Rehabilitation Engineering Solutions

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Rehabilitation Engineering collaborates with many areas of TOHRC to create engineering solutions for unique problems in accessibility, client care and research. The following projects are highlights of our 2009 activities.

DEVICES DEVELOPED FOR ACCESSIBILITY IN LIVING

Custom Communication Device Cover

A protective casing with a clear window was designed to cover the viewing screen on a Dynavox VMax communication device. The protective window prevents the touch-sensitive screen from being activated unintentionally. The casing also protects the speakers from rain, and the cover can be removed easily and safely by sliding it over the device.

Accessible Remote Control for Window Blinds

The Independent Living Unit (ILU) at TOHRC allows clients to test their ability to manage on their own. Over time, it became clear that the buttons on the remote control used for operating automated blinds were too small and difficult to access for many clients. To solve this problem, we purchased a remote from the manufacturer (shown in white and blue) with three large blue buttons for controlling the "up", "down" and "stop" functions. In addition, we mounted three larger button switches (yellow and red) for clients having difficulty operating the white and blue remote.

Snowmobile Foot Brake

Our client had difficulty using the hand brake on the left side of his snowmobile. We designed and installed a cabled, foot-operated brake pedal to accommodate hands-free braking.

Accessible Infant Car Seat

As primary caregiver, this parent needed to be able to independently and safely move his infant in and out of a car seat from his manual wheelchair. Putting the car seat on the van seat was not an option, as it was too high and out of reach for the client. The height of the car seat had to be low enough for the client to access the seat from outside the minivan from his wheelchair. To do so, one of the rear seats was removed and the base was used to attach the custom pivoting car seat system to the van floor. This system allows the seat to pivot from the rear facing position for travelling (lower right photo) to the sideways position for access (upper left photo). Each position locks in place and can be unlocked by the parent using a latch that is under the seat, well out of reach of the child.

Enhanced Vehicle Console Lighting

A client had difficulty seeing the individual labels on a 14 button custom remote secondary driving control. Several attempts were made to improve the lighting, but none was sufficient. A custom strip with miniature green LEDs on both sides was made and positioned down the centre of the two columns of buttons. The intensity of the light is adjustable, allowing the client to read the labels in different lighting conditions.

Accessible Infant Crib

For many years Rehabilitation Engineering has been customizing infant cribs to make them wheelchair accessible. In 2009, three accessible cribs were loaned to new parents. In addition, a fourth crib was made accessible to increase the number of cribs available for loan.

EQUIPMENT TO ENHANCE DELIVERY OF CARE

Reaction Timer Upgrade for Driver Assessments

When a person's driving is assessed at TOHRC, a driving simulator is used to measure how long a person takes to react to different signals, such as turning and braking. The original reaction timer was custom-made over 20 years ago and has needed frequent servicing. The upgraded system, now based on a programmable microcontroller, has all the original functions with added capabilities for future changes and enhancements.

Ergonomic Solutions for Clinicians

We also provide engineering services to other areas of TOH through the Occupational Health, Safety, and Emergency Preparedness department. We have developed custom devices for staff recovering from repetitive strain injuries, as well as devices designed to help prevent them. For example, several ultrasound probe adaptors have been made that provide a more ergonomic grip for clinicians.

Improvements to Height Adjustable Parallel Bars

The Prosthetics and Orthotics Department uses parallel bars to support clients during walking assessments. Each time an individual client is assessed, the bars need to be adjusted according to his/her height, a procedure that is time consuming and requires more than one person. With the help of a group of Algonquin College Mechanical Technology students, a crank mechanism was added to allow for quick, easy and safe raising and lowering of the bars by a single person.

INSTRUMENTATION AND DEVICES TO TAKE REHABILITATION RESEARCH FURTHER

Stacked Breath Counters

Rehabilitation Engineering developed a device that counts the number of stacked breaths using a modified resuscitation bag. The counter is used by Dr. Doug McKim and his team in the Pulmonary Lab to train patients to use the stacked breath technique to increase their lung volume. The device is activated when two miniature adjustable pressure switches are closed. One switch will close when a minimum pressure threshold is detected at the mouthpiece; the second switch will close when a minimum pressure threshold is detected at the bag. It is only when both switches are closed that a count is recorded. The device will not count stacked breaths if there is an inadequate seal at the mouthpiece or if the bag is unintentionally squeezed. The recorded data can be downloaded using a USB interface, and Windows software specifically designed to log the event data.

Electronic Arthrometer

Several years ago, we developed a mechanical instrument to measure rat knee angular displacement at various soft tissue loads, under normal and pathological circumstances, for research studies lead by Dr. Guy Trudel. An electronic version of this instrument was recently developed, which provides controlled accurate automatic application of the four torque levels and a digital readout of the knee joint angle.

Portable Ramp with Adjustable Slope

A commercial portable ramp was modified to allow quick slope changes between 1:10, 1:12 and 1:16 grades. A self-braking belay descender device and mounting climbing rope were the basis for a wheelchair safety tether system. This ramp was used to study the Effect of Snow and Ice on Exterior Ramp Navigation by Wheelchair Users, a project conducted by Dr. Ed Lemaire.