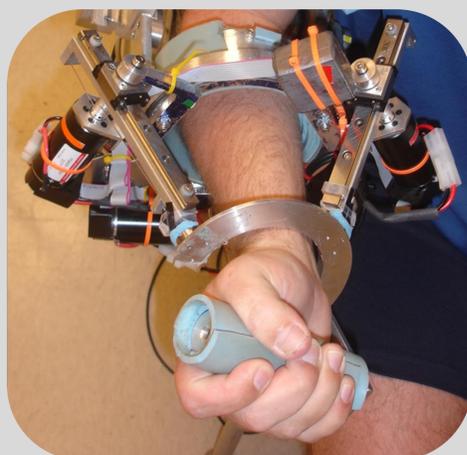


# The RiceWrist Grip: A Means to Measure Grip Strength of Patients Using the RiceWrist

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## Background & Motivation

- In the United States approximately 12,000 new cases of spinal cord injury occur each year.
- Since 2000, the most frequent neurological category at discharge has been incomplete tetraplegia.
- The MAHI Exo II was developed by our lab for rehabilitation of these spinal cord injury patients.

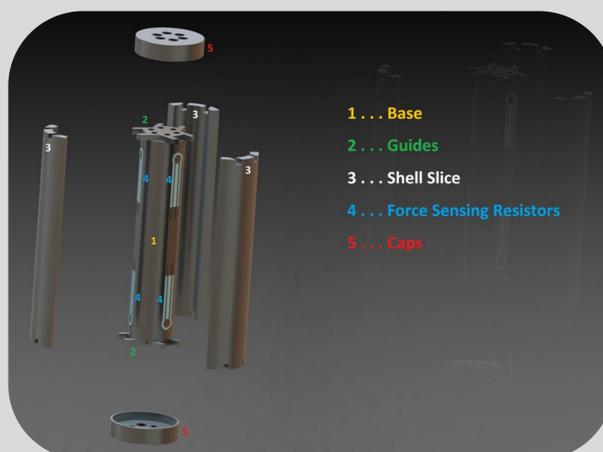


Current handle on the MAHI Exo II

- Tetraplegia in the upper limb can cause a drastic decrease in grip strength.
  - Grip strength is an important factor in performing activities of daily living.
  - Patients using the MAHI Exo II have shown an increase in grip strength.
- Currently, a patient's grip strength is measured with a dynamometer.
  - Adds time to the rehabilitation session.
  - Dynamometer grip not representative of common objects' geometry.
- To better aid in the rehabilitation of spinal cord injury patients using the RiceWrist, a handle which can measure grip strength has been developed.

## Preliminary design

- Aluminum design chosen for durability and ease of integration with the RiceWrist.
- Force sensing resistors chosen as the sensor to measure grip strength.



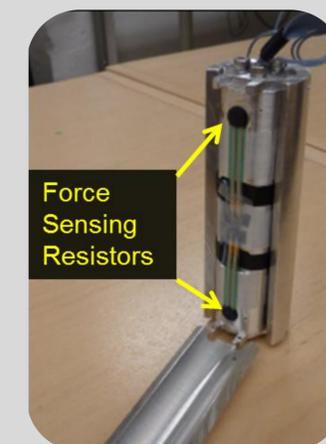
Solid model of the proposed grip force sensor

## Completed Design

- The 35 mm diameter handle easily integrates with the RiceWrist.
- Six force sensing resistors evenly spaced on handle circumference measure grip force.
- Signals are combined for real-time data collection and feedback via Simulink.
  - Patients' grip force can be measured without need of dynamometer.



Aluminum Handle

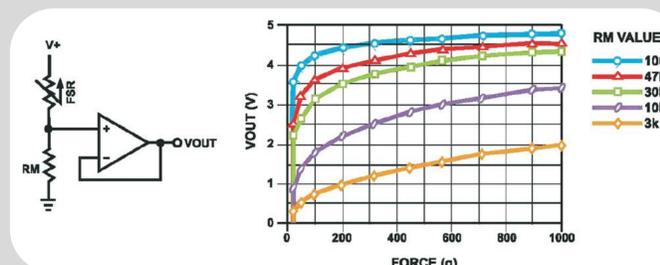


Force Sensing Resistors

Completed RiceWrist Grip closed (left) and open (right)

## Force Sensing Resistors

- Sensor resistance changes in presence of applied force.
- Voltage divider enables measurement of voltage as a function of applied force.
- Interlink Electronics' 400 series force sensing resistor selected for its low cost and low profile.



Typical application and force versus voltage curve for the Interlink 400 series force sensing resistor (image from Interlinkelec.com)

## Conclusions & Future Work

- The RiceWrist Grip has been successfully fabricated and has the potential to measure grip strength during rehabilitation therapy.
- Grip force measurement allows for quantification of improved grip strength during therapy.
- Calibration of force sensing resistors is necessary for accurate measurement of grip force.
- An alternative design using rapid prototyped materials is also being explored to reduce inertia felt by the patient during use.

## Acknowledgement

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