ABSTRACT

The Effectiveness of ProStretch® versus Manual Stretch on Active Ankle Dorsiflexion

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Introduction

Ankle dorsiflexion is an important component of a normal gait cycle. (1) A tight gastrocuemius muscle decreases ankle dorsiflexion, resulting in hip hiking and circumduction proximally (2), or in foot pronation distally. (3) The purposes of stretching are to increase range of motion (ROM), to prevent injuries, increase flexibility, and diminish muscle soreness. (1, 4, 5,6) In different clinics, various techniques of stretching the gastrocuemius muscles are used. Included among these techniques are: self-stretch against a wall, self-stretch using a towel, self-stretch on a step, manual stretch by a therapist, or ProStretch® (Tech Sport Inc. Little River, NJ).

ProStretch® is a more recent invention using a "rocker-bottom" type apparatus, which uses a person's body weight to stretch the gastrocuemius muscle.

We decided to compare which type of stretch, manual stretch of the gastrocuemius by a researcher, or stretching of the gastrocuemius using the ProStretch®, was more effective in increasing active ankle dorsiflexion. If ProStretch® was more effective, then there would be an increase in ankle dorsiflexion. The use of ProStretch® would benefit professionals when effective time management is imperative by allowing a patient to be independent in the clinic with their own stretch. This would permit the therapist to have more free time to perform other skilled techniques.

The purpose of this experimental study was to compare the effects of using ProStretch® to stretch the gastrocuemius on active ankle dorsiflexion. We hypothesized that there would be a statistically significant difference in the amount of active ankle dorsiflexion gained between ProStretch and manual Stretch.

Methods

Subjects: The study was approved by the Institutional Review Board at the University of New England (UNE). Written consent was obtained from subjects prior to participation in the study. The subjects were a sample of convenience comprised of volunteers from the UNE community.

Subjects were screened using a questionnaire with inclusion criteria requiring that the subjects:

1. Have no residual effects from any previous ankle injury that would limit active range of motion for either ankle.
2. Have no observable/measurable ankle edema.
3. Have the ability to stand in a static position for 2 minutes at a time.
4. Have &Mac178; 20 degrees of active ankle dorsiflexion on initial measurement.

These subjects were chosen for the following reasons:

1. They were convenient to access and available for all treatment sessions.
2. They provided a variety of age and fitness levels.

The subjects were assigned to two groups;
Group A and Group B. Subjects in Group A their right (R) gastrocuemius stretched using the ProStretch® technique and their left (L) gastrocuemius stretched using the manual technique . Subjects in Group B had their (L) gastrocuemius stretched using the ProStretch® technique and their (R) gastrocuemius stretched using the manual technique. The study consisted of l4 subjects whose ages range from 26-65 years.

Subjects were instructed that during the course of the study they were not to stretch their gastrocuemius muscles outside of the treatment sessions.

Materials and Equipment

A standard goniometer was used to measure active ankle dorsiflexion. Since intra-rater reliability is greater than inter-rater reliability (7), we had the same researcher perform all the active ankle dorsiflexion measurements.

The landmarks were:

1. Distal landmark, parallel to the lateral aspect of the fifth metatarsal.
2. Proximal landmark, head of the fibula; and axis, 1/2 inch distal to the lateral malleolus.

Ankle dorsiflexion measurements were taken before and after each type of stretch. A ProStretch® (figure 1) was utilized to stretch the gastronomies muscle. A stop watch was used to measure designated stretch intervals. Standard plinths were used for balance purposes during the ProStretch® technique.

Manual Stretching Technique

The subject was positioned in long sitting with their back supported, the extremity to be stretched extended and the contralateral extremity in a position of comfort. The designated researcher was seated at the end of the plinth. The researcher placed one hand on the subject's distal tibia to stabilize the lower extremity, and the palm of the other hand on the ball of the subject's foot to maintain 0 degrees inversion/0 degrees eversion of the foot. The researcher's shoulder then was placed against the dorsum of the control hand. The researcher applied the stretch into dorsiflexion with her body weight transmitted through the shoulder. The subject was instructed to inform the researcher when he/she felt maximum tension without pain in his/her gastrocuemius muscle. The timing of the stretch began at that point and was held for 45 seconds.

ProStretch® Technique

The ProStretch was modified using 1/4 inch T-foam on the forefoot and heel cup for comfort, The subject stood between two plinths. The researcher assisted the subject in placing his/her heel snugly in the ProStretch heel cup. The subject did not wear shoes throughout this procedure. The subject stood on the ProStretch®, bearing no weight on the opposite lower extremity. The subject was allowed to place his/her hands on the plinths for balance. With the foot on the ProStretch®, he/she gently rocked his/her heel back towards the floor to the point of maximum tension without pain in the gastrocuemius muscle. The timing of the stretch began at that point. Keeping the knee straight at all times, the stretch was held for 45 seconds. The same researcher guarded the subject and assisted in maintaining a straight, upright alignment through the shoulders, hips, and ankles during the stretch. The subject then rocked slowly forward out of the stretch position, releasing tension in the gastrocuemius muscle and stepped off the ProStretch®.

Test Procedure

This procedure was repeated for all subjects on a Monday-Friday schedule for a total of five treatments.

Statistical Analysis

The research was an experimental design with the research hypothesis stating that there will be a statistically significant difference between the amount of active ankle dorsiflexion gained with ProStretch® versus the amount of active ankle dorsiflexion gained from manual stretch, The dependent variable was ankle dorsiflexion. Independent variables were the time of measurement, i.e Day One through Day Five, and the method of treatment implemented, i.e. ProStretch® versus manual stretch An analysis of variance with repeated measures was performed using a p &Mac178; .05 level of significance.

Results

Thirteen out of the original 14 subjects completed the study. The one individual was eliminated secondary to illness. Patient compliance out of the 13 remaining subjects was 100% throughout the study. The average age was 45.5 years with the age range 26-65 years.
Figure 2 shows the mean active dorsiflexion for each stretch, Manual Stretch and ProStretch®, for days one through five. Day One measurement represents the pre-stretch measurement and Day Two through Five represent the post stretch measurements for that day.

A repeated analysis of variance performed on SYSTAT (Evanston, IL) revealed that ProStretch® significantly increased ankle dorsiflexion when compared to manual stretch, F (1,12) = 7.03, P = .021. Overall there was a significant increase in active ankle dorsiflexion among the days without regard to type of stretch, F (4,48) = 22.17, P = 0,00. Most importantly, the change in active ankle dorsifiexion utilizing ProStretch® during the study period was significantly greater than the change in active ankle dorsiflexion utilizing the manual stretch during the study period, F (4,48) = 4.45 P = .(X)4.

The main purpose of this study was to compare changes in active ankle dorsiflexion using two different stretching techniques. There was a statistically significant change in active ankle dorsiflexion using ProStretch® during the study period. These results allow us to reject our null hypothesis.

Our data suggest that ProStretch® is an effective means for increasing active ankle dorsiflexion. This is done in a manner that does not require hands on treatment by the therapist after initial patient education on how to use ProStretch®. This is important not only to therapists but to individuals who seek to gain increases in active ankle dorsiflexion. This research was done on a population of subjects that ranged from 26-65 years of age with varying fitness levels, Therefore this stretching technique may be used on a wide variety of patients. Because we limited our study to subjects with &Mac178; 20 degrees active ankle dorsiflexion, we cannot make assumptions about the effects of ProStretch on people with &Mac178; 20 degrees active ankle dorsiflexion at initial measurement. Figure 2 shows that both ankles had approximately

the same mean active ankle dorsiflexion at the start of the study. Points on the graph between Day Four and Five show that ProStretch® maintained the increased active ankle dorsiflexion and manual stretch decreased slightly.

In our study, manual stretch required verbal feedback from the subject to maintain a constant tension, The amount of stretch provided by ProStretch® was controlled by the subjects themselves and allowed the subject to increase the tension as the muscle accommodated to the stretch.

The manual stretch uses the therapist's body weight to initiate and maintain the stretch, ProStretch® uses the subject's own body weight to initiate and maintain the stretch, This may be significant because of differences in therapist's body weight versus subject's body weight. For example, a 110 pound therapist as compared to a 200 pound subject may impact the amount of foree applied to the gastrocnemius muscle.

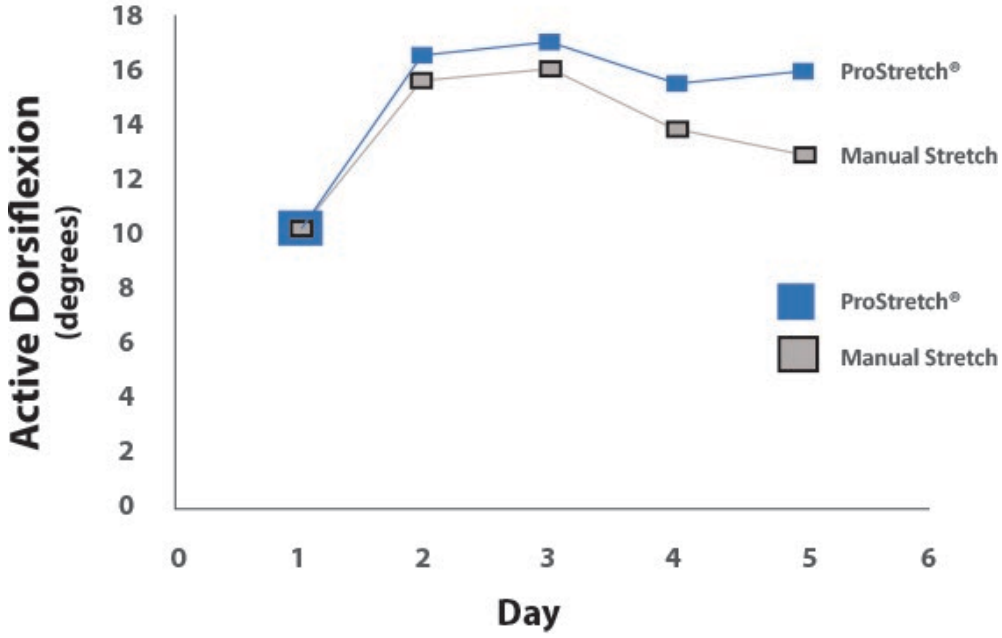
The design of the ProStretch® allows a direct line of force to be applied through the gastrocuemius muscle. This is more difficult to achieve with manual stretch.
This is the first quantitative study comparing the difference between ProStretch® and manual stretch on active ankle dorsiflexion. This study was limited in it's number of subjects as well as the amount of time for data collection. Each subject was instructed to inform us when they reached a point of maximum tension without pain in their gastrocuemius muscle. Due to individuality in pain thresholds, one may argue that this is a subjective measurement which could be a limitation of our study. Some subjects reported that they felt heel discomfort while using the ProStretch® which may have limited the force of stretch they applied to their gastrocuemius muscle.

In conclusion, future studies could determine if these results would continue to be significant over a period longer than five days. Additional suggestions would be to have the patients wear shorts to allow for marking of the landmarks to increase the accuracy of the dorsifiexion measurements. Subjects should be allowed to wear shoes when using the ProStretch to eliminate heel discomfort.

We further suggest investigation of the effects of ProStretch® versus other weight bearing stretching techniques.

Figure 1. ProStretch® PT-100

Figure 2. Mean Daily Dorsiflexion: ProStretch® vs Manual Stretch



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