Jumping for Recovery:
Trampoline Rebounder Exercise— A Novel and Effective Physical Rehabilitation Method for Brain-Injured Patients

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Description

An investigation of the effectiveness of Rebounder Exercise (RE) using the common mini-trampoline in helping stroke and other brain-injured patients improve strength, flexibility, and balance.

Introduction

Annually, millions of people worldwide suffer loss of motor function on one side of the body (hemiparesis) from brain injuries. With partial paralysis, daily tasks such as holding an object, eating, and dressing become difficult or impossible. One of the worst impairments is the loss of the ability to ambulate with the consequent loss of independence. All efforts should be made to help patients improve ambulation ability and therefore regain mobility.

Background

Rebounder Exercise (RE) is an ingenious rehabilitation technique that employs the commonly available mini-trampoline. There have been anecdotal reports of the beneficial effect of RE in helping people with impaired physical functions. We started a program in our kinesiology department to systematically study RE's effectiveness on improving strength, flexibility, balance, and coordination. We postulated that jumping on a trampoline, with or without hand-clapping in synchrony, would help to stimulate brain function while providing a total-body workout and that this would improve overall gait, mobility, and general well-being. We decided to focus on measuring the subjects' ability to bend the knees because stroke survivors often suffer from one-sided leg weakness with difficulty in bending one knee, resulting in foot-dragging, impaired gait, increased risk of tripping and falling, and outright inability to walk.

Methods and Subject Selection

The study was conducted during a period of twelve weeks in the Fall 2012 semester and was available to all qualified clients in the Skyline Adaptive Kinesiology class of Professor Cameron Chandler. To be enrolled in the study, the subjects must (1) be able to stand independently (although she/he may receive assistance to get up from the wheelchair), (2) be able to walk independently, (3) be able to attend the sessions consistently, and (4) not be suffering from pain or discomfort.

Based on the above-mentioned criteria, three subjects were selected and followed for the purpose of this study. Throughout the entire period, equipment and assistance were available for any adaptive students who wish to benefit from them even if they are not enrolled in the study.

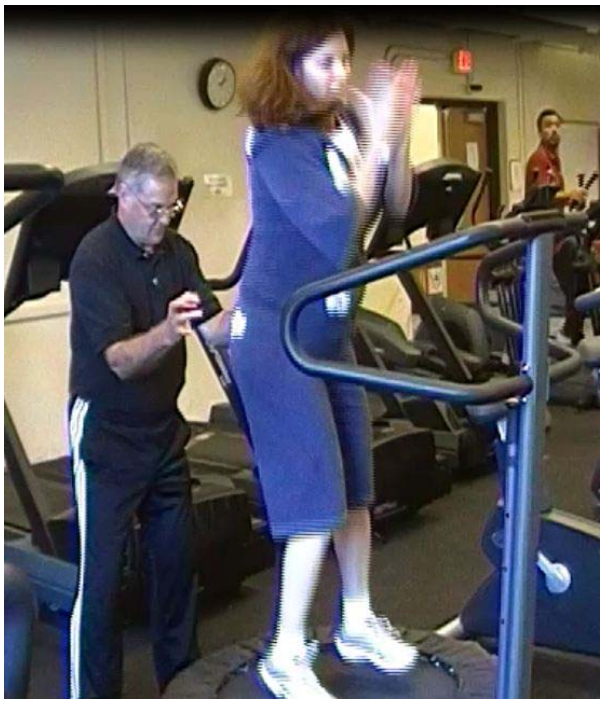
Procedures:

Since the study population is generally frail, at the start of each session, the subject is briefly interviewed to make sure she/he is neither suffering from pain or discomfort nor otherwise having an unusually bad day (such as from lack of sleep the previous night).

The subject has both knee angles measured before and after the trampoline session (figure 1). The subject is then asked to walk down the length of the room and back while Professor Chandler makes observations regarding their gait (figure 2). This is repeated after the trampoline session. Both walks are videotaped. On the trampoline, the subject is instructed to jump until tired (figure 3). The subject is allowed to hold onto the specially equipped handrail if necessary. In addition, there is at least one trained person (usually Professor Chandler) standing directly behind the subject to carefully monitor, steady, and reposition the subject. If able, the subject is asked to clap her/his hands in synchrony with the jumps. The counts of jumps and of hand claps are noted. The time duration is recorded with a timer. The trampoline session is also entirely videotaped. At the conclusion of each session, the resulting measurements and observations are reviewed with the subject to provide feedback.

Figure 1. The protractor (Baseline™ Instruments, Country Technology, Inc, P.O.Box 87, Gays Mills, WI 54631-0087) is our primary tool for measuring the minimum angle (maximum bend) of subjects' knees.

Figure 2. The subject's gait is observed and videotaped before and after the trampoline session. This photo shows the typical foot dragging due to the limited ability to bend the knee on the weak side of the body.



This photo shows the trampoline setup with the special handrail. The subject is instructed to clap and jump in synchrony. A coach stands ready to prevent falls.

Results

Data analysis demonstrated several positive trends. Chart 1 shows the increased strength all three subjects experienced, as evidenced by the overall increase in jumping speed which was measured in number of bounces per second.

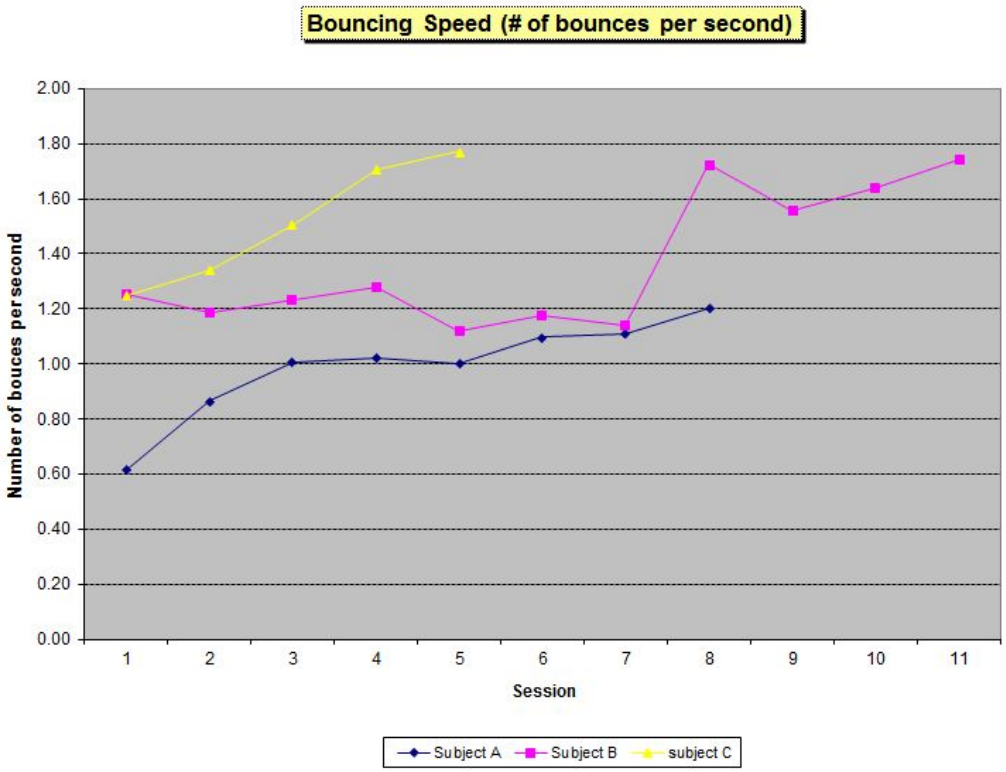


Chart 1

Chart 2 demonstrates that at every session, the subjects experienced increases in their ability to bend their knees as measured by the angle of active knee bending using the special protractor. The difference in the angle of the knee as measured before and after the trampoline session are graphed (angle before minus angle after). The greater ability to actively bend one's knees is important in reducing the foot dragging commonly seen in leg weaknesses due to brain injury.

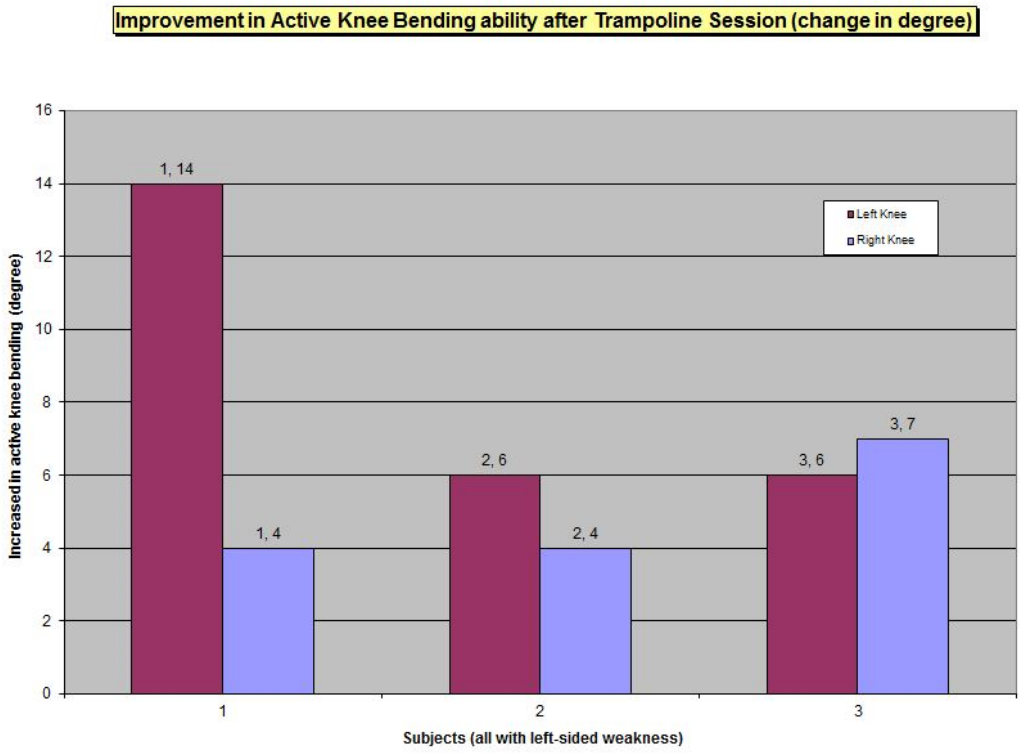


Chart 2

Discussion

RE probably works because of its rhythmic nature, which stimulates the mind and the entire body in synchrony. It is also gentle. A patient can start by simply bouncing up and down.

The trampoline needs to be equipped by safeguards, such as a handrail. An assistant, such as a family member, should be present nearby and ready to help catch the patient, who should not do the exercise on days he or she does not feel well.

Future studies could build on this and delve deeper into quantifying the overall benefits patients feel after an RE session. For example, one subject recounts feeling an improved flexibility for about 1 to 2 hours after the session, including while driving home. We could start to more consistently ask everyone how long the effect lasts. Perhaps a follow-up phone call to the subject the evening after each session should be built into the study procedure.

Conclusions

The study demonstrates that RE is beneficial. Because it is inexpensive to set up in any post-stroke rehab site, RE should be widely available. More awareness about this novel rehab modality would greatly benefit brain injured people trying to regain function and independence.

Authors' Roles

Ms. Jenny Vo-Phamhi is the lead investigator in this project. She initiated and designed the study, reviewed the background literatures, studied the video tapes, analyzed the results, and prepared the abstract, posters, and paper for presentation. Professor of Kinesiology Cameron Chandler has had decades of experience helping brain injured and mobility limited students to regain functions. Many of the Adaptive PE students regularly attend the class twice a week for years to benefit from his expertise and the mutual support from other students. All RE runs were under his direct supervision. Professor of Biology Shari Bookstaff brought the invaluable experience and perspective of a personal history of brain injury resulting from complication of a "routine" removal of a benign brain tumor. With her resulting physical impairment she served as a subject in the study. Dr. Teri Vo, MD, helped with the study design, patient coordination and video-taping.

Acknowledgement

The authors would like to acknowledge all the brain-injured and mobility-challenged students in the Skyline College Adaptive Kinesiology Class. Their hard work every day to regain function and lead an independent life serve as the main inspiration for this study.

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