

Tibial Stent Design Team Progress Report

Client: Dr. Matthew Halanski

Advisor: Dr. Paul Thompson

Team: Evan Lange *elange2@wisc.edu (Team Leader)*
Karl Kabarowski *kabarowski@wisc.edu (Communicator/BSAC)*
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Date: April 25th, 2014 – May 2nd, 2014 (Week 14)

Problem Statement

(revised 02/03/14)

Tibia fractures are common in children, and these injuries are currently managed nonoperatively using casts; however, a surgically implanted device would provide more structural stability and aid the healing of the fracture. Adult patients with this injury typically have a rigid intramedullary device implanted into their tibia bone. Unfortunately, these implants cannot be used in pediatric patients due to the presence of growth plates at the implantation site. A previous design team produced a working device that can enter the medullary canal through a hole in the side of the bone and then expand outward to stabilize the fracture, held in place by static friction against the canal wall. This device is flexible enough to fit into the canal, yet rigid enough to maintain fracture reduction, can be secured in place with screws, and can be removed from the canal when desired; however, the device is not fully fixated against the walls of the bone canal, and the friction force of the device is not sufficient to prevent axial rotation within the canal. This rotation can lead to device failure resulting in unnecessary pain for the patient and extra surgery to correct the issue. Last semester, this team designed a theoretical device consisting of a threaded segmented centerpiece inside of a metal biaxial braid. When the centerpiece is rotated, the braid experiences a compressive load, which causes it to expand radially. This radial expansion would ultimately provide the force to stabilize the fracture; however, the current design does not allow for sufficient force to be applied to the centerpiece.

The goal of this semester is to improve the design from last semester by strengthening the centerpiece joints, which will give us the ability to build and test a prototype, and develop a novel tool that can rotate the centerpiece when the implant is placed into a bone.

Last Week's Goals (14-21 days ago)

- Obtain all materials and begin fabrication as soon as possible
- Contact COE Student Shop personnel regarding TIG welding of braid to cap circumference
- Prepare SawBone models for testing
 - cut the bones at the fracture point
 - drill 8mm hole at 45° angle at top of canal

This Week's Goals/Individual Goals (14-0 days ago)

- Complete device fabrication
- Complete device testing
- Complete poster for poster presentations

This Week's Accomplishments

- Completed device fabrication
- Completed device testing/data analysis
- Completed poster for poster presentations

Project Difficulties

- n/a

Next Week's Team Goals

- Final report
- Evaluations
- Notebooks

Summary of Design Accomplishments

- The team is meeting weekly to accelerate the design process
- The team has a meeting scheduled with the client to discuss goals for this semester and to obtain information about quantifying device performance constraints
- The team has met with Dr. Halanski to discuss goals for this semester
- The team has completed the Design Matrices for this semester and the Midsemester Presentation
- The team has completed the Midsemester Report
- The team has conducted bend testing of K-wires and finalized 2 candidate diameters that are ideal for use with this device
- The team has ordered caps for both 3/32" and 5/64" diameter K-wires
- The team has ordered a flexible hollow drive shaft and a hexagonal brooch to implement the device inside the tibia canal
- The team has completed a prototype
- The team has completed testing of the prototype and elastic nails
- The team has created the poster for the poster presentation

Expenses

- ACE Hardware - \$6
- Polygon Solutions - \$392 (external hex broach)
- Casperson - \$669 (caps)
- Badger Welding supply - \$87

Activities

Person(s)	Task	Time (hrs)	Weekly Total	Semester Total
Evan	<i>Team Role (Leader)</i>		42.0	137.0
	Weekly progress report	1.0		
	Developed next week's team goals	0.5		
	<i>Other</i>			
	Badger Welding	1.0		
	Trips to Caspersen (x4)	6.0		
	Fabrication/Testing in Student Shop	27.5		
	Meeting with Russell at Caspersen	0.5		
	Device check	0.5		
	Data Analysis	3.0		
Poster	2.0			
Karl	<i>Team Role (Communicator/BSAC)</i>		52.0	160.0
	Locating silver solder	1.0		
	Caspersen	2.0		
	Polygon Solutions	0.5		
	<i>Other</i>			
	Search for silver solder	2.5		
	Trips to Caspersen (x4)	6.0		
	Fabrication/Testing in the Student Shop	33.5		
	Meeting with Russell at Caspersen	0.5		
	Acetone treatment/device check	4.0		
Poster	2.0			
Tyler	<i>Team Role (BPAG)</i>		38.5	93.5
	Excel sheet of expenses for Dr. Halanski	1.0		
	<i>Other</i>			
	Search for silver solder	2.5		
	Trips to Caspersen (x2)	3.0		
	Fabrication/Testing in the Student Shop	29.5		
	Device check	0.5		
Poster	2.0			
Sarah	<i>Team Role (BWIG)</i>		35.0	96.5
	Updated design website	0.5		
	<i>Other</i>			
	Badger Welding	1.0		
	Trips to Caspersen (x2)	3.0		
	Fabrication/Testing in the Student Shop	28.5		
Poster	2.0			

