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ABSTRACT

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Context: Dorsiflexion range of motion (DFROM) is often limited in patients with chronic ankle instability (CAI). Whole-body vibration (WBV) may enhance DFROM by helping to reposition the talus and assisting with talocrural arthrokinematics.

Objective: To determine if WBV can enhance DFROM in patients with ankle instability and determine if talar position is affected.

Setting: Cohort study.

Patients or Other Participants: A total of 25 subjects with CAI (17 women, 8 men; age = 22 ± 2.101 years, mass = 72.4 ± 17.9 kg, height = 171.2 ± 11.6 cm) participated.

Intervention(s): Participants in the WBV group completed a 4-week (12 session) WBV program consisting of 6 sets of 30 s at 35 Hz High amplitude with 30 s rest in between standing on a 30° slant board. Participants in the dorsiflexion (DF) group completed a 4-week program without WBV consisting of 6 sets of 30 s standing on a 30° slant board with 30 s rest in between. Participants in the control (C) group did not receive any intervention.

Main Outcome Measure(s): Lateral talus position via radiographic imaging, non-weight-bearing (NWB) DFROM, and weight-bearing (WB) DFROM were assessed preintervention, immediately postintervention, and 24 hours after the final intervention.

Results: No significant change was detected in talus position measured by X-ray ($F = 1.561$; $p < .05$). NWB DFROM ($F = 1.543$; $p < .05$) and WB DFROM ($F = .774$; $p < .05$) measurements also did not result in significant changes after the WBV program.

Conclusions: Four weeks of WBV treatments did not improve talus position or DFROM in ankle instability subjects.

Key words: dorsiflexion, mobilization with movement

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INTRODUCTION

Lateral ankle injuries are one of the most common injuries in athletics, occurring at an estimated rate of one per 10,000 people each day,[1] with a recurrence rate greater than 70%.[2] Residual symptoms are still present 6 to 18 months post injury in 55 to 72% of individuals who have suffered recurrent sprains,[3,4] and up to 75% of people who sprain their ankle develop chronic ankle instability (CAI).[5] Repetitive ankle sprains are also linked to altered loads through the joint, which can lead to premature osteoarthritis.[6]

CAI is a multifactorial condition with functional and mechanical components. Some functional limitations include insufficiencies in proprioception,[7] neuromuscular control,[8] postural control,[9] or strength.[10] Mechanical limitations can comprise factors that change the arthrokinematics of the ankle, such as adaptive shortening of the posterior capsule due to an anterior position of the talus.[11] This anterior talar positioning is caused by damage to the anterior talofibular ligament which prevents excessive anterior translation of the talus to maintain normal arthrokinematics at the talocrural joint.[12] This disruption and subsequent anterior positioning can cause osteokinematic limits in dorsiflexion range of motion (DFROM), as the talus is unable to translate posteriorly.

There are a variety of treatments that can help correct limitations in DFROM in patients with CAI. Joint mobilization has been shown to have immediate increases in range of motion[13] along with maintaining its effects up to two days posttreatment. Mobilization with movement (MWM) is also a common technique for restoring DFROM,[14-18] with some success both immediately and up to 2 days.[18] Joint mobilization is typically performed with the joint in an open-packed, neutral position, giving the clinician the most motion available to produce motion parallel to the joint surfaces. Ankle mobilizations are most often performed with the talocrural joint in neutral, and in talar neutral. Alternatively, when performing MWM at the ankle, typically the patient is placed into a position of forced dorsiflexion, most often a lunge position. The clinician applies a restrictive force through the plane of the joint into the restricted direction and instructs the patient to actively move into further dorsiflexion. The clinician then provides a mobilizing force against the capsular barrier, limiting motion while the patient is oscillating from the starting forced dorsiflexion position into the further range provided by the mobilization. Ultimately, this mobilization of the talus posteriorly through the capsular restriction is believed to reestablish joint congruency and allow capsular stretching while stimulating mechanoreceptors within the joint to permit posterior talar gliding.[14,19,20]

Localized vibration and whole-body vibration (WBV) have been purported to improve flexibility,[21-23] although predominantly for muscle flexibility of various muscle groups rather than joint ROM due to joint connective tissue issues. When compared to static stretching alone, the initial results are often equal to or greater in the vibration group immediately after the program.[21,22] Feland et al[24] reported significantly greater retention of the increased flexibility for at least 3 weeks after completing a vibration and stretch protocol, compared to static stretching alone. The increases in flexibility are thought to be caused through its effect on blood flow, increased muscle temperature,[25] an increased stiffness of the muscle,[26] and an increased tolerance of nociceptors during the stretch.[24] Lythgo et al[27] reported the use of WBV has resulted in an increase in velocity of blood flow to the lower leg. Because of its reported ability to facilitate muscle flexibility, increase blood flow and subsequent temperature, WBV appears to have potential at improving range of motion.

The mechanical nature of its vibration may be able to influence capsular restrictions in the ankle joint. WBV is a form of mechanical forced oscillation that is propagated from the base platform through lower extremity segments. Transmissibility of vibration between the base and the medial malleolus in a dorsiflexed foot at 35 Hz vibration has been reported as being 1.63 ± .55 while transmission between the base and the tibial tuberosity was reported as 0.63 ± 0.19.[28] This would suggest that significant damping and mechanical energy is being taken up in the ankle. While we cannot differentiate or quantify the muscular and arthrokinematic contributions of the foot and ankle system, it is possible that this mechanical energy is partially taken up between the talus and tibia. Thus, the vibration could force mechanical gliding and help to act as a unique mobilization tool. To date there have not been any published studies regarding WBV in conjunction with CAI populations. The purpose of this study was to determine whether WBV is an effective method to reposition the talus in CAI patients and thereby increase dorsiflexion range of motion.

METHODS

Research Design

This study was a controlled laboratory study with a between-factor analysis using two independent variables: treatment group and time. The dependent variables were DFROM and talus position relative to the tibia in the frontal plane. The 3 treatment groups were whole-body vibration (WBV), dorsiflexion (DF), and a control (C). The WBV group received the full treatment of WBV while maintaining a submaximal dorsiflexed position, standing on a 30° slant board and instructed to perform a mini squat until a stretch is felt. The DF group was placed into the same dorsiflexion position, but did not receive any vibration treatment, and the control group only had the measurements taken without any kind of intervention. Each measurement was taken at 3 time periods: baseline, immediately following the first treatment, and 24 hours after the 12th session of treatments.

Subjects

Twenty-five subjects (17 female and 8 male) completed this study. Subjects were college-aged students 18 to 30, who are recreationally active. Because there were X-rays taken, any females who were included in this study were required to take a pregnancy test and were disqualified if they were pregnant. The CAI inclusion criteria for subjects in this study followed those recommended by the 2014 position statement of the International Ankle Consortium.[29] All subjects had CAI as defined by the Ankle Instability Instrument (at least 5 "yes" answers including question number 1), the Cumberland Ankle Instability Tool (< 24 points), and the Identification of Functional Ankle Instability (> 11 points). Because X-ray measurement is currently the only method able to determine whether an individual possesses an anterior talus position, a dorsiflexion deficit of less than or equal to 15° passive ankle motion was required as an indirect way to increase the potential of a positional fault. The human subjects Institutional Review Board of Brigham Young University approved this study. All qualified subjects signed a written consent form pertaining to testing procedures. Subjects were disqualified if they missed treatment. Twenty-eight subjects were recruited, and 3 subjects were disqualified for this reason.

Instruments

1. V-Force Whole-Body Vibration Platform (Dynatronics, France) – this plate provides vertical sinusoidal vibration and claims to have the capability to perform amplitudes of 2 to 6 mm with a frequency range of 30 to 50 Hz. Upon validation, the vibration plate used in this study was found to give an amplitude of 1.2 mm unloaded at 34.4 Hz, and upon loading it with a slant board and an individual, the amplitude ended up being 0.9 mm during the treatments with a frequency of 32.8 Hz. The oscillations on this plate are uniform and give vertical displacement in both conditions.

2. X-ray machine (Bennett, United States) – HF 300 Direct Digital Imaging System; digital radiographs allow for adjustable image resolution at higher quality than film radiographs. Machine located in the BYU Athletic Training room in the Smith Fieldhouse (SFH).
3. 30 cm box – this box was used during the weight bearing lunge test.
4. Bubble inclinometer (Medical Research Ltd., United Kingdom) – used for DFROM measurements with values given directly in degrees. This instrument was zeroed on a verified horizontal or vertical surface prior to each measurement.
5. Analyze Pro (AnalyzeDirect, United States) – computer software that allows for advanced imaging visualization and measurements to be done on digital biomedical imaging. This was used to make measurements on the digital X-ray images taken of the subjects' ankles.

Procedures

All qualified subjects reported to the SFH Athletic Training room in active wear clothes that had below the knee exposed so they could be marked for consistency of inclinometer placement. While receiving their respective intervention, the subjects were in socks. Subjects were assigned to one of the 3 groups previously described upon arriving for their data collection. Both WBV and DF groups were expected to come in 3 times per week for 4 weeks, for a total of 12 sessions. Each session involved 6 sets of 30-second intervention with 30 seconds of rest in between while standing on a 30° slant board. The difference between the two groups was the WBV group received a vibration treatment at preset 35 MHz frequency, high amplitude, and the DF group did not receive any vibration. Each subject's visit occurred at a similar time to their first appointment; a 2-hour window was allowed for scheduling, with their initial appointment time in the middle of the window. The procedures for each of the 3 measurement periods were the same. All measurements were taken with bare feet. The subject had a pretreatment X-ray taken, non-weight-bearing ROM taken, then performed a weight-bearing lunge test. Individuals were then placed into 1 of the 3 groups. All groups, after receiving their first respective treatment, returned to have a posttreatment X-ray and non-weight-bearing ROM taken, then performed the weight bearing lunge test again to measure any immediate changes in DFROM.

For subsequent sessions, the subjects of the 2 experiment groups (WBV and DF) reported to the Athletic Training room, and received the respective treatment for 6 minutes. After the 12th session, the final posttreatment measurements were taken 24 hours later, and were comprised of the X-ray and the two DFROM measurements.

Measurements

Three measurements were taken for each subject at 3 different periods. First, prior to any treatment, second, immediately after the initial treatment, and third, 24 hours after the 12th session. Each measurement was performed 3 times, with the average calculated for analysis. The order was always X-ray, then non-weight-bearing ROM, then weight-bearing ROM using the Weight Bearing Lunge Test (WBLT) for each measurement. Talus position was measured with an X-ray and the AnalyzeDirect digital imaging measurement software following Veljkovic et al's Lateral Talar Station (LTS)[30] measurements. Non-weight-bearing ROM was measured with a simple goniometer, and the WBLT measurements followed those described by Cejudo et al.[78]

Measurement of Talus Position by X-ray

Measurement of the talus was performed on each radiograph taken at each measurement period. Films were standardized at 40 cm for each X-ray taken. For consistency, the subjects were given the exact same instruction each time. Subjects were instructed to align the medial malleolus with the crosshairs integrated into the X-ray machine, and the vertical line of the crosshairs was lined up with the tibial shaft.

The X-ray was a single-leg weight bearing lateral view image, taken with the ankle in a self-identified neutral position. The subject's normal stance was used, since this was a within-subject study, and no standardization of foot placement was done except to ensure positioning was the same as the initial X-ray with regard to the angle of dorsiflexion at the ankle. The subjects were placed on a platform specifically made to allow for both standardized subject and film placement consistency. The talus distance measurement was made using the technique described by Veljkovic.[30]

Lateral Talar Station (LTS) is typically measured by drawing two circles on the tibia, one on the shaft of the diaphysis 10 cm above the plafond and the other on the distal metaphysis, 5 cm above the plafond (Figure 1), and a line is drawn through the middles of the 2 tibial shaft circles, extending through the talus. A circle is placed on the talus and the center marked, with the dome of the talus providing the arc of the circle. The measurement is done using a perpendicular line from the center of the talus circle to the tibial line (Figure 2).[30,31] The software used has a maximum allowance of 2 circles, so to circumvent that limitation, once the 2 tibial circles were formed along with the bisecting line, the image was saved and reimported and the third circle drawn. Due to further limitations of AnalyzeDirect, the third circle was placed to encompass the medial dome of the talus, as the software isn't capable of performing the conical cylinder computation. This method didn't seem to raise any problems in pilot testing. Since the talus varies by person, the main focus was to ensure the placement of the talus circle was consistent within each subject. The line drawn from the talar circle was measured in millimeters to the nearest .05 mm.

ROM Measurements

Non-weight-bearing ROM measurements (Figure 3) were taken with the subject laying prone, knee flexed. The goniometer was placed with the axis just distal to the lateral malleolus, fixed arm in line with the fibular head, and the moving arm in line with the fifth metatarsal. The placement was marked on the subject's lateral lower leg, malleolus, and a midline of the fifth metatarsal to ensure consistency in measurements (Figure 4). The subject was placed in neutral, then passively dorsiflexed to maximum ability, and the ROM measurement was taken 3 times with an average calculated.

When measuring weight-bearing DFROM, the bubble inclinometer was aligned with a midheight, midline bisector of the lateral side of the calf (Figure 5). The individual placed the involved foot on a 30 cm box and adopted an incline lunge position that allowed the ankle to maximally dorsiflex without feeling unstable or having to shift footing during the measurement (Figure 6). The individual was asked to actively shift the pelvis forward going into a deep lunge over the second toe, until unable to continue without lifting the involved heel (Figure 7). While the subject was at the furthest point of dorsiflexion, the rater read the left side of the inclinometer reading from 0 to 90 degrees and recorded the DFROM measurement. In order to ensure consistency of placement, a marking was made on the lateral calf at the point where the superior most portion of the inclinometer sat, at the 90 degree marking. This mark was replaced after each treatment to avoid fading.

Statistical Analysis

Differences between groups across time were evaluated for each of the 3 dependent variables (NWB DFROM, WBLT, and talus position). For each variable, a 3 x 3 mixed model

ANOVA (3 between groups and 3 time points) was run followed by Tukey post hoc tests to determine pairwise differences ($\alpha = 0.05$).

RESULTS

Demographics of the 25 subjects were: 17 female, 8 male, age = 22.0 ± 2.1 yr., mass = 72.4 ± 17.9 kg, height = 171.2 ± 11.6 cm. Treatment groups were as follows: WBV (11), DF (8), Control (6). The average scores on the inclusion surveys were: 6.64 “yes” answers on the Ankle Instability Instrument, 15.55 points on the Cumberland Ankle Instability Tool, and 17.92 points on the Identification of Functional Ankle Instability survey.

Summary data for DFROM and talar position measured by X-ray are presented in Tables 1 to 3 and Figures 2 to 4. Passive ROM measures did not result in time-by-group interactions ($F_{(4,44)} = 1.543$; $p = .207$), however a significant interaction was detected for time ($F_{(2,44)} = 30.094$; $p = .00$). Dorsiflexion increased in all treatment groups, suggesting the intervention did not have a significantly different effect on the increase in ROM relative to the other groups. WB DFROM didn’t show any time-by-group interactions ($F_{(4,44)} = .774$; $p = .548$), or significant increases in ROM. No time-by-group interactions were detected for X-ray measurements ($F_{(4,44)} = 1.561$; $p = .201$).

DISCUSSION

The purpose of this study was to determine whether whole-body vibration could increase DFROM and reposition the talus in a CAI population. Contrary to our hypothesis, we found no differences between treatment and control groups, suggesting that the WBV protocol that we used did not have any measureable effect on this population.

Individuals with CAI have been shown to experience altered osteokinematics, most often a decrease in DFROM.[10] This change has been attributed to altered arthrokinematics[32] and has been hypothesized to be linked with an anterior talar position.[33] Conventional treatments currently used to correct positional faults and DFROM limitations in this patient population include High Velocity Low Amplitude (HVLA) joint manipulations and joint mobilization with movement (MWM). Both are supported in the literature to help with elongation of the joint capsule tissue in the posterior ankle joint to allow for a return of normal arthrokinematics.[18] MWM is also supported in the literature to correct a bony positional fault at the talus.[34] In this study, WBV was theorized to act on the capsule in a similar way to MWM, oscillating loads against the point of limitation.

There are no studies in the current literature that use WBV as a MWM. The parameters used for this study were based on WBV protocols[35,36] and MWM protocols,[15-18,37] both of which show positive effects in ROM for populations, including those with CAI. Studies measuring the effects of joint mobilization alone used a variety of protocols ranging from a single bout to multiple weeks of treatment.[15,16,19,38] Each study with MWM positions the ankle in a forced close-packed position, and either translate the tibia anteriorly, or the talus posteriorly.[39,40] Those using similar protocols to the current study found significant increases in DFROM,[39,40] where this study using WBV as the mobilizing force did not.

The possible explanations hypothesized for not finding significance in this study are insufficient amplitude from the WBV platform and improper positioning which did not allow mobilization through the joint restriction, both of which resulted in the talus remaining in a faulty position. The vibration platform output appeared to be substantially lower than the manufacturer-advertised amplitude output. In a video-based pilot analysis on one subject, we measured a .9 mm amplitude when the vibration plate was loaded (85% lower). There is currently no literature on the effects of varying WBV amplitudes and frequencies, or the effects that tissue damping has on these parameters. Amplitudes greater than those in this study could potentially have an effect on joint positioning. Also of note is the ability of the clinician in MWM to control and focus the applied forces along the plane of the joint, whereas WBV does not allow for that control. A comparable method to achieving a similar motion or mobilization motion using the WBV platform is unknown, as the vibration platform is unable to isolate forces to a specific joint. Instead, the vibrational forces are transmitted through the ankle, which acts to help dampen the transmission of vibration as it continues upward through the entire body. It could be that proper positioning can allow the majority of the forces to reach the ankle joint and cause anterior to posterior movement of the talus such that a mobilization effort is achieved. Because there was no significant change in both ROM and talus position of the experiment group, it is still possible that the hypothesis that increased DFROM occurs as a result of the repositioning of joint surfaces in the ankle, and that the protocol used for this study was insufficient to elicit a significant change.

It is unclear what position is ideal for a WBV platform to best promote movement at the talocrural joint and potentially treat CAI similarly to MWM. This study used a submaximal dorsiflexed position on a 30° slant board with the intent to move the talus more perpendicular to the platform and imitate the forces applied in joint mobilization. In an attempt to allow for motion at the tibia, the subjects were not placed in a position of forced dorsiflexion, which is different from MWM. This positioning removes the comparable pressure on the posterior capsule that mobilizations incur and removes the stimulation of the capsule to lengthen. While the intention of the positioning was to increase the possible motion occurring at the talus, our data shows insufficient movement to cause any positional change. Due to this lack of change, further research is needed to find the minimum threshold of force required to cause translation of the talus, along with the ideal positioning for using a WBV plate, beginning with the fully closed-packed position used in MWM.

Limitations in this study include a low output amplitude from the WBV platform, small and unequal group sizes, a procedure based largely on hypothesis with indirect literature support, length of treatments, and potential treatment position inconsistencies between subjects. The vibration plate used in the study claims amplitudes of 2 to 6 mm, but on its highest setting we measured a loaded amplitude output of only 0.9 mm. This discrepancy with the expected output and actual output could be a major factor in the insignificant results from this study. It is unknown what forces are produced that reach the talus from WBV treatments in a dorsiflexed position, nor what actual force is required to have significant effects. In traditional joint mobilization, 25 to 60 N of force is transmitted through the joint.[41] There have been no comparisons made between manual therapy and a vibratory force with joint translation. There is potential that these two forces don't directly compare, and that a much lower force could accomplish similar results due to the higher oscillations in a vibration platform. Alternatively, a longer treatment duration overall or longer repetitions may show more significant results than the total of 3 minutes used in this study. The degree of incline needed to incur changes at the talus is currently unknown. This study used a slant board to produce a dorsiflexed position on the vibration plate, with an angle of 30° to reach approximation to posterior capsular restrictions while not forcing the talus into a close-packed position. This was intended to allow for motion at the talus while the vibration forces acted on the ankle joint. Because the positioning wasn't standardized to a fully dorsiflexed position, or to a specific degree, it's possible the subjects stood in different positions during the study.

Conclusion

Our hypothesis that WBV could be an effective method for repositioning the talus in subjects with CAI was not supported. Limitations inherent in the protocol and measurements could explain the lack of movement at the talus and the insignificant change in DFROM within subjects. More focus and study needs to be devoted to this modality to test treatment times, ankle positioning, and frequency/amplitude of treatment to discover any possible significant effect in repositioning the talus or improving DFROM limitations due to positional faults and capsular shortening. Future research should be aimed at testing protocols with a forced dorsiflexion position, longer treatment time, and higher output amplitudes from the vibration plate. This study worked exclusively with chronic populations to test its ability to help individuals who have been suffering from CAI. There's potential that an acute population may receive benefits from lower amplitude outputs because the capsular restrictions haven't developed as severely.

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Table 1. Means and standard deviation values of non-weight-bearing DFROM measurement.

	Baseline	Immediate	Long-Term
Control	9.71° ± 3.406°	10.38° ± 3.052°	15.857° ± 4.071°
Dorsiflexion	7.608° ± 1.949°	10.941° ± 2.87°	14.278° ± 5.321°
WBV	9.39° ± 2.75°	11.53° ± 4.505°	13.44° ± 4.825°

Table 2. Means and standard deviation values for Weight-Bearing Lunge Test DFROM measurements

	Baseline	Immediate	Long-Term
Control	33.047° ± 5.865°	34.143° ± 5.92°	32.62° ± 5.94°
Dorsiflexion	28.78° ± 6.02°	28.67° ± 5.91°	32° ± 9.72°
WBV	28.39° ± 5.55°	29.89° ± 3.51°	28.89° ± 3.63°

Table 3. Mean and standard deviation values of the Lateral Talar Station X-ray measurements

	Baseline	Immediate	Long-Term
Control	1.102 mm ± 0.43 mm	1.127 mm ± 0.656 mm	1.0998 mm ± 0.347 mm
Dorsiflexion	1.12 mm ± 1.13 mm	1.86 mm ± 1.59 mm	1.45 mm ± 1.948 mm
WBV	1.262 mm ± 1.321 mm	1.096 mm ± 1.118 mm	1.493 mm ± 1.701 mm

Figure 1. Lateral X-ray with initial bisector of the tibia drawn through circles at 5 cm and 10 cm from the tibial plafond

Figure 2. Lateral X-ray with final measurement from talar dome center perpendicular to the bisector


Figure 3. NWB ROM measurement position with landmarks emphasized

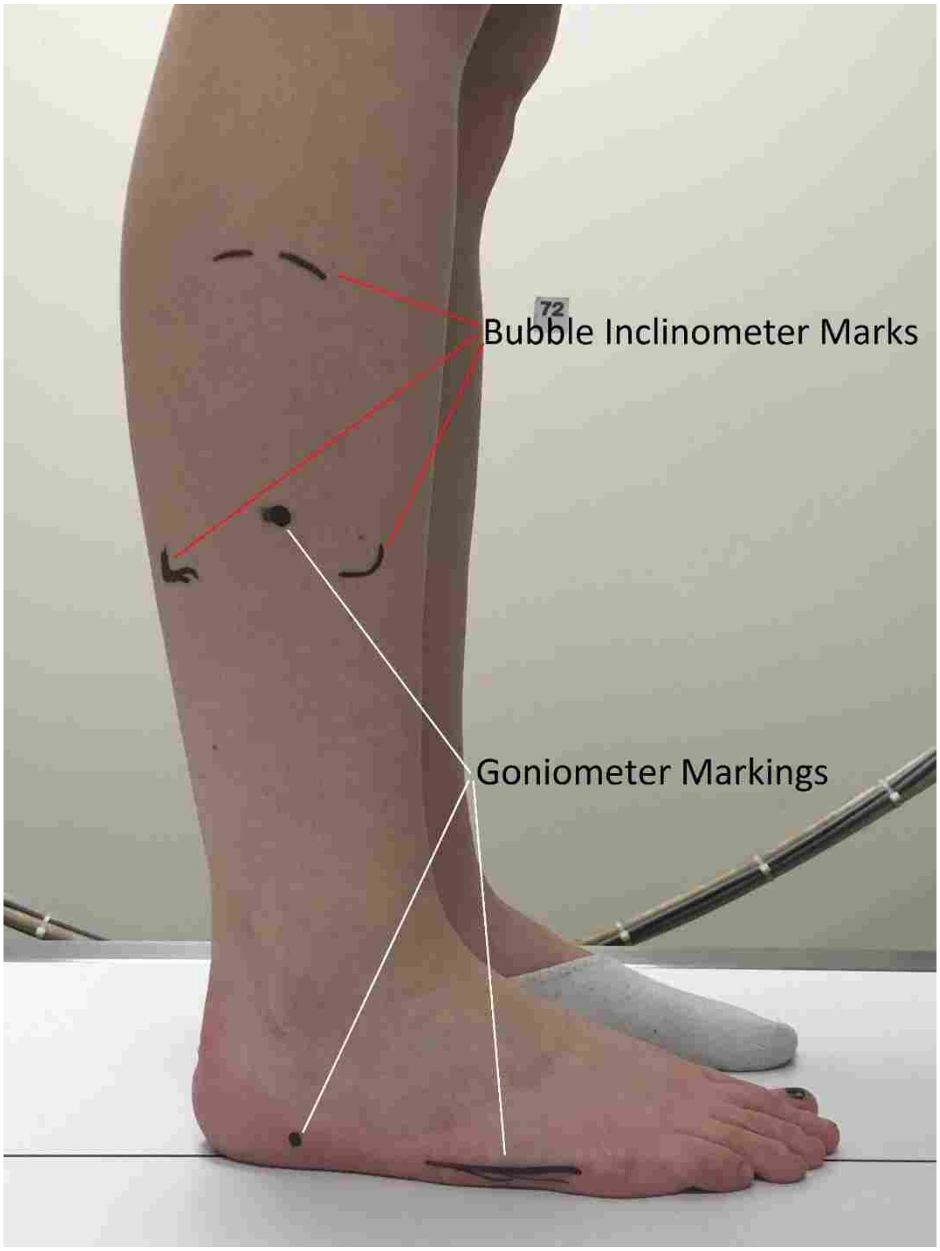

Figure 4. Markings made for both DFROM measurements

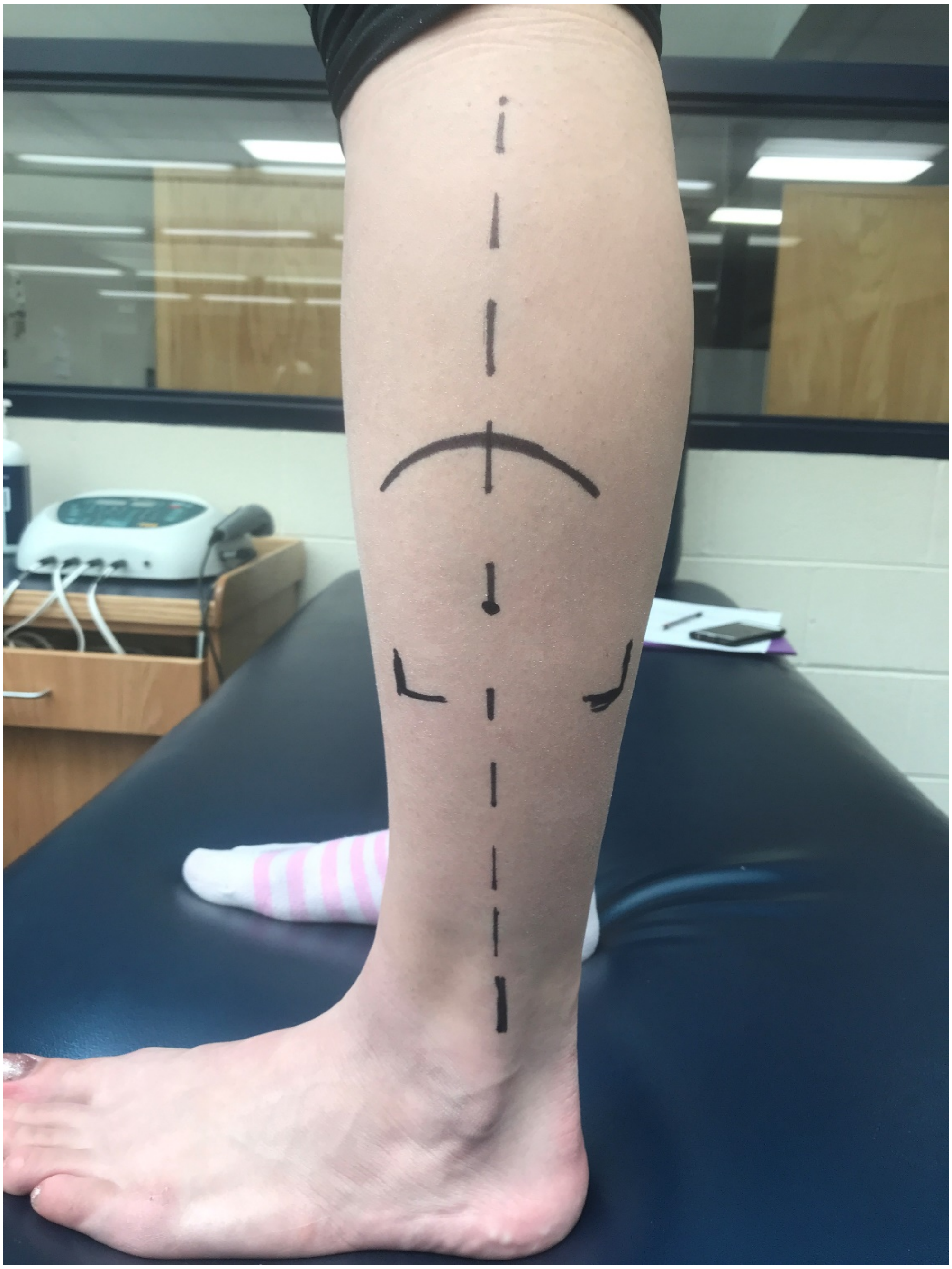
Figure 5. Midheight midline bisector of the calf used for placement of the bubble inclinometer

Figure 6. WB DFROM WBLT measurement position – starting

Figure 7. WB DFROM WBLT measurement position – ending

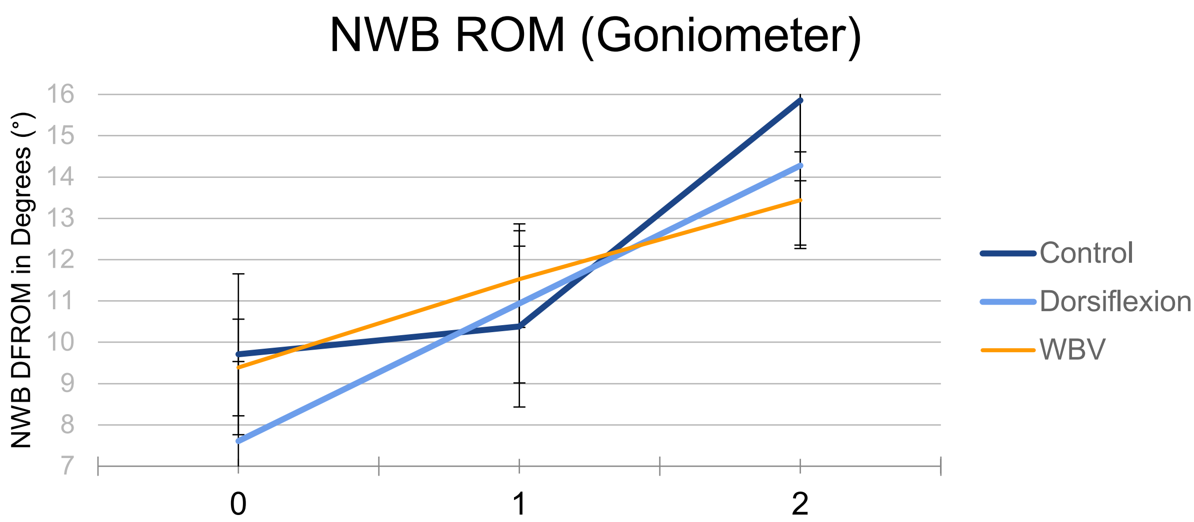

Figure 8. Non-weight-bearing ROM mean values taken at baseline, immediately following the first treatment, and 24 hours after the 12th treatment along with standard error values for each

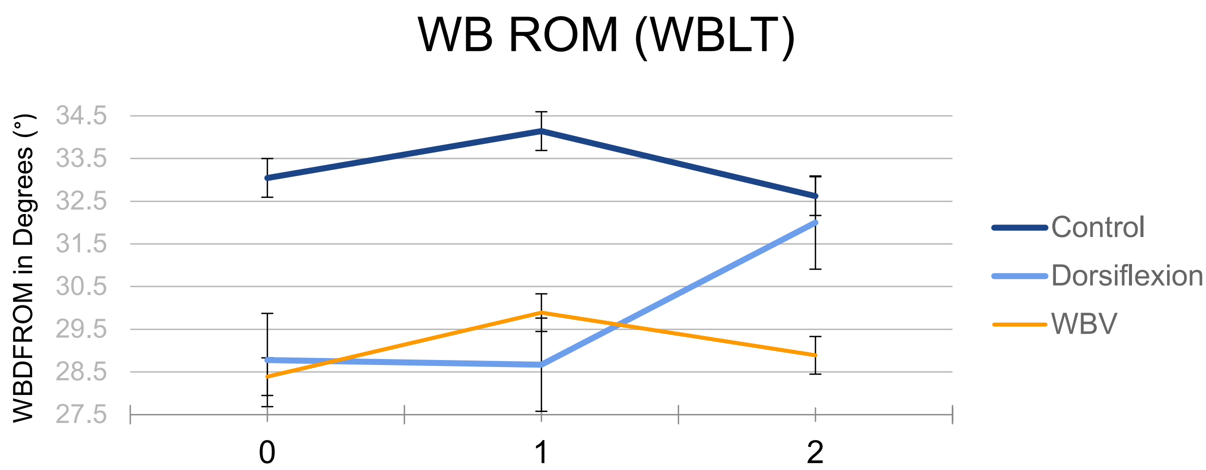

Figure 9. Weight-bearing mean values along with standard error values for each

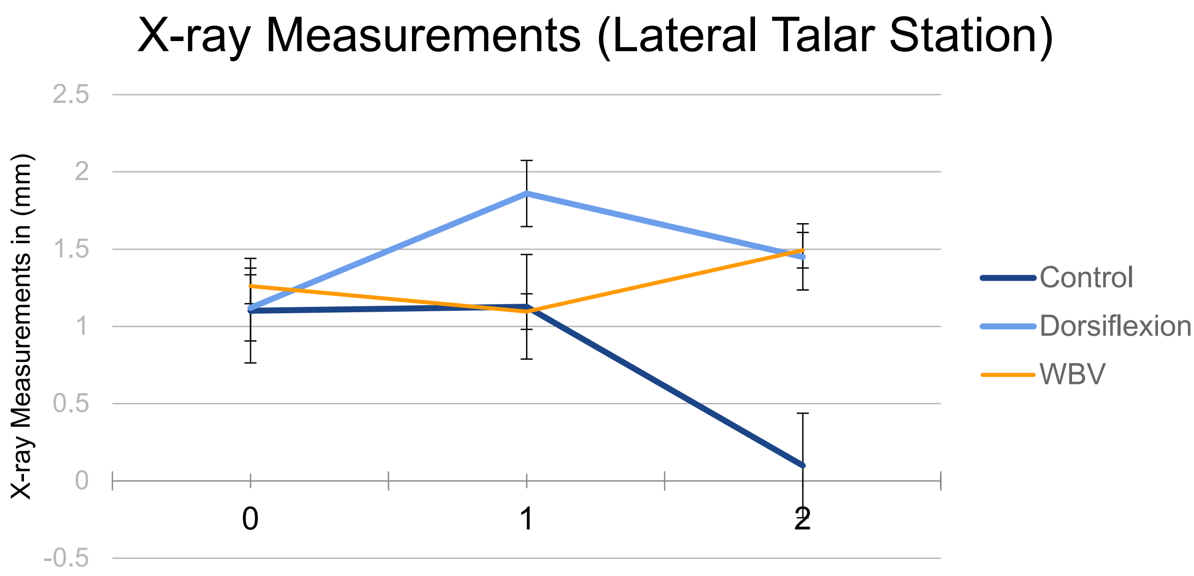

Figure 10. Mean values of X-ray measurements along with standard error values for each

APPENDIX – Questionnaires

Ankle Instability Instrument

Ankle Instability Instrument

Instructions

This form will be used to categorize your ankle instability. A separate form should be used for the right and left ankles. Please fill out the form completely. If you have any questions, please ask the administrator of the survey. Thank you for your participation.

1. Have you ever sprained an ankle? ☐ Yes ☐ No
2. Have your ever seen a doctor for an ankle sprain? ☐ Yes ☐ No

If yes,

2a. How did the doctor categorize your most serious ankle sprain?
☐ Mild (grade I) ☐ Moderate (grade 2) ☐ Severe (grade 3)

3. Did you ever use a device (such as crutches) because you could not bear weight due to an ankle sprain? ☐ Yes ☐ No

If yes,

3a. In the most serious case, how long did you need to use the device?
☐ 1–3 days ☐ 4–7 days ☐ 1–2 weeks ☐ 2–3 weeks ☐ >3 weeks

4. Have you ever experienced a sensation of your ankle "giving way"? ☐ Yes ☐ No

If yes,

4a. When was the last time your ankle "gave way"?
☐ <1 month ☐ 1–6 months ago ☐ 6–12 months ago ☐ 1–2 years ago ☐ >2 years

5. Does your ankle ever feel unstable while walking on a flat surface? ☐ Yes ☐ No
6. Does your ankle ever feel unstable while walking on uneven ground? ☐ Yes ☐ No
7. Does your ankle ever feel unstable during recreational or sport activity? ☐ Yes ☐ No ☐ N/A
8. Does your ankle ever feel unstable while going *up* stairs? ☐ Yes ☐ No
9. Does your ankle ever feel unstable while going *down* stairs? ☐ Yes ☐ No

Cumberland Ankle Instability Tool

Please tick the ONE statement in EACH question that BEST describes your ankles.

	LEFT	RIGHT	Score
1. I have pain in my ankle			
Never	□	□	5
During sport	□	□	4
Running on uneven surfaces	□	□	3
Running on level surfaces	□	□	2
Walking on uneven surfaces	□	□	1
Walking on level surfaces	□	□	0
2. My ankle feels UNSTABLE			
Never	□	□	4
Sometimes during sport (not every time)	□	□	3
Frequently during sport (every time)	□	□	2
Sometimes during daily activity	□	□	1
Frequently during daily activity	□	□	0
3. When I make SHARP turns, my ankle feels UNSTABLE			
Never	□	□	3
Sometimes when running	□	□	2
Often when running	□	□	1
When walking	□	□	0
4. When going down the stairs, my ankle feels UNSTABLE			
Never	□	□	3
If I go fast	□	□	2
Occasionally	□	□	1
Always	□	□	0
5. My ankle feels UNSTABLE when standing on ONE leg			
Never	□	□	2
On the ball of my foot	□	□	1
With my foot flat	□	□	0
6. My ankle feels UNSTABLE when			
Never	□	□	3
I hop from side to side	□	□	2
I hop on the spot	□	□	1
When I jump	□	□	0

7. My ankle feels UNSTABLE when			
Never	□	□	4
I run on uneven surfaces	□	□	3
I jog on uneven surfaces	□	□	2
I walk on uneven surfaces	□	□	1
I walk on a flat surface	□	□	0
8. TYPICALLY, when I start to roll over (or "twist") on my ankle, I can stop it			
Immediately	□	□	3
Often	□	□	2
Sometimes	□	□	1
Never	□	□	0
I have never rolled over on my ankle	□	□	3
9. After a TYPICAL incident of my ankle rolling over, my ankle returns to "normal"			
Almost immediately	□	□	3
Less than one day	□	□	2
1–2 days	□	□	1
More than 2 days	□	□	0
I have never rolled over on my ankle	□	□	3

NOTE. The scoring scale is on the right. The scoring system is not visible on the subject's version.

Identification of Functional Ankle Instability

IDENTIFICATION OF FUNCTIONAL ANKLE INSTABILITY (IdFAI)

Instructions: This form will be used to categorize your ankle stability status. A separate form should be used for the right and left ankles. Please fill out the form completely and if you have any questions, please ask the administrator. Thank you for your participation.

Please carefully read the following statement:

"Giving way" is described as a temporary uncontrollable sensation of instability or rolling over of one's ankle.

I am completing this form for my **RIGHT/LEFT** ankle (circle one).

1.) Approximately how many times have you sprained your ankle? ________

2.) When was the last time you sprained your ankle?

☐ Never	☐ > 2 years	☐ 1-2 years	☐ 6-12 months	☐ 1-6 months	☐ < 1 month
0	1	2	3	4	5

3.) If you have seen an athletic trainer, physician, or healthcare provider how did he/she categorize your most serious ankle sprain?

☐ Have <u>not</u> seen someone	☐ Mild (Grade I)	☐ Moderate (Grade II)	☐ Severe (Grade III)
0	1	2	3

4.) If you have ever used crutches, or other device, due to an ankle sprain how long did you use it?

☐ Never used a device	☐ 1-3 days	☐ 4-7 days	☐ 1-2 weeks	☐ 2-3 weeks	☐ >3 weeks
0	1	2	3	4	5

5.) When was the last time you had ***"giving way"*** in your ankle?

☐ Never	☐ > 2 years	☐ 1-2 years	☐ 6-12 months	☐ 1-6 months	☐ < 1 month
0	1	2	3	4	5

6.) How often does the ***"giving way"*** sensation occur in your ankle?

☐ Never	☐ Once a year	☐ Once a month	☐ Once a week	☐ Once a day
0	1	2	3	4

7.) Typically when you start to roll over (or 'twist') on your ankle can you stop it?

☐ Never rolled over	☐ Immediately	☐ Sometimes	☐ Unable to stop it
0	1	2	3

8.) Following a typical incident of your ankle rolling over, how soon does it return to 'normal'?

☐ Never rolled over	☐ Immediately	☐ < 1 day	☐ 1-2 days	☐ > 2 days
0	1	2	3	4

9.) During "Activities of daily life" how often does your ankle feel ***UNSTABLE***?

☐ Never	☐ Once a year	☐ Once a month	☐ Once a week	☐ Once a day
0	1	2	3	4

10.) During "Sport/or recreational activities" how often does your ankle feel ***UNSTABLE***?

☐ Never	☐ Once a year	☐ Once a month	☐ Once a week	☐ Once a day
0	1	2	3	4

Version 1.0