# IMPACT OF DIMINISHED VISUAL FEEDBACK ON POSTURAL CONTROL

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## Abstract

INTRODUCTION: Sensory systems are an integral key to efficient postural control. Out of all the sensory systems, visual has shown to be the most heavily relied on. With the progression of age there is a decline with not only this sensory system but also postural control. The vestibular sensory system contributes to equilibrium, balance, and spatial orientation.

PURPOSE: The purpose of this study was to evaluate postural control when visual feedback was diminished in an unstable support surface.

METHODS: Twelve women (age $75 \pm 10.0$ yrs), of the Center of Healthy Living and Longevity, volunteered to participate in this study. Each subject participated in a 12 week balance/strength training program to increase balance. A pretest was given to them before the program started and a post test after the last session. The tests before and after included a Sensory Organization Test on the Neurocom (The SMART Balance Master®). The condition of eyes closed with an unstable support surface was analyzed after three trials and an average of the scores were taken for comparison.

RESULTS: The hypothesis was not supported. After analyzing the data with a dependent sample t-test, post testing equilibrium scores ($M = 70.70$, $SD = 7.53$) did not yield a significantly greater mean than pre testing equilibrium scores ($M = 67.52$, $SD = 10.82$) $t$ (11) = -1.22, $p = .25$.

CONCLUSION: Although there was an increase in vestibular function during post testing; the results of this study indicate that balance/strength training does not aid in a significant difference for vestibular function in regards to postural control.

## Introduction

Sensory systems are an integral key to efficient postural control. Out of all the sensory systems, visual has shown to be the most heavily relied on. With the progression of age there is a decline with not only this sensory system but also postural control. The vestibular sensory system contributes to equilibrium, balance, and spatial orientation. The vestibular system is made up of three components: Balancing for older adults is more of a demanding task, even if the adults are relatively fit. Site diminishes with age, the ability to see clearly, focus, and depth perception all lower. Age related eye problems can also cause visual impairments and distort vision. Without these visual cues balance can be compromised. In a balance test, where trunk sway measures postural stability, participants closed their eyes and were recorded swaying three times as much than when they had their eyes open. The aim of this study was to evaluate postural control when visual feedback was diminished. The goal was that with strength training the vestibular system would become more efficient.

## Methods

Twelve women (age 75.33 ±5.63 yrs), of the Center of Healthy Living and Longevity, volunteered to participate in this study. Each subject participated three times a week in a twelve week training program to aid in the increase of fitness and balance. Table 1 portrays the workouts conducted.

## Methods (cont'd)

A pretest was given to the participants before the program started and a post test after the last session. Subjects had an average height of (64.63 ±2.07 in.) and average weight of (162.33 ± 22.59 lbs). The tests before and after included a six minute walk, thirty second bicep curl (using five pounds), and a Sensory Organization Test on the Neurocom (The SMART Balance Master®). The condition of eyes closed with an unstable support surface was analyzed after three trials and an average of the scores were taken for comparison. The bicep curls and 6 minute walk were used to see if strength gains were made during the training program.

Table 1. Geriatric Fitness Workout

| COUNT | EXERCISE | COUNT | EXERCISE |
|---|---|---|---|
| | Warm Up | 10x (hold last one 5s) | Foot ball squeeze |
| 5 min. | Brisk Walk/Marching in place | 10x | Bicep curls with resistance band/weight |
| | Stretching/Flexibility | 10x (hold 5s on last) | Straight front arm raises with band/weight |
| 3x | Look U, D, L, &R | 10x (hold 5s on last) | Side arm raises |
| 3x L&R | Neck Rotations | 10x 5 sec hold | Leg/hip abductors with bands |
| 10x F&B | Shoulder Shrugs & Large Arm Circles | 20 sec | Jog in place, swing arms |
| 10x ea way | Wrist, Thumb, Ankle Rotations | 10x | Chest opener with band/weight |
| 15 ea | Seated High Knees | 10x | band pull out |
| 2x10sec ea. | Straight leg toe-reach – 10 seconds each leg, 2 sets | 10x | Tricep extension |
| 10x ea way | Foot rides opposite leg- 10 each leg | | Standing Shoulder Flexibility |
| 10x | 10 Chair Stands, arms crossed | 10x | Hold band overhead |
| 3x | Deep Breaths with Hands overhead on inhales | 10 sec | Side bend: Stretch to each side |
| 10 sec | Palm/arm stretch | 10x | Band: overhead to back to chest |
| 5 min. | Brisk Walk/Marching in place | 5 min | Brisk Walk/Marching in place |
| | Standing | | Balancing and Standing Exercises |
| 10x ea | Trunk Rotations w/ ball | 15 sec ea. | Raise one knee up, stretch one/both arms out |
| 10x ea way | Ball raise/lower | 15 sec ea. | Hold one leg back, one/both arms out |
| | Seated Exercises | 15 sec ea. | Hip flexor stretch and balance |
| 15-20x | Seated jumping jacks | 10x ea. | Open hip rotation |
| 10x 5sec hold | Ball squeeze and release | 10x ea. R,L,F&B | Leg Raises |
| 10x 5sec hold | Arms straight out ball squeeze | 12x | Squats |
| 10x F&B | Ball rotations | 10x ea. | Calf raises, toe raises |
| 15x | Ball transfer across the chest | | Stretch/Cool Down |
| 15x | Ball transfer overhead | 10 sec (R&L) | Stretch Neck, Toe Reach, Arm Stretches |
| 10x 5sec hold | Ball squeeze with knees | 3x, 10x | Deep Breaths and Eyes Open and Close |
| 10x (hold last one 5s) | Leg lifts with ball between feetmini lifts. | 3x | Center of the ear hold |



Fig. 1 Neurocom The SMART Balance Master®

## Results

The hypothesis was not supported. After analyzing the data with a dependent sample t-test, post testing equilibrium scores (M = 70.70, SD = 7.53) did not yield a significantly greater mean score than pre testing equilibrium scores (M = 67.52, SD = 10.82) t (11) = -1.22, $p = .25$.

## Results (cont'd)



Fig. 1 The Relationship between Average Equilibrium Pre Test vs. Post Test
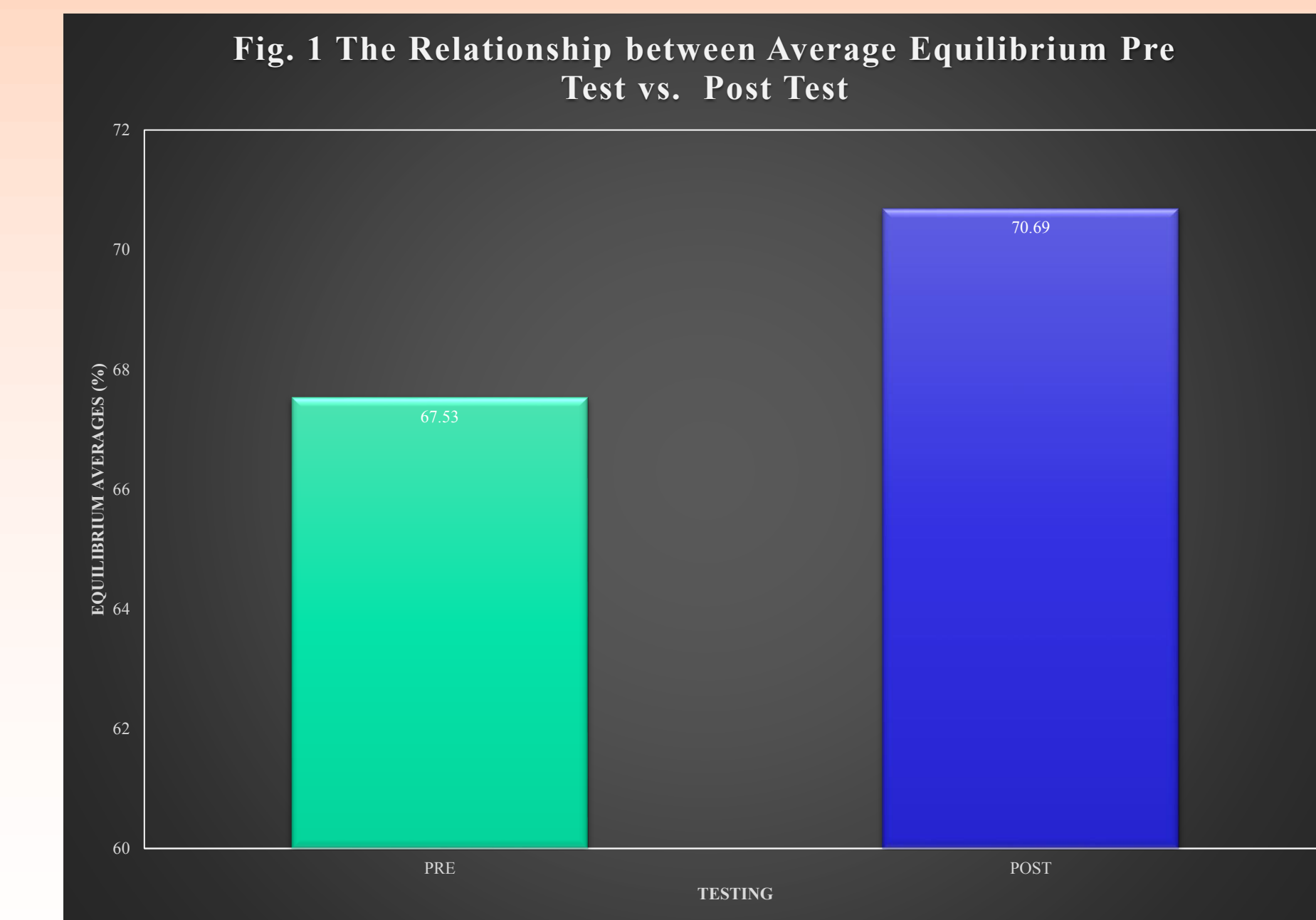
Subjects did better in Pre Testing (21.67 ± 5.63) for the most repetitions of Bicep Curls in a span of thirty seconds than post testing (19.17 ±4.63). For the 6 Minute Walk the average was lower for the pre test (429.90 ± 169.11 yds) compared to the post test (490.07 ± 177.83 yds).

Table 2. Subject Demographics

| | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|
| Equil_Pre | 50.67 | 83.33 | 67.5244 | 10.81851 |
| Equil_Post | 57.67 | 80.00 | 70.6958 | 7.52698 |
| Age | 69.00 | 86.00 | 75.3333 | 5.63001 |
| Height (in) | 62.00 | 68.00 | 64.6250 | 2.07939 |
| Weight (lbs) | 117.00 | 196.00 | 162.3333 | 22.59257 |
| Bicep_PRE | 13.00 | 31.00 | 21.6667 | 5.85170 |
| Bicep_POST | 10.00 | 27.00 | 19.1667 | 4.62863 |
| 6 Min Walk PRE | 141.70 | 621.70 | 429.9000 | 169.10730 |
| 6 Min Walk POST | 108.33 | 798.33 | 490.0692 | 177.83732 |

## Conclusions

Although there was an increase in vestibular function during post testing; the results of this study indicate that balance/strength training does not aid in a significant difference for vestibular function in regards to postural control. The pre and post test indicate that fitness gains from the workout program were inconsistent. These inconsistencies could be due to a variety of things. For example weather change caused a few of the patients arthritis to flare up which deterred them from giving their best effort in post testing. Recommendations for future studies is a larger pool size, and more indicators of fitness for pre and post testing.