4-2020

Musical Shoes Shine a New Light on the Clinical World

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By: Emma Madonna

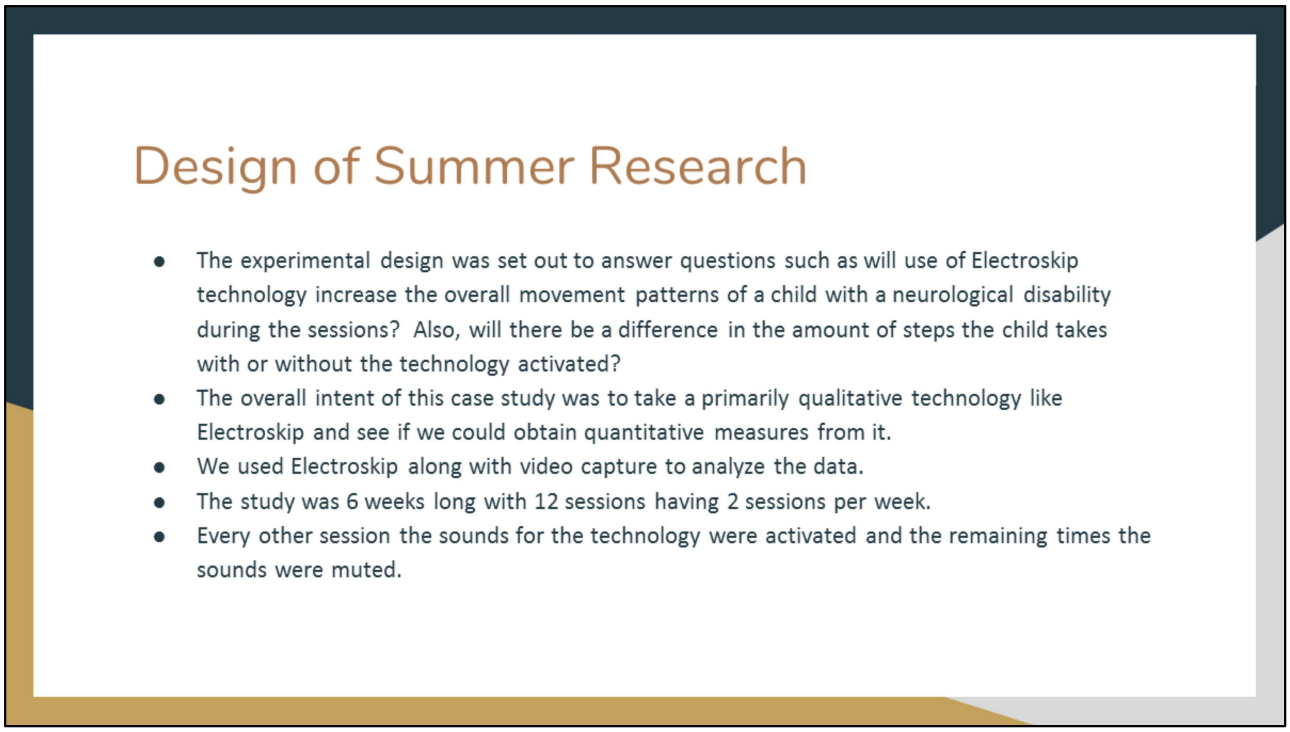
The Electroskip Technology

- The inventor is a Professor at Canisius College in Buffalo.
- The technology was originally designed to assist dancers in choreographing their own music.
- It is now making its way into the clinical world. The first study was a case study of an individual with Parkinson's Disease using the technology.

Electroskip is a biofeedback system that utilizes insole pressure sensors to generate a variety of sounds as a person moves. It is a wireless system that transmits sounds via Bluetooth from the sensors to an Surface pro computer. As I mentioned before, it was originally designed to help dancers follow or create music themselves, but we feel the technology can be adapted to clinical populations, such as Cerebral Palsy, Parkinson's or other neurodegenerative diseases.

Demographics of the participant and Cerebral Palsy

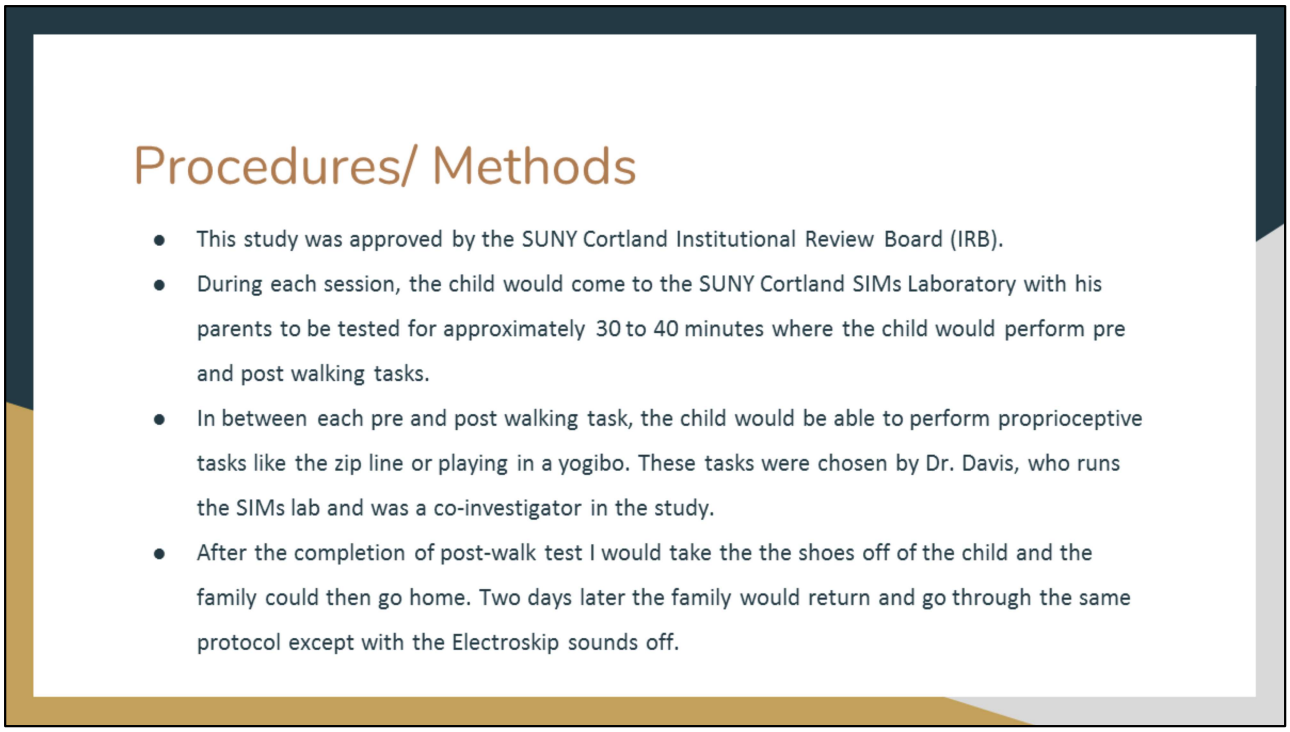
- The participant that we were working with was a 5-year old boy who has spastic quadriplegic cerebral palsy, as well as some cognitive deficits.
- The child regularly attends physical therapy through school and is actively a part of the SIMs laboratory, which is run by Dr. Davis.
- Child is a frequent toe walker and we wanted to try to help improve that.
- Cerebral Palsy is a disorder of movement, muscle tone, and posture.
- Cerebral Palsy is a result of abnormal brain growth, often before birth.
- There is currently no cure for this disorder, but movement in Physical Therapy, medicine, and sometimes surgery can help individuals.



We wanted to be able to see if the technology could be more suitable than just making sounds when walking. We wanted more data to be able to support why and if individuals with neurological disorders may or may not improve with the technology.

We had to have one session each week with sound and one without so that we could see if there was any difference in the child's performance in his pre and post walking tasks.

We used the video recording to be able to have a more accurate reading of the steps the child was getting since the Electroskip is still upcoming.



The child originally was going to do laterally walking, but after many times with the child not wanting to do it, we omitted it from the study and just did straight line walking.
The child would enter the laboratory and I, the Principal Investigator, would put the Electroskip shoes on the child that were specifically designed for him. The child would then walk over to the parallel bars with the assistance of his parents. After that I would talk with the child to see what sound he wanted that day if the sound was activated. After that, the child would walk down to the other end of the parallel bars while I would have the steps being recorded on Electroskip and with a camera. I was also noting the motivation levels of the child during each pre-walk with or without Electroskip and post-walk. As the sessions progressed the child was able to walk back as well. I used the camera, in addition to Electroskip, so that I could simultaneously check the reliability of the Electroskip especially in counting the amount of heel or toe strikes the child got.

The sound was off so we could see if there was any significant difference in the steps taken between having sound and not, which is the main purpose of the study. We did pre and post testing to see how the child may have changed after being able to play etc.

Results

- In order to see if there was any significant difference between the pre and post tests and any difference between using the Electroskip sounds or not we had to run paired samples T-tests. Since the data was not normally distributed we used nonparametric T-tests.
- There was no significance found between the time of completion with or without Electroskip activated or pre and post testing scenarios. An additional T-test for our video data did not find any significance in terms of time of completion.
- There was no significant difference found between the amount of steps that the child took with the pre-post tests or with Electroskip active versus inactive Electroskip.

This is not to say that the technology did not work. The mere fact that the child was able to move and be motivated to walk each session was a success in itself.

Results

Table 2: Number of steps taken for all of the sessions from Electroskip™ and video data.

Collection Type	N	Mean	SD	SE	P-Value
Pre-Step Electroskip	11	46.1	22.8	6.9	0.426
Pre-Step Video	12	44.3	12.8	3.7	0.476
Post-Step Electroskip	10	59.6	61.7	19.5	0.426
Post-Step Video	11	54.5	48.8	14.7	0.476

This is one table that represents some of the results from the study. Here you see that it represents all of the steps taken for all sessions from both Electroskip and video data. There is no significant difference since our alpha level was 0.05. This result table, as well as the following table and graph, were extracted from the research paper written on this research that is currently under review for publication.

Table 4: Number of steps taken for sessions with Electroskip™ inactive with Electroskip™ and video data.

Collection Type	N	Mean	SD	SE	P-Value
Pre-Step Electroskip	6	34.3	17.9	7.3	0.438
Pre-Step Video	6	38.2	9.5	3.9	0.057
Post-Step Electroskip	6	38.7	13.2	5.4	0.438
Post-Step Video	6	35.7	8.8	3.6	0.057

In this table, Electroskip was inactive and there is almost a significant p-value in the pre and post steps recorded from the video source. On the next slide is the graph depicting this data. The reasoning behind why there was almost a significance caught in the video data and not Electroskip is due to the inconsistency in data provided by the tech-scan sensors of the Electroskip system. The problems that were found with the sensors are now being fixed by the inventor and engineer.

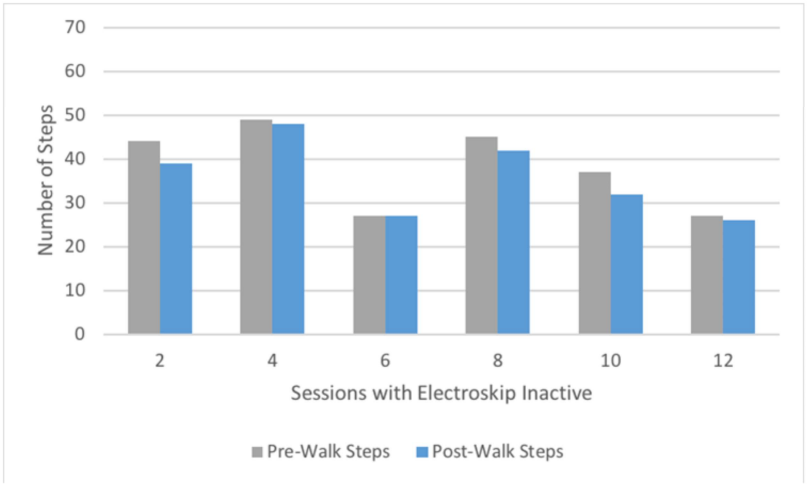
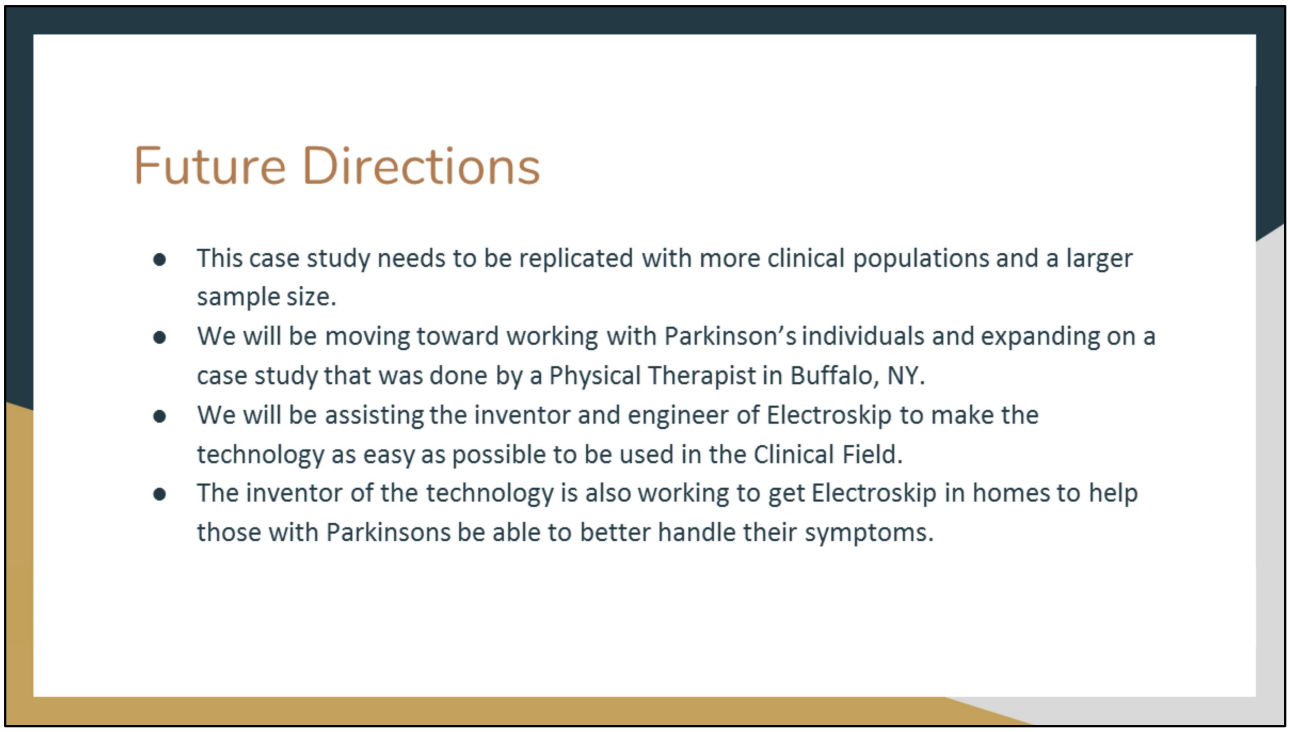


Figure 2: Number of steps taken in sessions with Electroskip™ inactive using video data.

On the y-axis of this graph shows the number of steps between the right and left foot that the child took in either pre-walk or post-walk. The x-axis depicts that the sessions are ones without the Electroskip technology active.

Final Results

- Dr. Davis did a pre-assessment of the child using the Adapted Physical Education SIMs Report (APESIMs) and found that the child could walk two feet with the assistance and support of a walker and hand support under both arms.
- In the post-assessment in August after the research had completed, the child was able to walk 8 feet unassisted while holding onto the parallel bars.
- This is a very promising result, but we cannot assume it is solely from the research intervention of Electroskip.



The case study was a great way to explore the different potential uses of this technology, but it needs to be expanded.
We cannot simply rely on the data from this study since the sample was much too small to try to make an assumption of how it would affect the whole population.