

A critical appraisal of “Improved Walking Capacity and Muscle Strength After Functional Power-Training in Young Children with Cerebral Palsy”

By

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Abstract

Spastic Cerebral Palsy (CP) can increase lower-limb spasticity, decrease strength, and result in the loss in sensitivity therefore affecting a child's walking capacity and muscle strength compared to typical developing (TD) children. Anywhere from 60-70% of children with CP are enrolled in public schools and recreational activities and therefore must be able to participate in the same manner as TD children. In this study, both walking capacity and muscle strength were improved using high velocity power-training techniques in a physical therapy clinic by incorporating functional exercises in the form of a game. The key difference between this intervention and others done in the clinic is that high velocity movement was used. Such movement is more functionally appropriate. The outline of this appraisal breaks this study into its individual components (Introduction, Methods, Results, and Discussion) first discussing each component's strengths and then subsequently their weaknesses. The many strengths of this study, as a whole, supports the use of a high velocity power-training intervention for children with spastic CP.

Key words

Cerebral palsy, muscle strength, walking capacity, high velocity power-training, appraisal

Introduction

The purpose of this appraisal is to discuss the strengths and weaknesses of a published study regarding children with spastic CP who toe-walk, and the question of whether surgical intervention is more effective in bettering their movement and minimizing their pain compared to what can be done in a clinical setting. As with any appraisal, the importance of this paper is to evaluate the relevance and reliability of the evidence provided in this study.

Methods

The database PubMed and keywords: “physical therapy,” “children,” “spastic cerebral palsy,” and “surgical intervention” were used. The limits selected were “Free Full Text” and for the publication date “5 years.” Setting such limitations allowed only for articles that were more recently published within this given area of research. The inclusion/exclusion criteria for this search was that the population studied be children with CP who underwent either a surgical intervention or physical therapy treatment. Any findings about adults receiving treatment were excluded. The purpose for such criteria was to reduce the number of appropriate studies to consider reading after list generation. Together, the above keywords, limitations, and inclusion/exclusion criteria resulted in a database generation of 289 articles from which three were read and one chosen for appraisal.

The study chosen for appraisal was picked because of its many strengths some of which are listed below. This study was written by Liesbeth F. van Vulpen, PT, MSc, Sonja de Groot, PhD, Eugene Rameckers, PhD, Jules G. Becher, MD, PhD, and Annet J. Dallmeijer, PhD all of whom are from the Netherlands where this study was conducted. It was published in 2017 by *Neurorehabilitation and Neural Repair*, which has an impact factor of 4.617. Secondly, it was published in the journal’s thirty-first volume. With this publishing history, it can be assumed that

this journal understands the importance of publishing only quality studies. Lastly, there was less than 10% attrition, when as much as 15% is acceptable.

Results

Summary of the study

Children with lower limb CP exhibit motor impairments, spasticity, and muscle weakness, particularly in the plantar flexors, thus impacting their step length and speed of walking. This study assesses the improvements in walking capacity and strengthening of plantar muscles in children with CP after participating in a functional power-training treatment program consisting of high movement velocities. Twenty-two children participated and each served as their own control. After a baseline evaluation, the children continued their usual care routine for fourteen-weeks. Measurements were taken again before completing fourteen-weeks of the treatment. A third assessment was taken immediately following the treatment and a final assessment after fourteen-weeks had passed post-treatment to observe if improvements were maintained. During the treatment portion, each child participated in three, one hour sessions every week in place of their usual care routine. Exercises included running and walking, both emphasizing the importance of the ankle push-off period, high movement velocity exercises, and progressive load exercises. Outcome measures for walking capacity included the Muscle Power Sprint Test, 1-minute Walk Test, 10-meter Shuttle Run Test, and Gross Motor Function Measure. Outcome measures for isometric muscle strength included assessing the plantar flexors, knee extensors, and hip abductors and dynamic muscle strength was assessed using the single leg standing heel-rise test. Results showed that the power-training treatment resulted in an increased walking capacity and muscle strength with a small, significant decline fourteen-weeks post-intervention. Secondly, greater strength improvement was found in the weaker limb's plantar

flexors. Therefore, as hypothesized, higher velocity strength training positively affected walking capacity and muscle strength for young children with CP.

Appraisal of the study introduction

This study had many strengths. The introduction of this article was written very clearly and was comprehensive. It effectively explained what CP is, how it affects children compared to TD children functionally, what causes those functional deficits, and why a high velocity power-training intervention was proposed compared to progressive resistance exercise (PRE). Previous studies about PRE and those study's weaknesses were referenced within the introduction to explain this study's decision to utilize its chosen intervention.

While the weaknesses of PRE were discussed, no other intervention was. Possible surgical interventions were completely ignored. This was the only area in which this article was found to be lacking in comprehensiveness. A second weakness of the introduction was the use of Reference 11, which is a systematic review. This was deemed a weakness because systematic reviews are not as powerful as experimental studies.

Appraisal of the study methods

This study was prospective and longitudinal lasting 42 weeks with measurements every 14 weeks. This is a strength of the study as this allowed ample time for effects to take place and for researchers to assess how well the effects of treatment lasted once discontinued. Also, the children were similar in sociodemographic, clinical, and prognostic characteristics at the start of the study as shown in Table 2 and no major differences were found. Furthermore, the intervention was clearly described. The outcome measures were also thoroughly described and the reliability and validity of each was provided. Each were supported by other sources. Lastly,

the procedure for data collection was clearly described. For these reasons, this study should be easily replicated. The above-mentioned features are indicative of a strong study.

On the other hand, the research design used was quasi-experimental seeing as the children served as their own control (single system design), which is weaker when compared to a Randomized Control Trial (RCT). Second, there was no blinding in any form (enrollment, subject, clinicians/outcome assessors), which may have allowed for bias. A third weakness of the methods is that the exercises given to each child as a part of their treatment were chosen specifically for them based off of the goals set for them by their parents. Other than that, the children were all managed the same by investigators. This difference in treatment can be viewed as a weakness since an exercise that resulted in greater progress may not have been performed by all subjects therefore negatively skewing the data. The same could be true regarding a less beneficial exercise resulting in positive skewing of data. Without absolute similar treatment, it is not possible to know if such skewing occurred.

Appraisal of the study results

The results were presented in the same order as the research questions that were mentioned in the introduction: first walking capacity and then muscle strength. Beginning with the characteristics of the subjects as well as the compliance and progression of the training sessions before discussing walking capacity and muscle strength created a nice, rational flow within the literature making this a strength for the results section. Concluding this section with the description of any adverse events that occurred was an appreciated inclusion that is often not mentioned in other studies. For this reason, each aim of this study was thoroughly addressed, a great strength of the article. All outcome measures presented in the methods were found in Table 3 within the results section and all tables and Figure 1 were presented clearly. The labels and

keys associated with each made sense and Figure 1 created a great depiction of changes in walking capacity.

Twenty-two children were recruited for this study. Weaknesses of the study include that one subject missed the follow-up assessment due to being hospitalized for other reasons yet still included due to “intention-to-treat”. Furthermore, while subjects did not attend all training sessions due to illness, vacation, doctors’ appointments, etc. all were included in final analyses. One subject that was still included missed 43% of the power-training treatments due to moving to another city. By still including such subjects, it is believed that final statistical analysis should be considered to be somewhat skewed. Second for weaknesses, as mentioned in the discussion of strengths of the results section, Figure 1 was both clear and appropriate, but a second figure could be added depicting changes in muscle strength and because absent could be considered a weakness. Lastly, there was no mentioning of the minimal clinically important difference (MCID) or the number needed to treat (NNT) within this study. While there was no specific mentionings of statistical clinical significance, an overall application statement was made regarding clinical significance. Greater detail regarding clinical significance could have been mentioned.

Appraisal of the study discussion

A strength of the discussion is that the authors tied their findings from this study to existing literature in numerous ways. They expanded on the meaning of their findings by comparing their study to others, pointing out the key differences within their study that may have contributed to greater statistical significance. Such differences include high velocity movements that are specific and functionally beneficial. Secondly, the conclusions made were accurately reflective of the results and no over concluding was found since all that was mentioned was support of the hypothesis.

The two oldest studies referenced were from 1981 (38) and 2003 (6 and 26). 2003, is not all that old, however 1981 is when considering whether a reference is strong or weak. Furthermore, the study from 1981 was a “review.” The limitations to this study, weaknesses, were recognized and mentioned. Such limitations included that this study was a double-baseline design where the children served as their own controls, which can be limiting as a RCT is often referred to as the strongest level of evidence. Furthermore, being a double-baseline study meant that the sample population was smaller than it would have been had it been a RCT.

Discussion

The question of which treatment improved a child’s pain and movement if living with CP can be addressed if this study were compared to studies regarding surgical interventions such as selective dorsal rhizotomy or multilevel tissue release. With this knowledge, a parent can decide which treatment they wish to pursue for their child making this study clinically significant to current physical therapy practice. Allowing options other than selective surgery may be comforting for parents and with this knowledge, hopefully parents will choose to initially try clinical treatments before trying more invasive ones. Furthermore, physical therapists will be able to help a more specialized population in a more functionally beneficial way.

After appraisal, I support the use of high velocity functional power-training, within a clinical setting, by children with CP. Potential benefits include an increase of their walking capacity and strengthening of their muscles. A second benefit is that the exercises prescribed can be modified and designed individually so that each child may achieve personalized goals. If modeled after this study, the exercises performed are functional and involve little risk. Injury is unlikely in terms of the intensity of the exercise and due to being supervised by trained physical therapists. For this reason, the benefits greatly outweigh the risks. However, the argument in

favor of using this appraised intervention could be strengthened by a second study, thus increasing the supporting data. Unfortunately, there is no way to design a similar study using blinding or a RCT. If possible, this would increase favor of the intervention as well.

Due to having more strengths than weaknesses and seeing that the reliability and validity of each test measure used was both mentioned and high, I have confidence in the validity of this research as a whole and would use it as evidence-based practice within my clinical practice. With my future knowledge, skill level, and resources, I anticipate implementing this treatment in the clinical setting. Having the desire to work with special needs children, I anticipate that children with CP will be a portion of the population I treat; and since spastic CP is the most common form of CP, this treatment method has the potential to be greatly utilized.

Through the appraisal of “Improved Walking Capacity and Muscle Strength After Functional Power-Training in Young Children with Cerebral Palsy,” more strengths were found than weaknesses. Therefore, the use of high velocity functional power-training when treating those with CP has been supported and this study found to be both valid and reliable.