

Jaipur Knee Upgrade Project

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Courtesy of Dr. Pooja Mukul, Bhagwan Mahaveer Viklang Sahayata Samiti - Jaipur Foot Organization, Jaipur, India. Used with permission.

Jaipur Knee Project: Need

- Above knee prosthesis designed for extreme affordability (< \$30).
- Built for BMVSS group in India; requires efficient, cheap manufacturing with materials that are locally available.
- BMVSS fits about 20,000 artificial limbs annually free of charge, with about 1/3 of these being above-knee amputations.

Background: Design Requirements

Prosthetic knee needs to:

- Be safe and robust
- Be stable during stance phase
- Promote natural gait
- Be cosmetically appealing
- Enable squatting
- Easy to fit and align

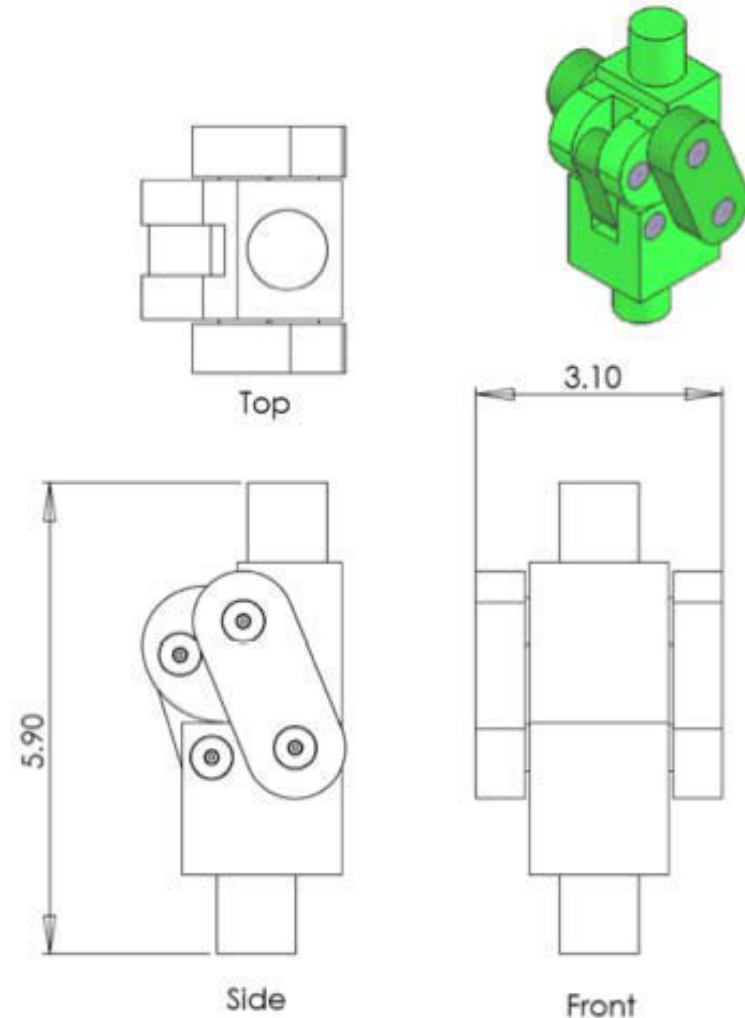
Current Knee Prostheses

	Single Axis	Friction Brake	Polycentric	Hydraulic	Micro-Controlled
<i>Stability</i>	Poor	Excellent	Excellent	Excellent	Excellent
<i>Cost</i>	Low	Low	Mid	High	High
<i>Gait Efficiency</i>	Poor	Poor	Mid	Excellent	Excellent
<i>Weight</i>	Low	Low	Mid	High	High

Image by MIT OpenCourseWare.

Stanford Group Design

- Four link structure
- Polymer-based
- Polycentric
- Affordable (<\$30) and easy to manufacture
- Holds up well in tests of fatigue life, ultimate failure strength, and bearing surface wear.
- Reliable to use for at least 2 years.





Kamal on his arrival
at the Jaipur foot
clinic, 1.5 years after
he was amputated
above his knee.

Courtesy of Dr. Pooja Mukul, Bhagwan Mahaveer Viklang
Sahayata Samiti - Jaipur Foot Organization, Jaipur, India.
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Kamal on his third day with the prosthesis



Courtesy of Dr. Pooja Mukul, Bhagwan Mahaveer Viklang Sahayata Samiti - Jaipur Foot Organization, Jaipur, India.
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Close to natural gait



Courtesy of Dr. Pooja Mukul, Bhagwan Mahaveer Viklang Sahayata Samiti - Jaipur Foot Organization, Jaipur, India. Used with permission.



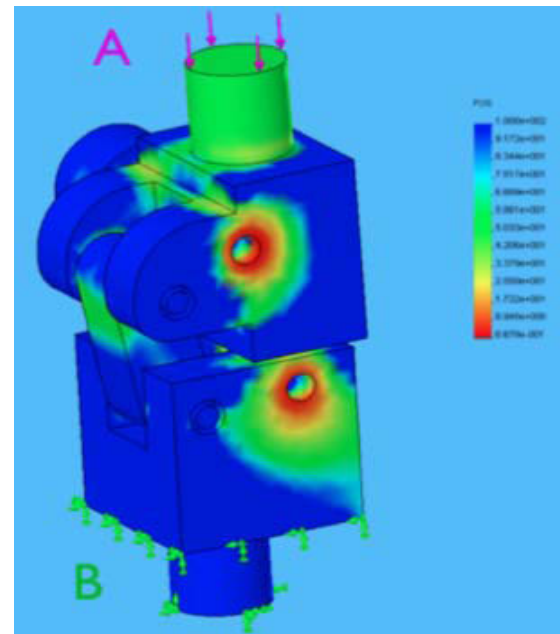
Courtesy of Dr. Pooja Mukul, Bhagwan Mahaveer Viklang Sahayata Samiti - Jaipur Foot Organization, Jaipur, India. Used with permission.

How can we build upon this design?

Improving Shock Absorption

- Increasing shock absorption during heel strike would greatly improve the comfort of the user while walking.

Photo of man walking with prosthetic leg and engineering drawing showing stress at joints of prosthetic knee have been removed due to copyright restrictions.



Cosmetic Improvements

Photo of Jaipur Foot with prosthetic knee removed due to copyright restrictions.

- Need to minimize noise output of device due to contacting elements.
- Appearance is extremely important- can design an attractive, functional cosmesis.

Adding a Manual Lock Mechanism

- This improvement would be simple to implement and would improve stability for the user.

Engineering drawing of prosthetic knee with manual lock mechanism removed due to copyright restrictions.

Easing squatting

Photo of man kneeling with prosthetic knee and leg has been removed due to copyright restrictions.

- Squatting is critical for religious practices and other aspects of life in India.
- We can improve the ability of an amputee to rise after squatting by adding an extension assist mechanism.

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EC.722 Special Topics at Edgerton Center:Developing World Prosthetics
Spring 2010

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