# Instrument Prototype Paper

* Presenting both a grasping + compliant tool and a suction + compliant tool

## Abstract:

**What type of tool is it?**

A bendable/compliant tool tip with an end effector

Suction-enabled compliant tool

**What problem is it addressing?**

Inability to reach structures visualized by the endoscope

**How will we show the testing to address this problem?**

1. Show the range of reach
2. Show CT scan photos of where it can reach – preface that the CT scans are of patients where the surgeon had to drill bone to reach the disease
3. Show that the tip can reach the area of interest and also perform the ‘tip function’ there
   1. In a model or cadaver
   2. Show that the tip can reach a tumor (made of silastic putty?) and then suck or grasp
   3. Show that the tool tip is stiff enough so it won’t break when in bone – force to break tip? Or displacement of tip before breaking – use the stereo camera system and bend the tip and every 0.5 mm of tip displacement take a photo which would characterize what displacement (and what corresponding force) would break the tip
   4. Force vs. tip displacement

## Introduction:

* Background describing why you need this type of tool
* Existing tools – literature and patent search

## Methods:

* Tool requirements
  + Functional
  + Surgeon
  + Safety
* Manufacturing overview
  + Reason for certain design decisions
  + How was handle shape/design determined? – rapid prototyping, 3D printed/machined – given to surgeons to test the feel, feedback used to make it better, iterative designs, etc.
  + Cutting geometry: Used CT scans to determine the arc length and radius of curvature desired which led to narrowing down the cutting geometry
  + Safety considerations of the cutting geometry – not too deep or it will break, not to shallow or will not bend enough
  + Materials used and why
* Cadaver testing methods
* 3D printed model – define the characteristics of the model, why it was built the way it was and how it was used to test the tool

## Results:

* Show the final specs of the tool – arc length, radius, cutting geometry with CT scans – want to follow up with the methods and presents the results from the CT scan investigation method used to figure out the ideal cutting geometry
* Final design specs shown
* CAD, close up pictures used to explain the final design and how the mechanism works
* Testing – bench top, cadaver, 3D printed model

## Discussion:

* Limitations
* Feedback for the next iteration of the prototype
* Describe how it will be improved