

**A critical appraisal of “Early term effects of robotic assisted gait training on ambulation and functional capacity in patients with spinal cord injury”**

**By**

**Ivana Cavazos, SPT**

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**Department of Physical Therapy**

**Angelo State University**

**Member, Texas Tech University System**

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## **Abstract**

This is a critical appraisal for the article “Early term effects of robotic assisted gait training on ambulation and functional capacity in patients with spinal cord injury.” First, an introduction to robotic-assisted gait training is provided. The purpose and importance of critically analyzed articles are also mentioned, along with the clinical question that is to be answered: Would robotic-assisted, body weight-supported treadmill training on the Hocoma Lokomat be an effective treatment modality to regain locomotion in individuals with spinal cord injury?

The methods utilized to complete the literature search along with the search terms, inclusion/exclusion criteria, and limitations that were encountered were included as well. Next, information about the authors, location, publication journal, and year of publication were mentioned along with a justification for the choice of article. The strengths and weaknesses of each section of the article are analyzed and suggestions for improvement are provided.

The critical appraisal concludes with a discussion that includes the clinical significance of the study to current physical therapy practice and its relevance to the clinical question. The discussion also includes an argument in favor of utilizing RAGT therapy along with potential benefits and risks. The discussion is then concluded with a scenario of the implementation of RAGT therapy to a patient with SCI.

## **Key words**

Robotic assisted gait training

Hocoma Lokomat

Spinal cord injury

Ambulation

Functional capacity

## **Introduction**

Robotic-assisted gait training is a relatively new treatment modality being utilized to rehabilitate individuals who have sustained a spinal cord injury. Unfortunately, there are very few articles available that evaluate the effectiveness of the Lokomat, a robotic-assisted gait training system. When utilizing newer treatment modalities, it is important that articles are critically analyzed to ensure that clinicians are utilizing methods that are not only effective but safe. The purpose of this critical appraisal is to examine a research study and determine if the evidence provided is accurate and trustworthy. The clinical question is: Would robotic-assisted, body weight-supported treadmill training on the Hocoma Lokomat be an effective treatment modality to regain locomotion in individuals with spinal cord injury?

## **Methods**

Pubmed was the database utilized to search for the abovementioned clinical question. Pubmed allows one to execute advanced searches and narrow down number of articles while still being specific to the topic. The specific search terms used were “robotic assisted gait training,” “spinal cord injury,” and “locomotion.” A limit encountered was that after checking off the “full free text” option, and narrowing the time frame of the articles, only 35 articles appeared. These filters were added so that the entire text of the articles was available and to ensure that the research was current. Additionally, articles with subjects who had SCI that studied specifically the effect of robotic-assisted training on locomotion were 2 inclusion criteria utilized. Subjects with other diagnoses and studies that had outcome measures other than those related to locomotion were excluded. This process left a total of 7 articles to review.

The article “Early term effects of robotic assisted gait training on ambulation and functional capacity in patients with spinal cord injury” was published in the Turkish Journal of

Medical Sciences in 2019. The research was conducted by authors Mustafa Aziz Yildirim, Kadriye Öneş, and Gökşen Gokşenoglu in Istanbul, Turkey. This article was selected for a comprehensive critical appraisal because it discussed outcome measures that were related to locomotion and all subjects included in the study had a spinal cord injury. In addition, this article would assist with answering my clinical question.

## **Results**

### *Summary of the study*

The research article, “Early term effects of robotic assisted gait training on ambulation and functional capacity in patients with spinal cord injury”, investigates how robotic-assisted gait training effects ambulation and functional capacity in individuals with SCI. Yildirim et al. recruited 88 subjects that were then randomly allocated into 2 groups. The RAGT group was required to participate in 16 sessions of RAGT therapy 2 times a week for 8 weeks in conjunction with conventional therapy twice a day, 5 days a week. The control group was required to undergo conventional therapy twice a day for 5 days a week. The results demonstrated that both groups had an increase in their functional independence measure at the conclusion of the study. The RAGT group scored a 69 on the Walking Index SCI II before the initiation of the training sessions and an 85 after treatment. The control group scored a 67 upon entry and a 77 after treatment. The improvement of the RAGT group was significantly higher according to the Walking Index SCI II score, which indicated that the RAGT group had scored 5 percent higher than the control group. This concluded that robotic-assisted gait training utilized in conjunction with conventional therapy contributed to a greater improvement in ambulation capacity and functional status than solely conventional therapy in individuals with SCI.

### *Appraisal of the study introduction*

This study describes the largest setback of SCI rehabilitation being that current treatment modalities are limited by fatigue. The introduction also provides the reader with background information about the advantages of RAGT machines. It then goes on to describe the current evidence on this topic and the aim of the research study.

The introduction left out information on ambulation and functional capacity, two words that are in the title of the article. The introduction is not comprehensive because it lacks information on why ambulation and functional capacity are important to this study and how they relate to RAGT.

### *Appraisal of the study methods*

One strength of this article was that the research design was a randomized clinical trial, a single-blind study, and the researcher evaluating the patients was blinded. This enhanced validity and minimized tester bias. Additionally, all the participants were being treated at the same neurological rehabilitation clinic, had a neurological level of  $\geq T6$  and above, were AIS-C and AIS-D, had an injury that occurred up to 6 months ago, and could walk independently prior to the injury. According to the article, the “normal distribution suitability of the variables was tested using the Kolmogorov–Smirnov test with Lilliefors Significance Correction,” and the “distribution of categorical variables to groups was compared using the Pearson chi-square and likelihood ratio chi-square tests.” Next, the Mann–Whitney U test was used to compare the two groups and the Wilcoxon test was used to compare the pre- and post-rehabilitation averages. According to my research on these tests and analyses, all of them were utilized appropriately.

The article mentions that during the RAGT session the subject begins with one-half of their body weight supported, then support is reduced, and finally the subject completes gait training with full body weight. For future researchers replicating this study, there would need to be more detail on the rate at which the support is reduced and at what point in the 30-minute training session this is completed. Another observation was that all the outcome measures had sources supporting their reliability and validity, except for the 7-point scale. The description of this outcome measure implies that it is prone to subjectivity and will therefore decrease its accuracy. In addition, the procedure for data collection of neurological level, AIS score, and 7-point scale were extremely vague.

#### *Appraisal of the study results*

The results section is both clear and concise and the authors present their results in the same order that they are introduced in the evaluation parameters section. Another strength is that the results address the research question and the aim of the study. The effect of RAGT on ambulation and functional capacity in individuals with SCI are both included in the author's research aim. The effect of RAGT on ambulation is addressed through the WISCI-II scores and functional capacity is addressed through the FIM scores. Another strength of the article is that Figure 1 is presented clearly and accurately, and Figure 2 is very helpful for readers to visualize an RAGT system.

In the evaluation parameters section of the article, it is mentioned that a "7-point scale was used to score total independence," but these scores were not addressed in the results section. Another weakness can be observed in Table 1. Although the table is accurate, it has a lot of

information in a singular table making it difficult to read. The authors could have made a table for patient demographics and a separate table for patient clinical characteristics.

### *Appraisal of the study discussion*

A strength in the article's discussion is that the author expands on the implications of the findings and mentions that the combination of conventional therapy and RAGT yielded the most significant results. Furthermore, the literature cited was current and published on distinguished journals except for article 21. Article 21 was published in 1988 but has been cited 524 times which indicates that it contains pivotal information that is essential to spinal cord injury research. Additionally, the author recognizes the limitations of the study which I believe is a strength so that they can be avoided in the future if this study were to be replicated.

The authors concluded that RAGT should be used in conjunction with conventional therapy and not as an alternative. Besides this, the authors did not include the clinical significance of the study. This is a weakness because the failure to address the clinical significance of these results diminishes the importance of the results and the need for replication of the study.

### **Discussion**

According to the World Health Organization, between 250,000 to 500,000 individuals sustain a spinal cord injury every year. SCI can result in partial or total loss of sensory function, paralysis, or both. RAGT is rehabilitative strategy used to treat individuals with neurologic injuries. The Lokomat is most often used to assist individuals with regaining and improving walking ability. Studies that evaluate the effectiveness of up-and-coming treatment modalities are pivotal to the physical therapy community because they provide evidence that assists



therapists in creating an effective treatment plan and maximizing the care of their patient. “Early term effects of robotic assisted gait training on ambulation and functional capacity in patients with spinal cord injury” is an article that addresses my clinical question because it evaluates the effectiveness of utilizing the Lokomat to improve ambulation and functional capacity in individuals with spinal cord injury.

Utilizing the Lokomat would benefit individuals who are attempting to regain locomotion, only if utilized in conjunction with conventional therapy. Although the researchers were not able to confirm that there are benefits to using this treatment modality because of the small sample size, greater improvements were observed in ambulation capacity and functional status in the RAGT group. The Lokomat can provide patients with additional treatment time that is more safe and less strenuous and fatigue-inducing than other more common gait training methods such as overground gait training. Furthermore, conventional overground gait training is not always feasible because it may require multiple therapists to ensure patient safety.

I have enough confidence in the research validity of this paper to consider using this evidence with my future patient if they meet the inclusion criteria and used the Lokomat in conjunction with conventional physical therapy. I decided this would be an appropriate treatment modality because no negative effects or decline in functional capacity or ambulation were recorded in the study.

The article “Early term effects of robotic assisted gait training on ambulation and functional capacity in patients with spinal cord injury” has made a great contribution to research for SCI rehabilitation. However, there is still research to be conducted so that clinicians will utilize the Lokomat with 100% certainty that it will be an effective treatment method for individuals with SCI to regain locomotion.