Right Angle Screwdriver

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Overview

- Reconstructive surgery of the mandible
- Current Screwdriver
- Design Requirements
- Alternative Designs
- Design Matrix
- Testing and Future Work

Reconstructive surgery of the mandible

- Broken mandible repaired with use of titanium plates and screws
- Current procedure uses straight screwdriver
  - Incision made in gums to see screw
  - Incision made to the exterior cheek for screwdriver access
- Plates left in after surgery

Current Screwdriver

- How it works
  - Straight screwdriver
    - Ball bearing handle
    - Interchangeable screw head
- Pros:
  - Efficient for fastening screws in surgeries other than the mandible
- Cons:
  - Cannot reach mandible without exterior incision
  - With extra incision, screws are still hard to access

Design Requirements

- Create a right angle screwdriver that will eliminate need for an exterior incision

- Specifications
  - Must fit standard incision size (3-5 cm)
    - Maximum thickness of 1.5 cm
  - Safe and sanitary according to surgery protocol
  - Must supply sufficient torque to seat screw

Design Idea #1

- **Worm and Wheel Design**
  - Using gear and rotating thread

- Pros:
  - Gives high levels of torque
  - Works at a right angle
- Cons:
  - Surgeon loses “feel” of screw
  - Increases number of turns per screw

Design Idea #2

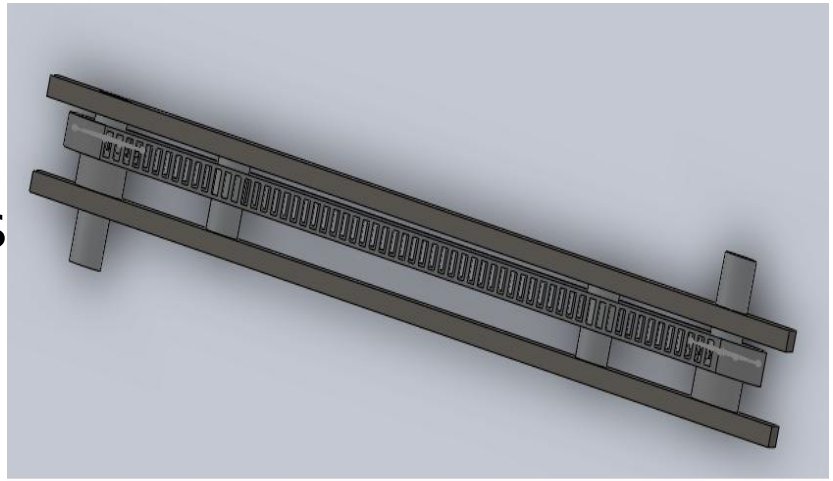
- **Bevel Gear**
  - 2 mitered gears set at a right angle

- Pros:
  - Can be easily enclosed
  - Applies sufficient torque

- Cons:
  - Too big for specifications

Design Idea #3

- **Sprocket and Chain Design**
  - Two sprockets connected with a chain
  - Handle and screw head at opposite ends



- Pros
  - Provides 1:1 torque
  - Able to fit in small incisions
  - Use existing screw driver for handle and screw head
- Cons
  - Moving parts make it hard to sterilize

Design Matrix

Criteria		Possible Designs		
Considerations	Weight	Sprocket and chain	Worm and wheel	Bevel gears
Safety	10	10	10	10
Ease of Use/Ergonomics	20	18	12	13
Size	35	32	32	15
1:1 Torque provided	25	23	12	23
Durability	10	8	10	10
Total	100	91	76	71

Testing and Future Work

- Find torque needed to seat screws
- Find torque load capacity of prototype
- Making the prototype enclosed
- Test durability
- Design interchangeable screwhead

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Questions?