# **BiOM Prosthesis Adapter**

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#### **Project Description**

The BiOM Prosthesis Adapter team's purpose is to design an adapter that attaches to a bent knee. This adapter will allow a below-the-knee amputee to connect their limb with the ankle prosthetic, allowing comfortable and easy use. This team is working together to aide in making improvements within the medical field.



Image 1: BiOM Ankle Prosthesis

#### Client / Stakeholders

Client:

- > Dr. Zachary Lerner
- > Thomas

#### Stakeholders:

- Below-the-knee amputees
- > Doctors
- > Hospitals

#### **Background & Benchmarking**

- Previous design
- Attachment on outside of leg
- Testing on individual without amputation



Image 2: Project Description Image

#### Background & Benchmarking (cont.)

 U.S. Department of Veteran Affairs - Journal of Rehabilitation Research & Development [1]



Image 3: U.S. Department of Veteran Affairs Prosthesis [1]



#### Figure 1: Forces and Moments on Residuum [1]

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#### Background & Benchmarking (cont.)

Orthomedics - Below Knee Prosthetics [2]



Image 4: Orthomedics Below Knee Prosthetic [2]

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### **Design Requirements**

- Quick and rigid attachment
- ➢ Height adjustable
- > Lightweight
- > Easy attachment
- Minimize skin irritation

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### **Customer Requirements**

## **Engineering Requirements**

- > Lightweight
- > Comfortable
- Quick/easy attachment/detachment
- > Adjustable
- > Durable
- > Portable
- > Affordable
- Made from hypoallergenic materials
- > Not Dangerous

- > Weight must be less than 1 kg
- > Friction must be minimized
- > 30 second attachment
- ➤ Height adjustable to 15 cm
- Socket diameter adjustable for 7-20 cm
- ➢ Be able to support at least 180 lbs (8.3 N)
- ➢ Minimize cost
- > High Factor of Safety
- High Modulus of Elasticity

Leah

#### **Quality Function Deployment (QFD)**

Table 1: QFD

Engineering Requirements Customer Requirements	Weight	Weight	Friction from Socket	Attach/Detach Time	Adjustment Height Range	Diameter of Socket	Applied Force	Cost	Factor of Safety	Modulus of Elasticity
Lightweight	5	9					3	3	3	
Comfortable	4		9					1	3	
Quick Attachment	3			9						
Adjustable	5		20	3	9	9		3	3	
Durable	5	3	25 50				9	3	9	9
Portable	5	3			3	3				
Affordable	4	1	3		1	1		9		3
Not Dangerous	5						1		9	1
Units		kg	unitless	sec	cm	cm	N	\$	unitless	GPa
Target Value		<1 kg	N/A	<30sec	<15	7<>20	>800	N/A	3	>70
Absolute Technical Importance		79	48	42	64	64	60	85	87	57
Relative Technical Importance		15%	9%	8%	12%	12%	11%	16%	16%	11%
Rank Order of Importance		2	5	6	3	3	4	1	1	4

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#### Schedule & Budget

Table 2: Gantt Chart

No current budget for the project at the time. The cost of the BiOM Prosthesis Adaptor is to be kept as low as possible.

	PROJECT MANAGER DOMINIC									
WBS NUMBER	TASK TITLE	TASK	START DATE	DUE DATE	DURATION (Days)					
1	Project Team Charter	Leah	9/3/18	9/12/18	9					
2	Presentation 1 - Background	Ebrahim	9/10/18	9/17/18	7					
3	Website Check I	Abdulla	9/10/18	9/28/18	18					
4	Peer Evaluation I	Individual	10/3/18	10/5/18	2					
5	Analytical Analyses I Team Memo	Dominic	10/1/2018	10/12/18	11					
6	Presentation 2 - Concept Gen and Eval	Leah	10/5/18	10/17/18	12					
7	Preliminary Report	Ebrahim	10/9/18	10/19/18	10					
8	Website Check II	Abdulla	10/12/18	11/2/18	20					
9	Individual Analytical Analysis I	Individual	11/01/2018	11/9/2018	8					
10	Final Proposal Presentation	Dominic	11/5/2018	11/14/2018	9					
11	Peer Evaluation II	Individual	11/13/2018	11/16/2018	3					
12	Final Proposal Report	Leah	10/19/2018	11/25/2018	36					
13	Final Prototypes Summary	Ebrahim	11/16/2018	12/5/2018	19					
14	Final CAD package and BOM	Dominic	10/19/2018	12/7/2018	48					
15	Website Check III	Abdulla	11/26/2018	12/12/2018	16					
16	Peer Evaluation III	Individual	12/10/2018	12/13/2018	3					

PROJECT TITLE BIOM Prosthesis Adapter

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#### References

[1] L. Frossard, E. H&Ggstr&M, K. Hagberg, and R. Br&Nemark, "Load applied on bone-anchored transfemoral prosthesis: Characterization of a prosthesis& A pilot study," *The Journal of Rehabilitation Research and Development*, vol. 50, no. 5, p. 619, 2013.

[2] "Prosthetics," Prosthetics - OrthoMedics Orthotic & Prosthetic Services | Omaha, Nebraska. [Online]. Available:

https://www.orthomedics.us/services. [Accessed: 17-Sep-2018].