# The Effects of Eyes Open and Eyes Closed Balance Training on Balance Outcome Scores in Individuals Identified as Having Chronic Ankle Instability: A Protocol Paper

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## INTRODUCTION

Ankle injuries, including ankle sprains, are one of the most common injuries in the United States. Research has found that over $1000 is spent on average when treating sprains, along with recreational activities in addition to the cost of time off of work or school.[1-2] Balance training has previously been shown to be an effective form of treatment for chronic ankle instability.[6] The removal of visual input is often a progression used in clinical settings when performing balance training, however there is a gap in the literature regarding the efficacy of eyes closed balance training when compared to eyes open balance training.

Balance training has been shown to be an effective form of treatment for treating chronic ankle instability by improving functional outcome scores[3] and dynamic balance.[4] Balance is the result of three sensory systems providing information to the central nervous system, which in turn develops a motor response. The three sensory systems for balance include the vestibular system, visual system, and proprioception.[5] A way in which one can challenge balance is to take away one of these systems to force one's body to rely upon the remaining sources of sensory information. It has been theorized that difficulties with balance in patients with chronic ankle instability can stem from impairments to ankle proprioception.[3] It is theorized that eyes closed balance training would yield better results, due to the removal of a balance system. However, a gap in the literature exists when comparing the efficacy of a balance training program deprived of visual input with a program utilizing visual input for effective rehabilitation of ankle sprains.

## RECRUITMENT

Participants of the study will be students at Misericordia University between the ages of 18-29 with Chronic Ankle Instability that met our inclusion and exclusion criteria as described below. Participants were recruited through convenience sampling by way of the following flyer. The flyer was posted around campus and on social media by the researchers.

**Inclusion Criteria:**
- 2 or more ipsilateral ankle sprains
- Ages 18-29
- Student enrolled at Misericordia University

**Exclusion Criteria:**
- No history of lower extremity injury aside from ankle sprain
- No history of ankle sprain within 6 weeks prior to study
- No history of balance disorder, neuropathies, or other conditions that may affect balance
- No participants actively participating in an organized sport
- No history of injury to the spine with residual sensory/motor dysfunction

DO YOU ROLL YOUR ANKLES?

We are seeking for participants in a study on Chronic Ankle Instability. Participants will be entered to win a $20 Visa Gift Card!

Disclaimer: Participants will be asked to participate in a balance program that could improve their instability but has a risk of new injury

MISERICORDIA UNIVERSITY

WE ARE LOOKING FOR PEOPLE THAT HAVE A HISTORY OF SPRAINING THEIR ANKLE(S) MORE THAN ONE TIME

YOU WILL BE ASKED TO PARTICIPATE IN A BALANCE TRAINING PROGRAM 2 TIMES A WEEK FOR 6 WEEKS

PARTICPANTS MUST BE MISERICORDIA STUDENTS BETWEEN THE AGES OF 18-30

PARTICIPANTS SHOULD HAVE NO CURRENT OR PRIOR HISTORY OF SIGNIFICANT INJURY TO EITHER LEG OTHER THAN ANKLE SPRAINS. NOR ANY OTHER CONDITIONS IMPACTING BALANCE

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## RESEARCH DESIGN

This randomized controlled trial will utilize 2x2 independent-measures experimental design. The independent variables are group (eyes open vs. eyes closed) and time (pre vs. post intervention).

## INTERVENTIONS

Participants will provide informed consent prior to the beginning of training during the initial collection of objective and subjective measurements. Participants are to be randomly assigned to one of two groups via random selection prior to the first balance training session. The participants will be informed that one group will be completing their training with eyes closed interventions while the other group is doing the same protocol with their eyes open. There will be no deception taking place in this study.

The balance protocol is to be completed for 6 weeks with each group meeting twice each week for a total of 12 sessions. Once the groups have been designated, two session meeting times must be given to each. Research members will be present at all sessions (2 sessions per week for eyes open and 2 sessions per week for eyes closed) to ensure safety of the participants and proper implementation of the protocol.

When hosting the balance sessions, all participants will complete four priming exercises with their eyes open **(See Figure A**). Afterwards, the balance training protocol will be performed with either eyes closed or eyes open (**See Figure B**). The balance protocol should take 18-20 minutes to complete.

| Priming Exercises | Parameters |
|---|---|
| Quadrant Hop | 5 cycles clockwise, 5 cycles counterclockwise |
| Single Leg 4-Way Tap | 3 sets completed for 10 repetitions |
| Single Leg Hip 4-Way | 3 sets completed for 10 repetitions |
| Single Leg Ball Toss | 3 sets completed for 10 repetitions |

**Figure A**: Priming Exercises performed with eyes open by both groups

| Balance Training Protocol | Parameters |
|---|---|
| Single Leg Stance with Knee at 90-90 | 45 second hold for 3 sets |
| Tandem Stance on Airex Foam | 30 second hold for 4 sets |
| Single Leg Stance with Finger-to-Nose | 45 second hold for 3 sets |
| Alternating Step Taps | 45 second hold for 3 sets |
| Single Leg Stance with Head Turns | 45 second hold for 3 sets |

**Figure B**: Balance Training Protocol Exercises performed with eyes open or eyes closed depending on group designation

## OUTCOME MEASRUES

Outcome measures will be administered by the same licensed Physical Therapist both before and at the end of the training protocol. The administrating therapist will understand how to perform each objective outcome measure and be blind as to which group the participant belongs.

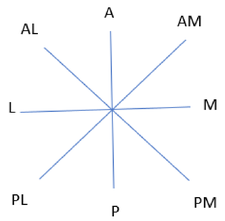
**Subjective Outcome Measure:**
Foot and Ankle Ability Measure (FAAM) – ADL and Sport
Shown to be reliable, responsive, and valid outcome measure for self-detection of deficits in individuals with CAI.[6-7]

**Objective Static Balance Outcome Measure**:
Balance Error Scoring System (BESS) Test

Shown to have interrater reliability that is fair to excellent and medium criterion related validity when assessing balance in individuals.[8]

**Objective Dynamic Balance Outcome Measure:**
Star Excursion Balance Test

Reliable and valid test for determination of reach deficits in individuals experiencing CAI.[9] The test re-test reliability has been found to be moderate to good.[10] All 8 directions for the SEBT were tested.




## ANALYSIS

**Power Analysis**

A power analysis was performed based on an alpha level of 0.05 and two group, one-tailed design. The desired number of participants was determined to be 44. In order to account for possible attrition of 10%, a total of 50 participants should be recruited.

**Statistical Analysis**

Given that multiple outcome measures are being used to assess the effect of our balance training protocol, several statistical analyses will need to be performed. The FAAM and FAAM-Sport, though converted to a numeric score should still be analyzed as non-parametric data. The Mann-Whitney *U* test will be used to assess for a statistical difference in the mean change in scores between the two groups. The relative distance of each direction of the SEBT will be treated as a dependent variable. The mean relative distance of each direction of the same group will be calculated. The change in each mean value of each group will be used to perform a repeated measures multivariate analysis of variance (MANOVA) to determine if a significant difference exists. The effect of our interventions on the BESS test will be assessed using an independent t-test. The mean score of each group will be calculated after each administration of the BESS, and the mean change will be used to perform the t-test. The results of the statistical analyses will be used to assess our hypothesis that the eyes closed group will have greater improvements in outcome measures than the eyes open group.

## SIGNFICANCE

Altering a balance program from eyes open to eyes closed is a commonly used progression used in physical therapy clinics for patients with chronic ankle instability. The progression is made to target the proprioceptive and vestibular systems to provide them with challenge and therefore increase overall balance. Through an extensive literature search, we determined that there is a gap in the literature to support this progression. We hypothesize that the eyes closed balance training group would have better outcome scores in subjective outcome scores, a static balance test, and a dynamic balance test. However, we believe that it is important to have research from which to base this progression in an evidence-based practice.

## LIMITATIONS

There are limitations to the study as it is constructed presently. First, we do realize that a third control group can expand upon our current study and add to the validity of the study. However, the difficulty of recruiting an ample number of subjects cannot be overlooked. The power analysis of the study, as it is constructed presently, determined 44 as the number of subjects to participate in the study. Our study and inclusion/exclusion criteria require the subjects to have chronic ankle instability, be between the ages of 18-29, a student of Misericordia University, and not be a member of a sports team. These criteria do eliminate a large percentage of the population/campus. Another limitation to the study would be the logistics of having an outside physical therapist be available to perform the same tests both before and after study. With college students being the subjects, and working physical therapists administering the tests, scheduling the pre and post tests would be difficult. A third limitation of the study would be the number of exercise sessions performed by the subjects. Other studies, such as McKeon et al.[11], had subjects perform the balance training three times per week for six weeks. However, this would again prove to be difficult for our study as all of the participants are college students at Misericordia University and would likely be reluctant to participate three times per week.

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