The Prevalence of Lower Extremity Non-Contact Injuries in Athletic Populations in Relation to Measured Ankle Dorsiflexion

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Abstract

Context: Ankle dorsiflexion is the degree to which the dorsal aspect of the foot can be brought closer in relation to the shin. Restricted ankle dorsiflexion can cause altered biomechanics and loading patterns, which can lead to injury from over-compensation in movement patterns. Limited ankle dorsiflexion alters frontal and sagittal plane biomechanics and has been hypothesized to contribute to common lower extremity injuries. The weight-bearing lunge test is a simple clinical evaluation test that can measure the range of ankle dorsiflexion. **Objective:** The purpose of this study was to determine if there was a correlation between restricted range of motion with ankle dorsiflexion and lower extremity injuries. We hypothesized restricted range of motion at the ankle would lead to increased stress on other joints resulting in chronic stress injuries. **Design:** Cross-sectional study **Setting:** Athletic training clinic at a mid-west NAIA institution. **Participants:** One-hundred forty-eight college athletes (104 males and 44 females; age = 19.32 ± 1.21 years, height = 69.64 ± 4.89 inches, mass = 81.39 ± 18.57 kg) who were all fall sport athletes (football, N=70; women's volleyball, N=17; men's soccer, N=34 and women's soccer, N=27) were the participants of this study. Some athletes were excluded from the study if they had suffered a lower extremity injury in the previous year. **Main Outcome Measures:** Ankle dorsiflexion range of motion measured using the weight-bearing lunge test; lower extremity noncontact injuries recorded via The Athletic Trainer System®. **Results:** Results were calculated using T-Tests via IBM SPSS® software. There was a total of 25 injured and 123 uninjured athletes. There was no statistical significance in ankle dorsiflexion between recorded injured and uninjured participants (p = 0.817). The average dorsiflexion for injured participants = 41.01° ± 6.28°. The average for uninjured = 41.85° ± 6.76°. Asymmetry between left and right ankle when compared to injured (2.1° ± 1.63°) vs. uninjured (2.49° ± 1.92°) was not significance (p = 0.290). **Conclusion:** There was no significant data to assume correlation or causation between restricted ankle dorsiflexion measured via the weight-bearing lunge test and increased risk of lower extremity noncontact injury. Lack of significance comparing asymmetry between left and right leg in both injured and uninjured groups provided further support for this conclusion.

Introduction

Research has suggested that limited dorsiflexion can predispose athletes to lower extremity injuries.[1,2,3] Normative data for non-weight-bearing dorsiflexion has been determined, but limited research has been completed to determine normative ROM values for weight-bearing dorsiflexion. The weight-bearing lunge test (WBLT) is a simple way to measure ankle dorsiflexion that has a high inter-rater and intra-rater reliability.[4,5] Currently there is limited data on normative values for the WBLT. Limited dorsiflexion ROM could be a determining factor in the risk assessment for lower extremity injuries in athletic populations. Current research shows the sagittal-plane coupling of the lower extremity joints and their importance in landing biomechanics and ground reaction forces.[1] This means that while there is independent importance of ankle dorsiflexion range of motion, it is also interrelated to the function of the knee and hip.[1,6] Hagins, et. al. showed increased ground reaction forces and knee valgus displacement with restricted dorsiflexion range of motion by having participants land on an inclined surface.[6] Decreased ankle dorsiflexion has affects at proximal joints while also contributing to altered landing biomechanics both in the sagittal and frontal plane as well as greater knee and hip displacement.[1,6] The purpose of this study was to determine if there is correlation between lower extremity non-contact injuries and limited dorsiflexion range of motion.

Methods

Study Design

A cross-sectional study design was used to compare preseason ankle dorsiflexion ranges. Only noncontact lower extremity injuries were considered and were recorded using The Athletic Trainer System®.

Participants One hundred forty-eight college athletes (104 males and 44 females; age = 19.32 ± 1.21 years, height = 69.64 ± 4.89 inches, mass = 81.39 ± 18.57 kg) participated in this study. All participants were fall sport athletes from football (70), women's volleyball (17), men's soccer (34), and women's soccer (27). Participants were without lower extremity injury for the previous year.

Instruments Ankle dorsiflexion was measured using the Android and IOS Clinometer App.

Procedures Participants were measured before starting mandatory practices with the team. Each participant was marked 15 centimeters distal to the tibial tuberosity on both legs to identify location of the smartphone. When measuring dorsiflexion using the WBLT, the leg being measured was staggered in front of the other leg. As the participant began to lunge forward tracking the measured knee directly over the measured foot, the measurement was taken just prior to when the heel of the measured foot was lifted off the ground or until the participant could not bend any further. This process was repeated three times on each leg and the average measurement was used for data analysis.

Table 1

Sport	Average	Asymmetry
FB	39.79	1.84
VB	43.16	2.76
WSC	43.21	3.37
MSC	43.75	2.68
Total	41.71	2.42

Figure 1

Figure 2

Table 2

Values	Status	Number	Mean	Std. Deviation
Average	Injured	25	41.01	1.26
	Not Injured	123	41.85	0.61
Asymmetry	Injured	25	2.1	1.63
	Not Injured	123	2.49	1.92
Average L	Injured	25	41.23	6.69
	Not Injured	123	42.03	7.04
Average R	Injured	25	40.8	6.17
	Not Injured	123	41.67	6.84

Table 1- average dorsiflexion and asymmetry by sport
Table 2- average dorsiflexion and asymmetry for all injured and uninjured participants; including leg specific measurements
Figure 1- starting position with clinometer placement
Figure 2- subject in final position

Results

There was no statistical significance (p = 0.817) between the average ankle dorsiflexion ranges of motion for participants that were recorded as injured (41.01° ± 6.28°) vs. uninjured (41.85° ± 6.76°). The correlation for asymmetry between the range of motion on the right leg versus the left leg between injured (2.1° ± 1.63°) vs. uninjured (2.49° ± 1.92°) participants was also not statistically significant (p = 0.290).

Discussion

The results of this study suggest that a measured weight-bearing lunge test was unable to show correlation between decreased ankle dorsiflexion ROM and asymmetry and lower extremity noncontact injuries throughout a competitive season. This is not consistent with current research which has shown the correlation between decreased ankle dorsiflexion and altered biomechanics which leads to an increased risk for lower extremity noncontact injuries.[1,2,6,7] Tabrizi, et. al. showed a strong correlation between lower extremity injuries and decreased ankle dorsiflexion which was not supported by our results.[8] The lack of correlation between lower extremity injuries and dorsiflexion ROM in this study may be due to measuring weight-bearing ankle dorsiflexion instead of non-weight bearing. In addition, we included athletes from any year in college (freshman-senior) with the understanding that older students incorporate ankle dorsiflexion ROM exercises frequently into their strength and conditioning programs. Further research should focus on expanding the number of participants and should look at other joints such as the knee and hip. Average values for dorsiflexion range of motion in an athletic population should also be determined to provide normative data for comparison in further research.

Conclusions

The WBLT is a simple clinical test to determine ankle dorsiflexion range of motion. Without proper ankle dorsiflexion range of motion, individuals have been shown to present increased ground reaction forces and displacement at lower extremity joints that can lead to noncontact injuries.[6] The purpose of this study was to look at a sample of fall sport athletes to determine if there was a relationship between below average ankle dorsiflexion and lower extremity noncontact injuries. Our data showed no significant values for average dorsiflexion range of motion when compared to the number of recorded lower extremity noncontact injuries. Asymmetry between the left and right ankle when compared to injured and uninjured participants also showed no statistical significance on lower extremity noncontact injury risk. Based on our findings, ankle dorsiflexion measured via lunge test has no predictive value for lower extremity noncontact injuries.

Sources

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