

Clamp Fixture for Computer Navigated Total Hip Arthroplasty

by *Lauren Aguiar, Juan Lizardi, Dionis
Perez, Angie Estrada*

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During total hip arthroplasty, surgeons insert a prosthetic femur head onto the femur bone, as well as inserting a prosthetic acetabular cup so both prosthetic components can cope with one other. Surgeons also insert pins onto the hip and femur bones to track the movement of those bones via infrared arrays, using computer navigated software, in order to mitigate surgical error. In the US there is more than 310,000 total hip replacement surgeries conducted per year, most of which are over the age of 45. Hip replacement surgery is needed for individuals who have osteoarthritis, avascular necrosis, and/or trauma. The average stay after total hip replacement for patients aged 45 and over is 4 days. The average cost of the surgery is about \$31,000. Decreasing recovery time in the hospital by just one day can decrease the cost between 10-20%. The greatest risks of this procedure would be misalignment of the hip bones or impairment of the femur bones. The objective is to design a surgical clamp fixture which will replace the current pins being used. Instead of penetrating a hole of 10 mm in diameter onto the hip, the design will clamp onto the iliac crest horizontally, along with the attached infrared arrays and provide proper fixation with no more than 0.5 mm of deviation from the clamping axis. By performing specific testing protocols the resulting outcome will be more beneficial than the current pins. The clamp fixture will be applied to synthetic material and then subjected to surgical forces, including application of excess forces along all axis', torsional forces and rotational forces to ensure stability and rigidity. The surgical clamp will be used to improve the clinical outcomes of the procedure by introducing a less invasive attachment for the infrared detection without compromising the current rigidity and effectiveness.