Elaborate Ways for Rehabilitation Stroke Patients Using Drug Treatment with Cerebrolysin vs. Advanced Physical Therapy Techniques

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Stroke patients are a major problem for their families because of the weight and limitations of recovery procedures. In this study, it is desired to show the benefits of virtual reality utilization both singularly and in tandem with the drug, namely the dual use of virtual realities and cerebrolysin. The aim of the study was to evaluate the overall functioning of patients diagnosed with stroke and their recovery. We compare patients who received drug treatment and physiotherapy and those who benefited from advanced physiotherapy (assisted by virtual reality) and drug treatment. The study group has a total of 42 participants (15 women and 27 men), of whom 22 received medical treatment and 20 underwent medical treatment and a virtual reality based physical therapy. Cerebrolysin administration protocol: 10 consecutive doses of 10 mL i.v. diluted in saline solution 500mL.

Basically the two study lot’s have received the same treatment respectively: electrotherapy: toning electrical stimulation for flaccid muscles and decontracturant electrical stimulation for spastic muscles, ultrasound therapy, laser therapy, cryotherapy, shortwave therapy, tecar therapy, shock wave, lymphatic drainage, relaxing massage. Physical Therapy: The Kabat method, The Bobath method, The Brunstrom method, The Jacobson method, Occupational therapy, Hydrokinetotherapy and the only difference is given throw the application of virtual reality. The study also shows the starting point for rehabilitation respectively that how started rehabilitation prior to the 1-year mark and after the 1 year mark. The analysis was carried out over a period of 1.5 years in the hospital with a specially militarized status for the former patients and followers for a period of 1 years and seeing their evolution in several tests of: balance, posture, speed and assessment of the degree of functionality. The Health Improvement Analysis was done on these parameters and on the answers given in a clinical self-evaluation questionnaire. The physical therapy and exercise added to medical treatment play a considerable part in the recovery of overall functioning of patients with stroke.

Key words: Stroke, virtual reality, physio therapy, cerebrolysin, rehabilitation

Table 1 shows an overview of patient characteristics in each group. Statistical tests did not found statistically significant differences of age, gender, stroke etiology proportions, living areas, and body mass index.

An important result was the absence of statistically significant difference regarding the time elapsed from...
stroke. In order to draft the protocol, the following tests are considered:

10-meter walk test (normal speed)
The test protocol is as follows: Measurement of the depression velocity (m/s) analysis is done at a distance of 10 meters of which 2 meters represent the acceleration phase, the following meters represent the actual travel speed and the last 2 meters represents the deceleration phase. The actual measurement will be made after exceeding the 2-meter line and will cease to reach the 8-meter distance and the result as a 6-meter pronounced exceeding the 2-meter line and will cease to reach the 8-meter phase. The actual measurement will be made after speed and the last 2 meters represents the deceleration phase, the following meters represent the actual travel 10 meters of which 2 meters represent the acceleration depression velocity (m/s) analysis is done at a distance of 10 meters.

2 minute walk test
This test measures the distance and the number of steps passed by the wearer and whether it has moved by itself or by means of a locomotive or baton or crutches [4]. The test is performed on admission and discharge and the results are compared [5].

SF-36 Health Questionnaire
The quality of life analysis was done using the standardized questionnaire: SF-36 Health Questionnaire. The life quality assessment scale was based on the standardized questionnaire used in the medical units. It is a scale that evaluates 6 areas of everyday life.

Experimental part

Material and method
Hospital corridor with a length of 100m and markings indicating the distance traveled.

Standardized physical therapy apparatus and treatments according to the respective unit norms (Military Hospital).

Advanced physical therapy techniques (using virtual reality-VirtualRehab). VirtualRehab is a clinically validated and CE certified complement to physiological recovery therapies for the patient with varying degrees of physical disability. It uses motion capture technology from Microsoft® Kinect sensors to turn the patient into a protagonist of video games interacting with 2D and 3D gaming environments. A multidisciplinary group of opinion leaders from neurology and physiotherapy has collaborated to develop VirtualRehab. It has been clinically validated on the basis of studies conducted in 2012. Their results have proven the utility of VirtualRehab in recovering patients combined with traditional therapies and were presented at the 8th World Conference on Neurorehabilitation in 2014 in Istanbul. Virtual Rehab has been created to improve the quality of life of patients with neurodegenerative, neuromuscular and neurovascular pathologies and to improve the mobility of the elderly. One of the main benefits of Virtual Rehab systems is that it provides a new and exciting platform for making a number of repeated recovery moves to encourage neuroplasticity. Virtual Rehab offers the only way to include Constraint-Induced Movement Therapy (CIMT) - Induced Constraint Motion Therapy. VirtualRehab is a flexible tool that allows specialists to create complex treatment programs. Combining various therapeutic exercises with the appearance of games, ensures an efficient and engaging recovery process; increases patient satisfaction, leading to greater involvement and visible progress. VirtualRehab Body Therapy (CIMT) - Induced Constraint Motion Therapy. VirtualRehab is a clinically validated system allows the return of abilities such as balance, body weight transfer, target achievement, muscle tonicity, effort and resistance. These are major issues in the daily life of the patient for daily activities: feeding, hygiene, dressing, etc.

One of the first attempts to use virtual reality in the treatment alongside physical therapy was a non-

Table 1
DESCRIPTIVE STATISTICS OF STUDY GROUPS

|                      | Group 1 (n=22) | Group 2 (n=20) |
|----------------------|----------------|----------------|
| Age (mean ± SD)      | 62.1±12.1      | 57.6±10.9      |
| Female (n)           | 9              | 6              |
| Male (n)             | 13             | 14             |
| BMI (mean ± SD)      | 27.3±4.43      | 28.3±3.62      |
| Hemorrhagic (n)      | 16             | 12             |
| Living in an urban area (n) | 10          | 14             |
| Living in a rural area (n) | 12          | 6              |
| Time elapsed from stroke (years) (mean ± SD) | 6±4           | 4.95±2.98      |

n – number of observations
SD – standard deviation
p – p value of the statistic test
BMI – body mass index

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immersive virtual environment for training gentle physical movements for stroke patients.

These exercises proved to be a good stimulus both in terms of physical exercise and the morale of many patients who were funny (the statements of the patients who found amusement and hope through these exercises and stated that they gave them a state of calm and reduced anxiety)(fig.1).

The measurement form analyzes data about convenient (normal) and fast (step-by-step) walking on a predetermined route as well as the travel speed and the number of steps required for this route (fig.2).

The Microsoft Kinect SDK recognizes 20 joint points of the human body: HipCenter, Spine, ShoulderCenter, Head, ShoulderLeft, ElbowLeft, WristLeft, HandLeft, ShoulderRight, ElbowRight, WristRight, HandRight, HipLeft, KneeLeft, KneeLeft, FootLeft, HipRight, KneeRight, AnkleRight and FootRight [8].

The 2-minute walk test gathers and analyzes the following data:

- If walking was done with or without a device or without outside intervention, the distance covered within 2 min and the number of steps made by the patient on that route and whether it was improved as a distance and as a reduction in the number of steps. Tests of continuous variables were carried out after the test of normality.
- Unpaired and paired T-tests, as well as Wilcoxon rank-sum and signed-rank tests were performed for continuous variables.
- Wilcoxon rank-sum test was used for questionnaires, whereas Chi-square test was conducted to test the categorical variables.
- The statistical level of significance was set at 0.05, the aforementioned statistical tests being performed with R [X].

Results and discussions

All tests from table 2 did not show a statistically significant difference between groups at admission.
Table 5
TEST RESULTS AT DISCHARGE

|                          | Group 1 (mean ±SD) | Group 2 (mean ±SD) |
|--------------------------|--------------------|--------------------|
| Normal speed, 10-meter walk test | 2.4±1.41           | 2.02±1.01          |
| Swift speed, 10-meter walk test    | 1.78±1.2          | 1.72±1.43          |
| Number of steps, 10-meter walk test | 11.4±4.76        | 9.83±2.77          |
| Center of gravity          | 13±4.25           | 12.7±3.55          |
| Step length                | 13.6±0.02         | 18.7±7.33          |
| Step dynamics              | 15.9±7.47         | 18.1±8.9           |
| Distance, 2 minute walk test | 69.6±32.8         | 131.9±204.6        |
| Number of steps, 2 minute walk test | 71.9±17.6        | 85.7±16.5          |

It can be seen from the table 3 that questionnaire results of patients from group 1 were not significant different from the results of patients from group 2.

Statistical tests from table 4 pointed out more improvements in group 2 than in group 1. The absence of significant differences at admission allowed a comparison of groups at discharge.

The results confirm the utility and usability of the digital patient in clinical reasoning and in educational applications as also confirmed by other studies [9, 10].

As for exposure risks Microsoft Kinect is a marker less body scanning sensor based on an infra-red structured light architecture the harmful exposure of the screened patients is reduced to zero [11]. Apart from its utility to analyze clinical and electrophysiological parameters [12, 13].

Although tests from table 4 showed few improvements also in group 1, results from table 5 emphasized better outcomes of patients from group 2 regarding Step length and two-minute walk test.

Therefore, results from tables 4 and 5 revealed an improvement in the dual-treatment group with virtual reality and drug treatment over those who only benefited from drug treatment.

Also, the group that benefited from a virtual rehabilitation treatment onset before the one-year point experienced a greater improvement over those who benefited after one year.

Thus complex medical rehabilitation therapy sustained and established early, can help improve an individualized recovery program (virtual recovery treatment).

Conclusions
The results revealed a significant improvement in the dual-treatment group over those who only benefited from drug treatment.

The group that benefited from a virtual rehabilitation treatment onset before the one-year point experienced a greater improvement over those who benefited after one year.

Thus complex medical rehabilitation therapy sustained and established early, can help improve an individualized recovery program (virtual recovery treatment).

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