Introduction: Pelvic and acetabular osteotomies are commonly performed to treat different pathologic hip conditions. In the adolescent population, these osteotomies are performed to improve femoral head coverage in an attempt to both stabilize the hip and to allow for more natural femoral head growth. Acetabular osteotomies are commonly fixed with fully threaded stainless steel screws. However, due to the remaining growth years, these screws often become embedded in bone. Since these patients will often times be converted to a hip replacement in adulthood, the steel screws must be removed. This second surgery to remove the screws poses further risk to the patient due to anesthesia and the potential for infection. A resorbable screw that provided adequate stability for this type of surgery would be extremely beneficial to both the pediatric orthopedic surgeon and the total joint surgeon. Thus, the purpose of this study was to compare the biomechanical properties of a triple innominate osteotomy fixed with either bioabsorbable or stainless steel screws.

Methods: Triple innominate osteotomies were performed on composite hemipelvis and fixed with either three 4.5mm PLLA bioabsorbable screws (Inion Inc., Tampere, Finland) or three stainless steel 4.5mm screws (Synthes Inc., Paoli, PA). Two screws were placed from the iliac wing above the acetabular fragment and one screw was placed from the acetabular fragment below into the iliac wing (Figure 1).

Results: For excursion in the axial direction, there were no differences between two resorbable (141.6±53.9N/mm) and three resorbable screws (121.5±72.9N/mm) (Figure 4). There were no differences between two steel (121.8±34.7N/mm) or three steel (196.2±76.3N/mm) screws for initial stiffness. For initial stiffness in the spica direction, there were no differences between two resorbable (59.7±18.9N/mm) and three resorbable (68.3±25.0N/mm) screws. There were also no differences between two steel (83.8±16.0N/mm) and three steel (88.9±24.6N/mm) screws. The spica direction was found to have a statistically significant decrease in initial stiffness compared to the axial direction (p<0.001). Post-hoc comparisons reported a statistically significant increase in initial stiffness for the steel screw fixation compared to the resorbable screw fixation (regardless of screw number) (p<0.011).

Discussion: For fixation of triple innominate osteotomies, bioabsorbable screws demonstrate comparable biomechanical properties to stainless steel screws in all directions of loading within the physiologic loads tested. Flexion and abduction of the femur adversely affects the stability of the construct for both materials. Bioabsorbable screws have comparable biomechanical stability to steel screws for fixing triple innominate osteotomies and would not require a second surgery for screw removal. Studies are now underway to examine in-vivo stability and potential problems such as osteolysis or infection.

Acknowledgements: This study was funded in part by a research grant from the Children’s Hospital Orthopedic Research and Education Fund.