A critical appraisal of "Who May Benefit from Robotic- Assisted Gait Training? A Randomized Clinical Trial in Patients with Subacute Stroke"

By

ELIZABETH MCDANIEL, SPT

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Department of Physical Therapy

Angelo State University

Member, Texas Tech University System

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Abstract

Robotic rehabilitation is an understudied option for treatment due to such high costs and unknown results for hemiplegic stroke patients. This critical appraisal aims to analyze an article that experimented with the outcomes of using robotic therapy alongside traditional therapy for hemiplegic stroke patients. The goal is to understand the purpose of the study and the strength and weaknesses of the authors introduction, methods, results and discussion. The overall findings of the research article show that there is a significant improvement in ambulation and balance control for severe hemiplegic stroke patients, while the findings for less severe hemiplegic patients are not significant. The study uses multiple outcome measures, like motricity index, taken by a physician before and after the therapy implementation, who also was blinded to the subject's treatment. This study also supports its hypothesis of robotic therapy and discussion through the use of multiple recent publications. The quality of the experiment is good and the execution of the experiment is good, the only limitation is the lack of detail for the traditional physiotherapy applied to all of the patients so exact replication could prove difficult. Overall, the data collected is valid and with further research could prove to be a turning point in stroke rehabilitation and the quality of life for patient's post-stroke.

Key words

robotic rehabilitation, stroke, gait, hemiplegia

Introduction

Hemiplegia, or paralysis of one side of the body, after suffering a stroke can be detrimental to any person and their ability to live and thrive independently, including the ability to ambulate and balance. The use of robotic therapy is a new resource that could prove to be beneficial to stroke patients, especially patients suffering from severe hemiplegia. So, for hemiplegic stroke patients, is robotic rehabilitation more effective than traditional motor learning therapy for improvements in gait and balance? The answer could significantly decrease rehabilitation time in patients, utilize therapy time more effectively and be critical for returning stroke patients back to an independent lifestyle.

Methods

The database used to search for literature for this question was the CINAHL database. Keywords used during the search were 'Hemiplegia stroke patient', 'Robotics', and 'Gait'. Limitations placed on the search included that studies had to be in English and the publication date limitations were set for 2007-2017 to ensure the most up to date articles were filtered through and in a language that was understandable for the reader. Inclusion criteria was the use of robotics or motor learning to train gait in stroke patients. The anticipation was to have less than 30 results to filter through and the final search number ended up being 21.

The journal selected was *Who May Benefit from Robotic- Assisted Gait Training? A Randomized Clinical Trial in Patients with Subacute Stroke*, published by Neurorehabilitation and Neuro Repair in 2011. The authors are Giovanni Morone, MD, Maura Bragoni, PhD, Marco Iosa, PhD, Domenico De Angelis, MD, Vincenzo Venturiero, PhD, Paola Coiro, MD, Luca Pratesi, MD, and Stefano Paolucci, MD and the study was conducted at the Santa Lucia Foundation, IRCCS, in Rome, Italy. The study randomly assigned patients to a robotic group or a

control group after obtaining a motricity index score and being divided into two groups based on that score, giving a total of four groups. The subjects were chosen based on when their stroke occurred as well as with other inclusion and exclusion factors. The control groups received conventional therapy only, while the robotic groups had half conventional therapy treatment with the other half being robotic treatment. The measurement outcomes are supported by other research articles confirming their validity and accuracy for measuring the subjects of this study correctly and upon discharge from the hospital four weeks after their stroke, the subjects are measured by a physician blinded to the treatment group. Limitations of the study include the small amount of subjects available due to exclusion criteria, the length of the study was short and treatment attrition due to adverse medical effects.

Results

Summary of the study

Independent walking after suffering a stroke is a main goal for both patient and therapists, yet working solely through the use of treadmill training has proven little efficacy. The implementation of robotic gait machines seems promising, but the cost and uncertainty about efficacy is concerning for future application. This article uses recent stroke victims and categorizes them based on a high motricity or low motricity index and from those two groups were randomly assigned to a control group with physiotherapy sessions only or the robotic group with implementation of robotic therapy paired with physiotherapy. The groups, after 4 weeks of training, were measured for effectiveness by a physician blinded to the treatment group. Results of the data show that there are improvements in effectiveness, functional ambulatory category and the 6-minute walk test for the low motricity, robotic treatment group relative to the high motricity groups and the control low motricity group. At discharge there was a higher percentage

of independent walkers among the low motricity robotic group than the other three groups. The difference between the control group and robotic group for the high motricity group was not significant. The efficacy of robotic therapy is discussed and upheld by the data presented in this experiment, but a limitation of this study is the size of the subject pool and the inclusion and exclusion criteria. Through the use of robotic therapy on severe patients, there was on average 650 more steps taken by robotic treatment patients than someone who only used conventional therapy, emphasizing a retraining limitation not poor therapy technique.

Appraisal of the study introduction

All of the points brought up by the hypothesis in the introduction are addressed and use studies that make this article objective. The authors supported their hypothesis through the use of 19 sources in the introduction alone. The title of the paper is supported by the introduction, the keywords are discussed in the abstract via literature and are recognized in the hypothesis. The independent variable is applying robotic therapy along with normal physiotherapy, and the dependent variable is the amount of independent ambulation achieved by the subjects.

Overall, this is a good introduction that is clear and understandable with minimal recommendations for improvement or noticeable weaknesses.

Appraisal of the study methods

Strengths of this experiments methods include the experimental, between subject design with two groups divided based on motricity level and robotic treatment was given to half of each of the two groups. The physician who measured the subject's outcome measures was blinded to the patient's group assignment and measured level of function. Of 149 subjects recruited, 48 were entered into the study upon meeting exclusion criteria. Attrition rates in the study are due to complications such as hypotension, weakness, fever of the patients which resulted in canceled

treatments, but no subject dropped completely out of the study. All of the subjects received the same amount of treatment with the only difference between control vs experimental treatments being the robotic therapy for the two experimental groups.

Weaknesses of the methods include the subjects were not blinded to the treatment they received. Also, the number of patients used could be a limitation for the applicability of this study to other populations. The physiotherapy sessions performed by the groups is not explained in great detail which could be limiting for repeating the exact process and understanding fully what kind of conventional treatment the subjects received.

Appraisal of the study results

The results section is well written and answers all questions posed by the hypothesis and presents data reported with the used outcome measures as well as the presents easy to read graphs. ANOVA is used to determine significance of data which found the low motricity groups to be significantly different between ambulation levels while the high motricity groups are not.

A weakness of the study is that neither MCID or NNT is mentioned in the study, but otherwise the results section is clear and concise.

Appraisal of the study discussion

In the discussion, the authors interpreted their results and applied them to their hypothesis clearly. Their data is supported with two articles in the discussion and the limitations of the study are discussed regarding the sample size being too small and the outcome measures not measuring a long enough time frame. The authors discuss how future studies could improve on the experimental procedures and they relate their findings back to clinical implications accurately. This study also provides references refuting their findings to provide all the data available on the subject objectively to the reader.

No weaknesses are found in the discussion section of the article.

Discussion

This study answers the posed hypothesis because it isolates the impact of robotic therapy on stroke patients while also remaining within the ethical guidelines and still practicing conventional treatment. This study can have significant impacts on the world of physical therapy because it proves that through the use of robotic treatment, severe stroke patients have a better chance of re-gaining independent walking ability.

The use of robotic rehabilitation proves to be beneficial for stroke patients suffering from hemiplegia that affects their ambulation ability through the findings in this study, particularly severely affected patients. Paired with conventional physiotherapy or motor learning treatment, robotic therapy shows to be crucial for returning stroke patients back to their daily lives especially when severely impacted and should be implemented when financially possible. Improvements on tests like the 6 minute and 10-minute walk tests, trunk control tests and motricity index scoring have been shown for low motricity subjects within the study, providing evidence to support the use of robotic therapy. Benefits outweigh the risks for this kind of treatment if the therapist using the robotic equipment are trained in the equipment adequately and understand their patient's ability to complete tasks from session to session.

The data and evidence provided from this study can be implemented in any clinic depending on how available the equipment is to the therapist. The validity of this study can be strengthened if there is a larger subject pool treated with robotics, but the analysis and data collected shows the power and significance of such rehabilitation, especially for low motricity scoring individuals. The limitation of the cost needed to implement such therapy can be a breaking point for large scale use of this treatment, but with promising scores collected from this

study and the ability to become trained for such equipment, the anticipation of more clinics being able to use this information seems promising. Along with training in working with neurologically impaired individuals and the risks that accompany such impairments, the probability of use in the future can almost be guaranteed, depending on the decrease in cost of future equipment.

The article used for this critical appraisal is sound with good outcome measures and proper resources used to support the experiment. The use of robotic rehabilitation has shown to be effective in returning severely hemiplegic stroke patients back to more independent levels of walking and body control faster than traditional motor training programs. The implementation of such equipment in neurorehabilitation facilities seems promising for the future depending on the cost of such treatment, but should become a necessity should future findings uphold the data found within this article.