3-dimension printing technology promises to be extremely versatile and can be used in preoperative planning and surgery simulation. It is beneficial for reducing operating time and blood loss, and also helps to reduce the fracture and insert the screws as the surgeon desired.