Effects of Simulated Equine Motion Therapy for Gait and Balance in the Elderly

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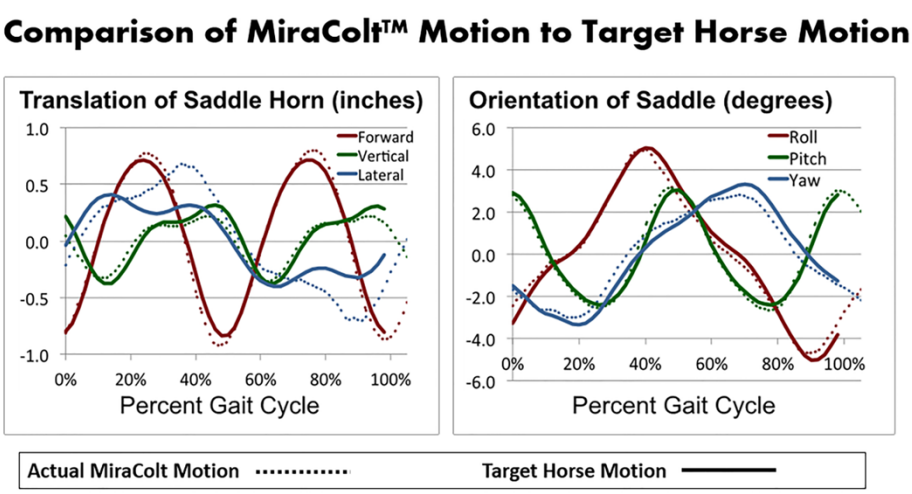
INTRODUCTION

The **risk of falling** is a major problem facing the aging community, with high incidence, high morbidity rates, added burden for caregivers, increased health care costs, and reduced physical and social activity[1].

Key factors associated with fall risk include balance, gait, and muscle strength, among others. One treatment strategy to address these challenges involves time riding on a horse. The rhythmic, three-dimensional horse-riding motion produces neuromuscular responses by integrated sensory and motor stimulation, including in the vestibular and proprioceptive systems, all of which contribute to equilibrium. However, access to such treatment with horses can be limited due to geographical location, weather, allergies, fear of animals, safety concerns, and cost.

This study considers the effectiveness of using an appealing complementary option that provides realistic equine riding motion by way of a mechanical simulator, the MiraColt™ by Chariot Innovations.

MiraColt By Chariot Innovations



The MiraColt™ is a medical-grade device that is compact, low to the ground, and safe. It provides variable speed control through a single electric motor that runs on standard 120VAC power.

It facilitates indoor, urban access to the realistic, natural motion patterns experienced when riding a horse. It can improve safety and accommodation, including that for the more severely impaired, reduce cost and needed human power for treatment, and increase the opportunity for more frequent dosage.

The MiraColt allows ready interaction between the rider and therapist, or with external objects which may be used in therapy. With the MiraColt, several treatment variations are possible, including speed, riding duration, frequency of dosage, motion amplitude (by adjusting sitting position), and use of accessories like stirrups.

METHODS

An IRB-approved study was conducted at The Delaney at Lake Waco, involving independent living residents. Twenty were enrolled, above 60 years of age, apparently healthy and medically stable, and physically able to participate.

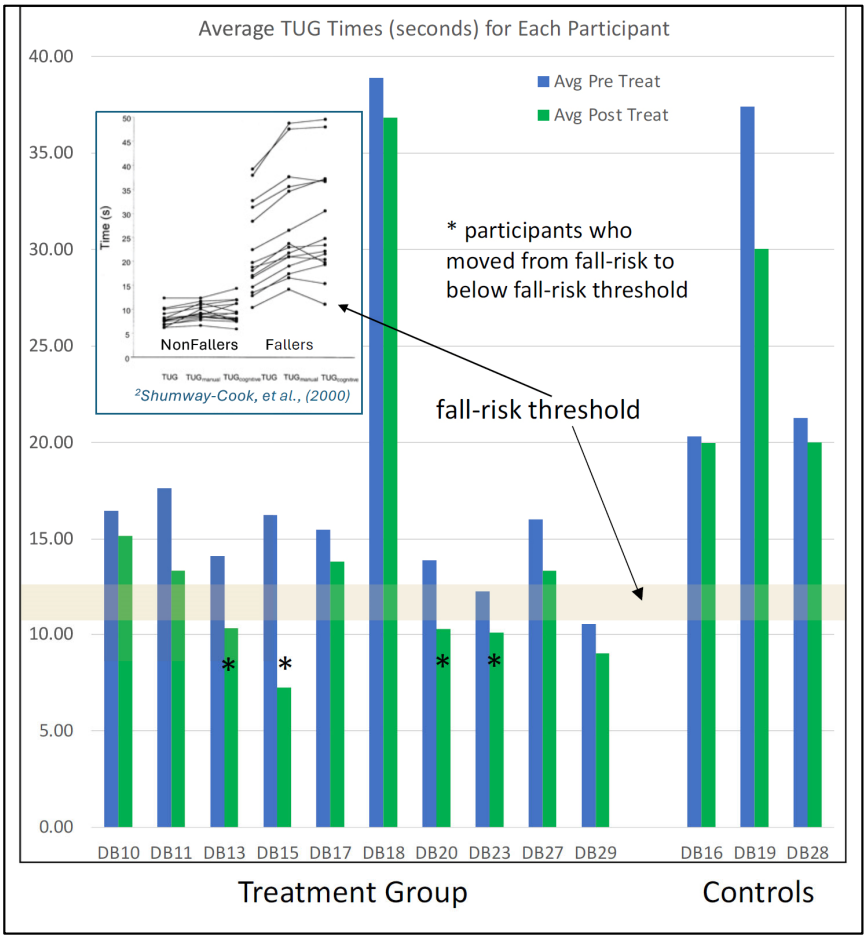
A StrideWay instrumented walkway was used to collect quantitative gait data for forward and backward walking trials, and timed-up-and-go (TUG) trials. Manual muscle testing was performed for strength of core, hip, and knee muscle groups in various directions of joint motion.

All continued with normal therapies and activities over six weeks, two sessions per week, with a treatment group (TX) incorporating simple MiraColt riding for 10 minutes, while a control group (CX) did not. Assessments were conducted before and after the six-week intervention period.

RESULTS: Overview

Of 20 participants who completed pre-assessment, several dropped out due to sickness, or frustration at being CX and not getting to ride MiraColt. Some CX also began riding MiraColt outside of protocol and thus were switched to TX. In the end, 3 as CX, and 10 as TX, completed the study

RESULTS: Timed-Up-And-Go (TUG)

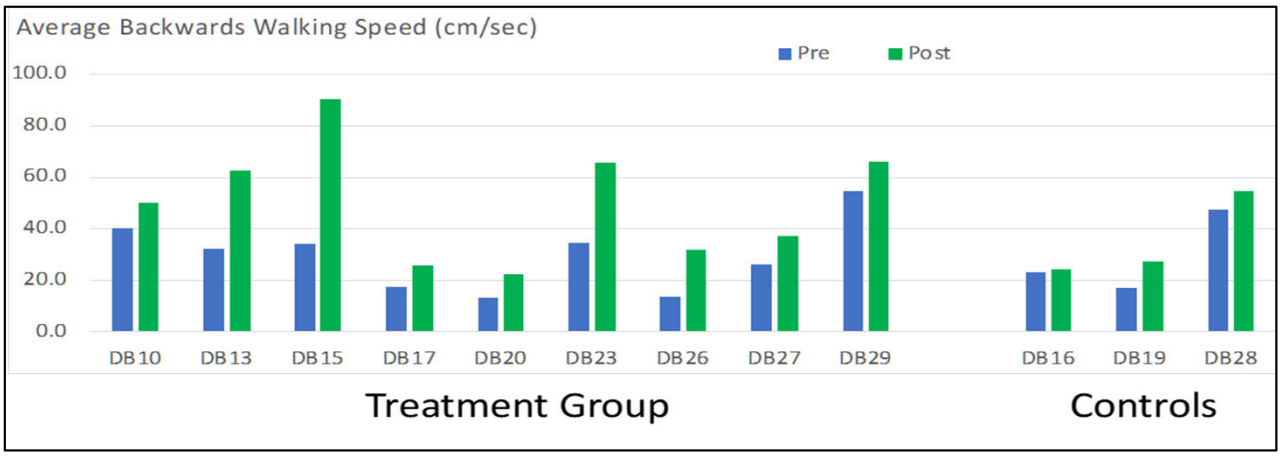


All in-treatment (TX) and control (CX) groups showed at least some improvement in TUG times. The CX group happened to begin at a worse level (20s) compared to TX (17s) but improved slightly less on average (3.0s compared to 3.2s).

As a percentage of the beginning level, however, TX improved on average by 20%, whereas CX by 9%, and that 9% was mostly from one participant (DB19).

Two-thirds of CX improved by less than 6%, whereas all but one (90%) TX improved by more than 7%, and seven (70%) by more than 14%. One TX improved 55% (DB15)! Of the ten in TX, nine began at or above the fall-risk threshold, and four of those (44%) improved to below the threshold. None in CX improved to be close to the threshold.

RESULTS: Backward Walking Speed



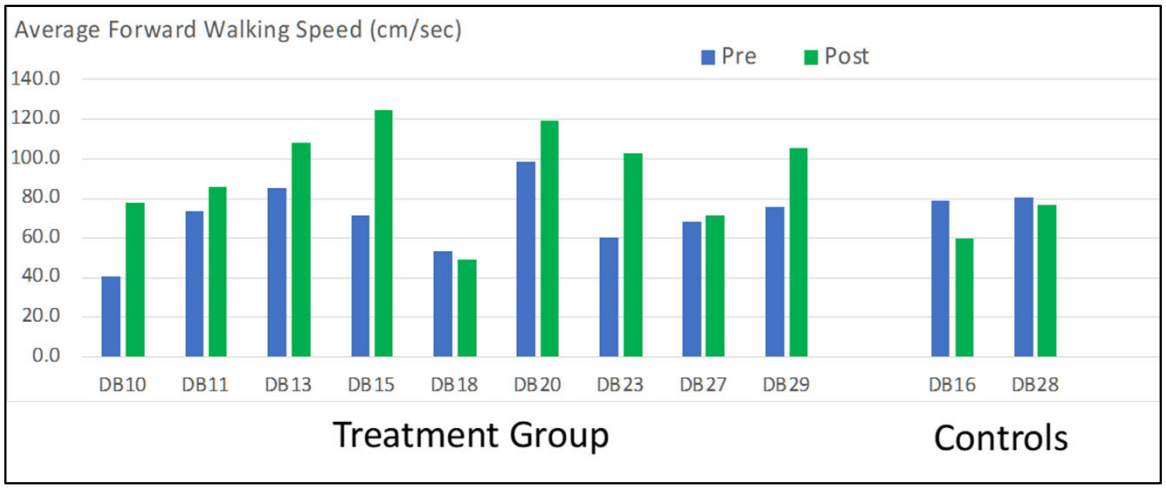
Each participant performed one backwards walking trial on the StrideWay during each assessment session pre- and post-treatment. Participant's walkers and canes were permitted as they performed the backwards walking test, using toe-to-heel foot contact, for the length of the mat.

Backwards walking speed (cm/sec) was computed using the StrideWay standard software. Research suggests backwards walking speed is a good measure associated with fall risk[3]. Normal backwards walking speed is about 70 cm/sec.

The results show that all participants saw at least some improvement in backward walking speed after the treatment period. The TX group improved by 20.6 cm/sec from an average of 29.6 to 50.2 cm/sec (an average 69.7% improvement).

The CX group improved by 6.3 cm/sec from an average of 29.3 to 35.6 cm/sec (an average 21.4% improvement). The improvement among TX was over 3 times that among CX. The minimum improvement among the TX group was 21.1% (DB29). One TX nearly tripled speed from 33.9 to 90.5 cm/sec (DB15). Four of nine (44%) TX improved by more than 85% (nearly doubling speed). Two of nine TX improved by less than 42%.

RESULTS: Forward Walking Speed



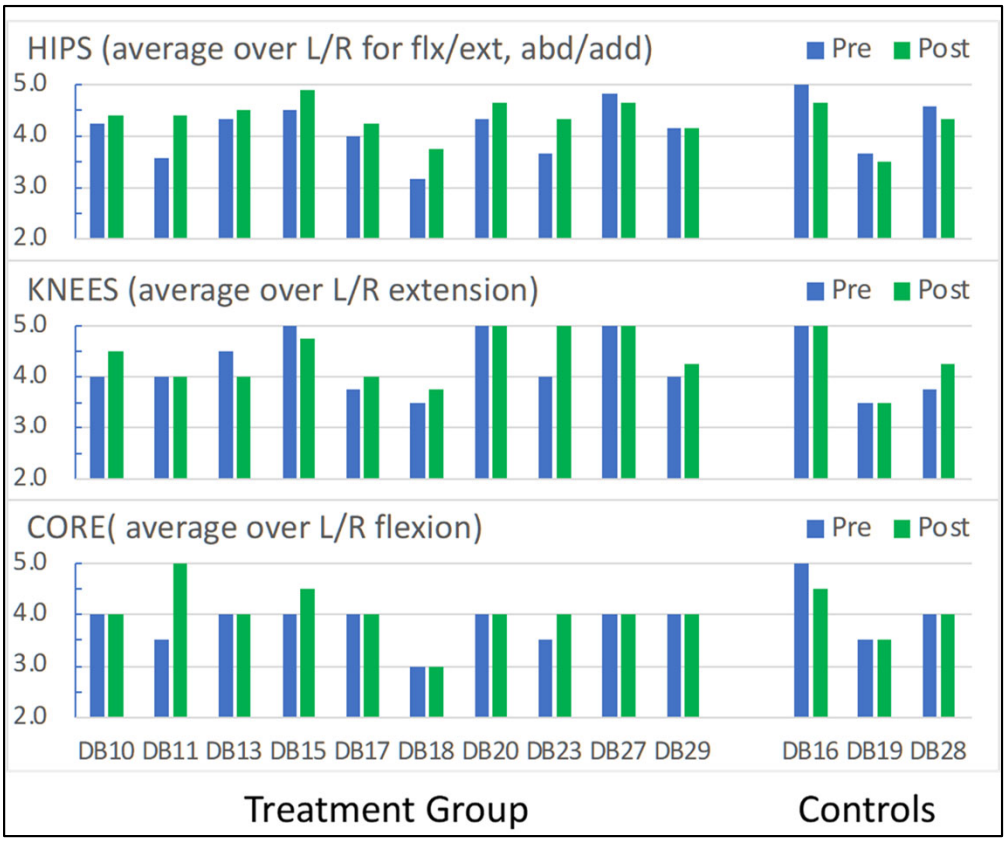
Each participant performed four forward walking passes on the StrideWay instrumented mat during each assessment session both pre- and post-treatment period. Participant's walkers and canes were permitted as they performed the forward walking test over the length of the mat. Forward walking speed (cm/sec) was computed using the StrideWay standard software. Normal forward walking speed is about 120 cm/sec.

Complete data from only two CX participants was available for forward walking speed. The results show that before the treatment period, the average forward walking speed of the CX group (79.5 cm/sec) was faster than that of the TX group (69.4 cm/sec).

After the treatment period, the TX group had improved speed by an average of 24.4 cm/sec to 93.8 cm/sec (a 38.1% improvement), whereas the CX group had decreased speed by an average of 11.4 cm/sec to 68.1 cm/sec (a 14.5% decline).

Eight of nine TX improved speed, while one declined slightly (7.1%). Both CX declined, and one declined by 24%. Three TX improved over 70%. The net difference between the average change in TX compared to the average change in CX is 35.8 cm/sec, or 50.2% advantage for improvement in the TX group compared to the CX group.

RESULTS: Muscle Strength



Manual muscle strength testing was conducted by the same trained evaluator for all participants and all tests. The strength tests included for hip (flx, ext, abd, add), knee (ext), and core strength (flx). The standard score for each test is from 1 to 5, where 1 = "muscle contraction without visible movement", 2 = "movement without gravity", 3 = "movement against gravity", 4 = "movement against gravity and moderate resistance", and 5 = "movement against gravity and substantial resistance".

Over all participants in the study, pre- and post-, average strength scores were between 3 and 5. Both treatment (TX) and control (CX) improved slightly at the knee. At the hip, eight of ten TX improved (avg +0.33), while all CX declined (avg -0.25). For the core, three TX improved (avg +0.25), one CX declined (avg -0.17), while other CX were unchanged. Net difference TX–CX: Hip=+0.58, Core=+0.42

REFERENCES & ACKNOWLEDGEMENTS

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