

Facilitation of Dynamic Neck Extension & Flexion During Fluoroscopy



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Motivation

The technique of dynamic fluoroscopic imaging is an important tool for assessing the health of the cervical spine. Currently, obtunded patients' necks are manually flexed and extended by hospital staff. This method is inconsistent and unnecessarily exposes staff to radiation. There is no existing device for dynamic positioning. Our goal was to develop a dynamic cervical spine positioning device providing robust, repeatable rotational motion, increasing safety for the operator and patient, and integrating with fluoroscopic imaging systems.

Abstract

A device is needed to replace existing methods of extending and flexing an obtunded patient's neck during fluoroscopic examination of the cervical spine. A previous design achieved a full range of motion, but was cumbersome and difficult to attach because it hung off the end of the table. This semester's prototype includes a gear and motor system that is more ergonomic with strong consideration of patient safety.

Prototype

Frame and Headboard

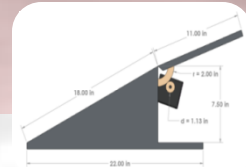
- 5/8" thick wood
- 25° of inclination
- Rubber bottom grips table
- Promotes natural neck motion

Motor & Gears

- 50 in-lbs of torque
- 12V DC at 1.3 rpm
- 4:1 gear ratio
- 3.5 °/sec rotational speed
- Range of motion of +/- 35°
- Rechargeable battery

Controls

- Doctor can toggle to select rotation direction, operate remotely from 15'
- Patient can stop device in event of emergency with hand held button



Background

Fluoroscopy

- Dynamic, real time, x-ray imaging
- Sensitive to tissue density
- Unable to see through metals

Cervical Spine

- C1- C7 vertebrae
- Untreated injury could lead to paralysis, death

Previous Work

- Previous design had range of motion, but was bulky and awkward because of extension beneath table
- Existing technology only capable of stationary positioning

Design Requirements

Performance

- +/-45° range of motion
- Rotate ~2° per second
- Stabilize head
- No image interference
- Promote natural neck motion
- Provide angle feedback
- Remote control

General

- Accommodate average adult
- Aesthetic and ergonomic
- Reusable
- Low maintenance
- Prototype under \$250

Safety

- Smooth and stable motion
- Emergency stop (panic button)
- Comfortable
- Rounded edges and corners

Future Work

Controls

- Explore integration with fluoroscopy equipment
- Develop an electrical display of position
- Create cordless controls
- Incorporate ways to set angles, speeds, etc.

Testing

- Assess Image quality
- Trial runs with dummies
- Proposal to IRB

Frame

- Optimize dimensions
- Use ideal materials, like plastics



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Flexion & Extension

<http://www.rad.washington.edu/pubicases/cases/Case09text.html>



Previous Model



Stationary Positioning Device
Mercury Medical <http://66.77.149.134/images/mmp/ptroop/>

