Patient Positioning Aid

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INTRODUCTION
A patient positioning aid is needed for individuals with disabilities. The disabilities create difficulties related to patient positioning. These difficulties include transferring the patient onto the medical devices and maintaining static positions during the procedure. The static positioning aids such as foam wedges and wrap around coils in use today for CT and MRI scan technologies are not very effective. The current options only satisfy the needs of specific patients. Therefore, a broader positioning aid with a wider range of capabilities is needed. The goal of this project is to create a versatile, low-cost, easy-to-adjust patient positioning aid that will work with a range of examination tables and imaging platforms and meet the needs of patients with disabilities. When designing the positioning aid both the hospital staffs’ and the patients’ needs were taken into consideration. For the technician the positioning aid needs to be light weight, easy to adjust, transfer, and store. For the patient the aid needs to be comfortable, sturdy, strong, and be able to immobilize patients. With these requirements in mind we came up with the design. A fairly light weight and strong material, PVC, was chosen for the base, with comfort coming from foam padding and a gel based headrest. The major goal of a positioning aid is to get the arms out of the way when the images of the body are being taken. Therefore, a handle bar was designed for the patient with arm stabilizers to provide additional comfort to the patient’s upper arm while reaching backwards and gripping the arm bar. The arm stabilizers will also keep the elbows of the patient steady and not allow movement. The leg stabilizers were implemented to reduce movement in the lower extremities of the patient and are tall enough to be able to adjust a larger patient. Lastly, a track system is used to move the arm stabilizers and leg stabilizers so they can meet a wider range of patients. The track system also comes with stick on rulers so the doctors can quickly line up the attachments and ensure a good fit. The main goal was to make this device very user friendly as well as accommodate the different size patients that may be using the device.

SUMMARY OF IMPACT
This positioning aid eliminates the need for hospital staff members to purchase multiple components in order to position and meet the needs of various patients. This device incorporates an upper body and lower body-positioning device, and both is easily adjustable using a track system, which helps in accommodating for the different sizes, and heights of the patients. The foam padding on the surface of the devices was added to the design to provide some additional comfort for the patient during the often-lengthy imaging procedures. This positioning aid was designed according to the specifications and meets the needs of patients with disabilities. It is strong so that the segment weight of patients weighing up to 500lbs can be supported and transported. The device better immobilizes patients so that for example a patient with diseases such as Parkinson’s can have an accurate image taken without having to worry about tremors. It is thin so once it is put on top of the imaging table patients with limited movement will not have to climb up very high. It is also durable so that a new device does not need to be purchased very often and will save the hospital money in the long run. Lastly, the positioning aid is compatible with various imaging technologies including but not limited to MRI, CT, and x-rays by using all non-ferrous materials as well as radiolucent materials.
TECHNICAL DESCRIPTION

The first major component of our design is the base for the patient positioning aid. A PVC (polyvinyl chloride) board was selected as our design's base. The board has the dimensions 72" x 22" x 0.5". The tables and platforms at the hospital measure six feet long and twenty-two inches wide, therefore, the transfer board is compatible and interchangeable with the various imaging device platforms since the 22" will be able to fit inside the MRI and CT scan. Due to the large weight that needs to be lifted on this board during patient transfer from examination room to imaging platform, cross members are needed to ensure the structural integrity of the board. Two aluminum cross members (which are non-ferrous and therefore safe in an MRI) that measure 1" x 0.5" x 72" run the length of the board set 2.25" from the sides of the board. Along with these, three PVC cross members measuring 1" x 1" x 17" run laterally across the board between the aluminum cross members. Attached to the PVC board are 4 aluminum handles which are used to lift the board. Also, foam will be attached to the bottom of the board along the sides and top and bottom which allows the user to lift from the bottom side of the board as well.

Figure 1: Overall Device

The second major component of our design is the arm bar and head rest. The rod of the arm bar is 1" in diameter, and the handle bar is 16.5 inches wide. The headrest is a donut shape and is 8.5" in diameter for the adult size. The donut shape benefits the patient since it allows them to place both the back of their head and their forehead on it. The next component is the arm stabilizers which are comprised of a base, a pivot, and linear bearing and an arm rest. The base has the dimensions of width 2 inches, length 7 inches, and thickness 1 inch. Attached to this is a piece of gray PVC type 1 which is 3 inches x 6 inches x 1 inch on which the patients arm can rest. The next component is the leg fixation device which is comprised of two bases, measuring 10 in x 2 in x 0.75 in made of gray PVC type 1. Along with these two bases, there are two leg stabilizer bars. The bars consist of a piece of high density polyethylene (HDPE). The bar was cut so it has a recess in it where the legs will be stabilized. The bar has dimensions of 2.5 in x 1 in. On each side of the bar an aluminum linear bearing is attached by aluminum bolts. These bearings attach to one of the aluminum extrusions on one of the leg stabilizer bases, and the other bearing attach to the aluminum extrusion on the opposite leg stabilizer base. The bearings have a hand knob on them allowing the user to position at any position on the extrusion they want to. The part of the fixation bar that comes in contact with the patient has a T-foam covering it to increase comfort. This T-foam eliminates pressure points, absorbs shock and vibration and recovers completely after being used. The foam is also breathable and lightweight. The track system that is used in this design involves silicon bronze carriage bolts going through a slit in the positioning aid base and attaching to the arm stabilizer and knee fixation device.

The cost of parts / material was about $1100.