SHOULDER PROJECT

Steffani Vivani
HMRC-CREATE 2010 Summer Intern
Dr. Kevin Deluzio's Lab

Abstract

This project is based on examining the stabilizing factors of reverse shoulder prostheses. The reverse shoulder prosthesis is a joint replacement implant that reverses the anatomy of the shoulder: a humeral cup replaces the ball like head on the humerus, and a glenosphere (half sphere) replaces the glenoid cavity on the scapula. Certain components of the implant: the humeral stem, humeral cup and glenosphere, are offered in varying sizes/styles and can be positioned differently and it isn't entirely clear which configuration is optimal.

This type of surgery is directed towards patients with osteoarthritis along with severe rotator cuff deficiencies to the point where the rotator cuff muscles can no longer function properly. The biomechanics of the reverse anatomy implant allow the affected patient to gain back some of their lost arm motion. It does this by medializing the centre of rotation of the joint (moving it closer to the body) as well as distalizing it (moving it towards the feet), which recruits more deltoid muscle fibre for arm abduction.

This shoulder project is testing the stability of the osteoarthritic/rotator cuff deficient shoulder using artificial bone, Sawbones (Pacific Research Labs, Vashon, WA), and attaching cables to simulate the remaining muscles in the shoulder. The cables are connected to the humerus through a humeral bone fixture, then pass through a guide on the coracoids process/acromion and then finally through guide holes in the scapula holder where they connect with the pneumatic actuators which apply the muscle loads. The specific mechanical factors that we will be testing are: centre of rotation medialization, neckshaft angle, glenosphere radius and humeral liner constraint.

The purpose of this project is to see how joint stability/force to dislocate along with range of motion and impingement are affected by moving the centre of rotation closer/farther from the body (medialization), changing the angle between the cup and the stem of the humeral component (neckshaft angle), changing the size of the glenosphere (glenosphere radius) and increasing the height of the humeral cup liner (humeral liner constraint).