CHAPTER 10
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EVALUATION AND TREATMENT TABLE

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INTRODUCTION

When speech-language pathologists, occupational therapists, physical therapists, or psychologists work with children and young adults with severe disabilities, treatment and diagnostic activities often take place in the therapy room. In order to work effectively with children and young adults, therapists need a table with adequate space to perform varied activities. A table was designed to allow adequate space around and underneath to accommodate individuals in different wheelchairs.

SUMMARY OF IMPACT

The table permits more effective treatment and evaluation for individuals in wheelchairs, and accommodates diverse users.

TECHNICAL DESCRIPTION

The tabletop (Figure 10.1) is made out of medium density fiberboard (MDF) covered by polyvinyl chloride (PVC) laminate. MDF is formed by heating and pressure treating a wood flour and glue mixture. The board is not like particleboard because it has no air pockets or small holes within the material. It has the density of solid oak, which makes the material very sturdy as long as it is protected from the elements. The PVC covering provides protection.

The tabletop has dimensions of 45”x 37”x 1”. The edges are rounded to 0.4” with a router. The surface of the top has a rectangular area cut out four inches from the top of the ellipse. This holds the tilting workspace when it is completely collapsed and makes it flush with the table. The rectangle measures 18” x 12”. The flattened ellipse that has been removed from the front of the table is 22” x 9”. The ellipse was flattened to create more room for the user. This also leaves 7.5 inches of tabletop to the left and right of the user, decreasing the distance he or she would have to reach for something on the table.

Under the rectangular cutout is a solid red oak box, which houses the brackets that support the tilting workspace. The dimensions of the box are 20.25” x 13.875” x 2.25”, ample enough not to interfere with legroom. The bottom of the box has only six inches of oak extending from each sidewall. Wood does not cover the entire bottom of the box so that it is easier to clean. One end of each bracket is fastened to each six-inch strip on the bottom of the box. The other end is fastened to the tilting mechanism.

The tilting workspace is also MDF with a PVC laminate. It is 18”x 12” x 0.5”. The round is 0.2”, slightly less than the rounding of the tabletop, so it is flush with the surface of the table. The top center of the tilt has an indentation made by a router in the shape of the flush brass pull ring so the pull ring is flush with the workspace surface. The flush pull ring is used as a way to raise and lower the workspace without actually having to hold onto it. This minimizes the number of pinch point areas on the table. The workspace is attached to the table with one piano hinge. The brackets are fastened to the back or underside of the workspace and support it in 14 different positions that range from 0 to 90 degrees.

The frame for the table is made from 2014-T6 (4.4% copper alloy) aluminum. The aluminum tubing is 1” x 1” x 0.25”. The frame is 34” on the short sides, 42” on the longest sides, and 11” to the left and right of the cut out. The frame is welded together at each of the four corners. A weld in each corner of the frame attaches the aluminum flange legs. The aluminum flange is made of the same alloy as the frame. Its dimensions are 2” x 2” x 0.125”, and the hydraulic cylinders are attached to the flange with screws. One leg

consists of a hydraulic cylinder attached to the 2" aluminum flange, which in turn is attached to the MDF.

Monarch Hydraulics, Inc manufactures the hydraulic cylinder unit. The hydraulic unit consists of four hydraulic cylinders, tubing, and the pump house. The cylinders are attached to the pump house by the fluid-filled tubing. The tubing is held in place flush with the under section of the tabletop via ring slip ties screwed to the table. The pump housing is attached to the MDF on the underside of the table using a 0.25" aluminum plate, which has counter sunk screws.

The white, non-toxic, hydraulic fluid is pumped through the pump house, through the fluid lines, and into the cylinders when the manual lever is turned clockwise. After the fluid is pumped to the bottom of the cylinder, it causes an increase in pressure that lifts the tabletop off the ground against its own weight. To lower the table, the manual lever must be turned in the counter dockwise direction. This releases the pressure, allows the fluid to return to the housing, and, in turn, allows the tabletop to lower to any desired position. Casters are attached to the bottom of the cylinders so the table can be moved from one place to another within the therapy room. Two of the casters have braking mechanisms for safety.

The final cost of the table was approximately $1500.

Figure 10.1. Evaluation and Treatment Table.

BICYCLE CART FOR A CHILD

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INTRODUCTION

A bicycle cart was designed for a child with developmental disabilities (Figure 10.2).

SUMMARY OF IMPACT

This project was designed for a family that enjoys active recreation. The family has been limited in what they can do together because of a daughter's physical disabilities. She has limited control of the muscles in her neck and trunk region. She has movement in her arms and legs about but cannot protect herself from falling, so she must be strapped into any seat she uses. The cart enables the whole family to go on bicycle outings together.

TECHNICAL DESCRIPTION

The bicycle cart was designed for a specific child but could be used for other children who have similar needs. The main design requirements for the cart were: 1) The frame should be sturdy and strong enough to support the child and additional supplies, such as medical equipment or food for a picnic; 2) The frame should be wide enough to prevent it from tipping over; 3) The seat should provide support for the child; 4) The seat should prevent the child from sliding out; 5) The seat should support feet and legs so that the child's legs do not dangle; 6) The seat should be adjustable as well as comfortable; 7) The clamp that attaches the carrier to the frame must be easy to attach and detach; and 8) The cart must fold quickly and easily to a size for easy transport.

The bicycle cart has four main components: the wheels, the frame, the side rails, and the attachment arm. The frame is square with rounded corners and lower supports. The wheels attach to the frame by way of a quick release mechanism that slides on and off of the aluminum wheel brackets located under the frame. The frame is made of 6061 USA grade aluminum tubing connected by welding pieces of solid aluminum round stock inside the tubing connection points. The side rails are attached near the corners of the frame. These rails are attached with bolts on plastic folding mechanisms. A horizontal roll bar is attached at the top of the side rails by bolts and has a plastic swivel for folding. On the front left underside of the cart is the attachment arm that clamps onto the bicycle frame near the wheel. The arm is attached to the cart by a pin that allows the arm to swing under the frame for transport and storage. The mechanism that attaches the arm to the bicycle is made of a ball joint and clamping device.

The frame is covered by eight-ounce coated cordura nylon that is sewn and bolted on. The seat is also made of eight-ounce coated cordura nylon, with nylon webbing for support and attachment. The webbing runs under the bottom portion of the seat and attaches to the cross members of the side rails. The webbing sewn to the roll bar also supports the back of the seat. On the seat is a pommel style harness made of the same webbing used in the seat. It is attached with a plastic backpack clamp.

The cart was analyzed for stress and deflection using simple beam point load calculations. The appropriate equations were selected from the Midwest Plan Service Structures and Environment Handbook, 11th ed. A safety factor of 1.43 was used. This safety factor had a corresponding probability of failure of 1%. A yield strength of 37,000 psi was selected from the tables in the same handbook. The maximum allowable stress was calculated to be 25,874.13 psi. The cart was originally designed to withstand a maximum load of 100 lbs. However, it was found that the cart exceeded the maximum allowable stress at loads between 225 to 250 lb with deflections in the range of

0.15 to 0.30 inches. The only deflection that exceeded this range occurred in the upper batten, where a deflection of 0.81 inches was noted at a 175-lb load. The upper batten was designed to provide lateral stability for the side rails and was not intended to endure loads over 100 lb.

Tests of the cart were performed with a 215-lb man. The cart showed little deformation and handled well even in rough terrain.

The final cost of this bicycle cart was approximately $1000.

Figure 10.2. Bicycle Cart.