The Role Of Advanced Rehabilitation Engineering In Development Of People With Disabilities

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ABSTRACT

Rehabilitation Engineering is a growing field focused on people with disabilities (PWD) and special needs.

The rise of required technology is gaining momentum as more people are more aware of advanced technology that they can access.
Lumba bionik berbasikal, inovasi teknologi FES UM untuk OKU menyerlah di peringkat dunia

DR NUR AZAH HAMZAID, UM 16 May 2018
The CYBATHLON is a competition for people with disabilities, who, supported by the latest assistance systems in various disciplines, compete against each other and solve everyday tasks.

- Powered Arm Prosthesis Race
- Brain-Computer Interface Race
- Powered Exoskeleton Race
- Functional Electrical Stimulation Bike Race
- Powered Leg Prosthesis Race
- Powered Wheelchair Race
BACKGROUND

THE RIGHTS OF PERSONS WITH DISABILITIES IN MALAYSIA: THE UNDERLYING REASONS FOR INEFFECTIVENESS OF PERSONS WITH DISABILITIES ACT 2008

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ABSTRACT

Persons with disabilities have the same rights with other people in which they have the equal potential to live a wholesome and fulfilling life. While Malaysia has endorsed the United Nations Convention on the Rights of Persons with Disabilities and enacted the Persons with Disabilities Act 2008 for promotion of the betterment of Persons with Disabilities, the rights of the persons with disabilities have yet to be fully practiced. The purpose of this paper is to prove the lack of effectiveness of the Persons with Disabilities Act 2008. To do so, this study analyses texts from local and international literatures. It is found that Persons with Disabilities Act 2008 merely ‘promotes’ the protection of rights instead of actually protecting the rights of Persons with Disabilities. It has been suggested in this paper that the statute needs to be amended to include a penalty clause and to get rid of any shielding provision in order to ensure effectiveness.
United Nations Convention on the Rights of Persons with Disabilities in Article 1 defines ‘disability’ as:

Persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments, which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others.\textsuperscript{12}

Malaysia on the other hand although adopting the definition, omitted the phrase ‘on an equal basis with others’. This is evident in section 2 of Persons with Disabilities Act 2008 which provides that:

Persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments, which in interaction with various barriers may hinder their full and effective participation in society.\textsuperscript{13}
PROSTHETIC LEG FOR RURAL AMPUTEES

Figure 2

Time Up & Go Test

3 minutes' walk test
AMPUTATION AND PROSTHESIS

- Transfemoral Amputation: Amputation between the hip and the knee (through the Femur bone)
- Transfemoral Prosthesis: Artificial limb to replace amputated limb above the knee.

SIT-TO-STAND ASSISTIVE DEVICE
CALL BELL
TALKMATE: SPEECH ASSISTANCE DEVICE FOR STROKE

A hemorrhagic stroke occurs when a blood vessel bursts within the brain.

An ischemic stroke occurs when a blood clot blocks the blood flow in an artery within the brain.
$I_{WB}$ is the length of the wheelchair base. Depending on the swivel of the caster wheels,

- $I_{WB} = L - R_c$ when the wheelchair is moving forward and
- $I_{WB} = L + R_c$ when the wheelchair is moving backward

$W_{\text{rear wheels}}$ is the sum of the weights components of both rear wheels

$W_{\text{total}}$, total weight (sum of the weights measured by all 4 load cells)

$$C_y = T_c \left( 0.5 - \frac{W_{\text{right wheels}}}{W_{\text{rear wheels}} + W_{\text{front wheels}}} \right) \quad (2)$$
FES-EVOKED EXERCISE

Used in rehabilitation to improve muscle function (Ryan et al., 2013)

Can improve oxygenation and muscle function (Hasnan et al., 2018).
Subject was secured with harness for safety

Subject stands due to FES stimulation

Muscle started to become fatigue = *knee angle drop
ORIGINAL ARTICLE

Electrical stimulation-evoked contractions blunt orthostatic hypotension in sub-acute spinal cord-injured individuals: two clinical case studies

NA Hamzaid¹, LT Tan¹, GM Davis¹,², A Suahimi³ and N Hasan³

Study design: Prospective study of two cases.

Objectives: To describe the effects of electrical stimulation (ES) therapy in the 4-week management of two sub-acute spinal cord-injured (SCI) individuals (C7 American Spinal Injury Association Impairment Scale (AIS) B and T9 AIS (B)).

Setting: University Malaya Medical Centre, Kuala Lumpur, Malaysia.

Methods: A diagnostic tilt-table test was conducted to confirm the presence of orthostatic hypotension (OH) based on the current clinical definitions. Following initial assessment, subjects underwent 4 weeks of ES therapy 4 times weekly for 1 h per day. Post-tests tilt table challenge, both with and without ES on their rectus abdominis, quadriceps, hamstrings and gastrocnemius muscles, was conducted at the end of the study (week 5). Subjects’ blood pressures (BP) and heart rates (HR) were recorded every minute during pre-test and post-tests. Orthostatic symptoms, as well as the maximum tolerance time that the subjects could withstand head up tilt at 60°, were recorded.

Results: Subject A improved his orthostatic symptoms, but did not recover from clinically defined OH based on the 20-min duration requirement. With concurrent ES therapy, 60° head up tilt BP was 89/62 mm Hg compared with baseline BP of 115/71 mm Hg. Subject B fully recovered from OH demonstrated by BP of 106/71 mm Hg during the 60° head up tilt compared with baseline BP of 124/77 mm Hg. Both patients demonstrated longer tolerance time during head up tilt with concomitant ES (subject A: pre-test 4 min, post-test without ES 6 min, post-test with ES 12 min; subject B: pre-test 4 min, post-test without ES 28 min, post-test with ES 60 min).

Conclusions: Weekly ES therapy had positive effect on OH management in sub-acute SCI individuals.

Spinal Cord advance online publication, 4 November 2014; doi:10.1038/sc.2014.187
How long does the prevention effect last? A comparison of two case studies of different FES stimulation frequencies in stroke shoulder subluxation follow up period

M. M. Thaw Dar, Nur Azah Hamzaid. 4+ authors  Glen M. Davis
Published 2014 in 2014 IEEE 19th International Functional...

There is strong evidence on the positive effect of functional electrical shoulder subluxation (SS) following stroke. However, the extent of s documented with regards to different stimulation frequencies. It is a frequency (35 Hz or 20 Hz) has better potential in maintaining the F follow-up period. Two participants underwent standard prescribed rehabilitation centre during their hospitalisation period. Electrical stimulation was performed on the supraspinatus and posterior deltoid muscles for up to 2 hours a day parameters were set constant except the stimulation current, which and stimulation frequency, which was set to high (35Hz: Subject A) among the intervened subjects during the 4 weeks FES therapy peri frequency prevented subluxation until the end of 4 weeks follow up.

Fig. 1. X-ray result showing D1 value (a) after FES therapy and (b) Post follow up in Subject.
CASE STUDY:
FES Device Needs And Affordability among Patients And Hospitals
LEVEL OF FAMILIARITY OF FES IN SCI PATIENTS AND MEDICAL PRACTITIONERS IN MALAYSIA

Survey based on 16 Spinal cord injured (SCI) patients and 29 medical practitioners

62.5% OF THE SCI INTERVIEWED HAVE NOT HEARD OF FES TREATMENT AND 81.3% OF THEM HAVE NEVER UNDERGOES FES TRAINING SESSION
FES is not available in all hospital or department as seen that 66.7% do not own any FES stimulator at their workplace.
93.1% of the medical practitioners and 81.25% of SCI patients believe that FES does help SCI post injury.
Are you receiving financial aid from the government and/or any organization?

- Yes: 43.8%
- No: 56.3%

Do you believe the financial aid you receive is sufficient to purchase or rent and FES device?

- Yes: 93.3%
- No: 6.7%

Eventhough more than half (56.3%) of the SCI patients surveyed receive financial aid. Almost all of them (93.3%) are not able to purchase or rent a FES device.
Range of amount willing to spend on FES device in SCI patients and medical practitioners.

<table>
<thead>
<tr>
<th></th>
<th>SCI patients</th>
<th>Medical Practitioners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than RM1000</td>
<td>50.0%</td>
<td>33.3%</td>
</tr>
<tr>
<td>RM1000 to RM10000</td>
<td>35.7%</td>
<td>52.4%</td>
</tr>
<tr>
<td>More than RM10000</td>
<td>14.3%</td>
<td>14.3%</td>
</tr>
</tbody>
</table>

Higher Percentage of SCI Patients (50% against 33.3%) willing to pay less than RM1000 compared to the medical practitioners.
CONCLUSION

This study highlighted the technological advancements in the field of rehabilitation engineering, especially the ones related to Malaysian participants and users.

The level of technology and its potential of increasing awareness among people with disabilities were highlighted.

This study hopes to gather better multidisciplinary interest towards providing technology and care to PWDs, in order to provide better access and level of competencies among the caretakers and policy makers.
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