The Effects of The Stick™ on Hamstring Length

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Abstract

Decreased hamstring length is an underlying source of idiopathic low back pain and a frequent source of referral to physical therapy. Flexibility has been referenced for its role in prevention of injury, increasing athletic performance, and keeping muscles healthy. The Purpose of this independent research project is to determine if, over a 3 week period of time, The Stick™ has any measurable effects on hamstring flexibility.

Keywords: the stick, flexibility, hamstring length

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The Effects of The Stick™ on Hamstring Length

Introduction

Decreased hamstring length is an underlying source of idiopathic low back pain and a frequent source of referral to physical therapy. Flexibility has been referenced for its role in prevention of injury, increasing athletic performance, and keeping muscles healthy (Standley, Miller, & Binkley, 2010; Baechle & Earle, 2008;Hartig & Henderson, 1999). The National Strength and Conditioning Association (NSCA) recommends a general warm up before any physical activity which includes an aerobic warm up, sports specific motions, as well as a stretching regime that includes all muscle groups along with those specific to the activity(Baechle & Earle, 2008). Recently the use of ergogenic aids to assist in promoting flexibility and athletic performance is becoming more popular. Ergogenic aids are tools that assist to increase performance (Silver, 2001). The Stick™ is one such tool designed by Intracell Technology, http://www.intracell.net/ that is gaining popularity in the clinical environment and referenced in anecdotal literature such as *Runner's World*. General claims include the ability to increase strength, endurance, and flexibility by the use of self-soft tissue mobilization.

The Stick™ is a 14-24 inch long (depending on model), semi rigid rod around which independent 1-inch spindles rotate. It is designed to assist in the deep manipulation or "stripping massage," as described by the manufacturer of soft tissues, particularly muscles and fascia. The manufacturer suggests that using the device prior to activity will resolve trigger points in the muscle and improve blood flow, which in turn will improve flexibility, muscular strength, and power. Although the precise mechanisms of how The Stick™ works are not clearly defined, theory behind its mechanisms show promise. To date there is very limited research that tests the effects of The Stick™ on muscular performance. A recent review of the literature does not

appear to include any peer reviewed, prospective literature on the long term effects. The purpose of this study is to determine if, over a 3 week period of time, The Stick™ has any measurable effects on hamstring flexibility. The proposed study cohort will include healthy college subjects 18-30 years old.

Overview of the Anatomy of the Hamstring Muscle Group

The hamstring muscle group is compromised of the biceps femoris, Semimebranosis, and semitendinosis. This muscle group is composed primarily of type II muscle fibers. The biceps femoris is made up of two heads; the long head originates from the distal portion of the sacrotuberous ligament as well as the ischial tuberosity. The short head, which does not cross the hip joint, originates from the lateral lip of the linea aspera of the femur, the proximal two-thirds of the supracondylar line, and the lateral intramuscular septum. Both heads insert distally onto the lateral edge of the head of the fibula, the lateral condyle of the tibia, and the deep fascia of the lower leg. The biceps femoris is innervated by two nerves: The long head is innervated by the tibial portion of the sciatic nerve and the short head is innervated by the peroneal portion of the sciatic nerve (Moore, Dalley, & Agure, 2010).

The semitendinosis and semimembranosis make up the medial hamstring. The semitendinosis shares a common origin with the long head of the biceps femoris at the ischial tuberosity. The tendon forms the medial border of the popliteal fossa. It inserts proximally into the medial surface of the tibia and the deep fascia of the lower leg and distally to form a member of the pes anserinus with the gracilis and sartorius. The semimembranosus originates via a thick tendon from the ischial tuberosity proximal and medial to the biceps femoris and the semitendinosis and inserts into the medial posterior aspect of the tibia via fibrous expansions.

The semitendinosis and semimembranosus muscles are innervated by the tibial portion of the sciatic nerve (Moore, Dalley, & Agure, 2010).

Literature Review

When fascia loses its pliability it becomes restricted and is a source of tension to the rest of the body. The collagen becomes dense and fibrous and the elastin will lose its resiliency. The combination of dense, fibrous collagen and tight elastin will cause a decrease in range of motion and flexibility of the fascia (Barnes, 1997; Kolber & Fiebert, 2005). Myofascial release is a technique that will facilitate a stretch into the restricted fascia, and after 90-120 seconds the tissue will undergo histological length changes which allow the release to be felt(Trampas, Kitsios, Sykaras, Symeonidis, & Lazarou, 2010). Hanten& Chandler (1994) compared the effects of myofacial release and contract-relax stretching on hip range of motions (Hanten & Chandler, 1994). The results of their study determined that both techniques increase ROM when compared to the control group, but the contract-relax technique increased ROM significantly more than the myofacial release group. Hanten& Chandler's study is important because it did find that myofascial release can increase hamstring flexibility. The mean increase in ROM was significant (6.6 degrees) after receiving the myofacial release therapy. Study limitations include; small sample size (75 participants including the control group), therefore 50 subjects received intervention, and only 25 received the myofascial release therapy (Hanten & Chandler, 1994).

In 2011, Healer, Dorfman, Riebe, Blanpied, &Hatfield conducted a randomized, crossover study that tested the effects of foam rolling and myofascial release on performance. The study found that foam rolling yielded a significant increase from pre to post test for fatigue, soreness, and exertion. Foam rolling uses the same concept as The Stick™ for self soft tissue massage. Healer et al. (2011) concluded that further research should be done to find the more

long term chronic effects of foam rolling on muscular performance. A significant limitation of this study was that there were only 26 subjects total and there was no standardized testing for flexibility. In 2006 a similar study concluded that using a foam roller did not show any significant improvement for hamstring flexibility in 23 participants (Miller & Rockey, 2006).

A study done by Huang, Di Santo, Wadden, Cappa, Alkanani, &Behm (2010) found that the use of 30-second massage provided a significantly greater hip angle ROM when compared to a control group. With the knee extended, the hip angle was measured during passive hip flexion using a goniometer. An average increase in ROM of 7.2% was found in subjects who received the 30-second massage. The authors concluded that a brief duration massage at the musculotendinous junction can provide an increase in hamstrings flexibility (hip flexion ROM) that is comparable to other common methods of stretch, but with a shorter time commitment. The study done by Huang et al. (2010) was a pilot study using 10 subjects, to be able to further validate these findings a study involving a larger cohort needs to be performed. Hopper, Conneely, Chromiak, Canini, & Berggren also concluded that soft tissue massage significantly increases hip ROM and hamstring. 19 female participants displayed a significant improvement in hamstring length following massage when compared to the control group. However 24 hours after intervention and testing the improvement in flexibility was lost, indicating that the massage had only temporary effects (Hopper, Conneely, Chromiak, Canini, & Berggren, 2005).

Similar to Huang et al. (2010) and Hopper et al. (2005), Hopper, Deacon, Das (2004) conducted a study to investigate the effect of dynamic soft tissue mobilization on hamstring flexibility in healthy male subjects. A larger subject pool of 45 subjects was used in a randomized, controlled single blind design study which found that STM significantly increased hamstring flexibility. Participants performed a straight leg test both prior and post treatment, an

increase of 4.7° of ROM was noted in the STM group. The authors suggest that dynamic soft tissue mobilization has an immediate effect on hamstring muscle length, and hence flexibility (Hopper, et al., 2004).

Currently, the only peer-reviewed literature related directly to The Stick™ was done by Mikesky, Bahamonde, Stanton, Alvey, &Fitton (2002). Mikesky et al. (2002) studied the acute effects of The Stick™ on strength, power, and flexibility. The results of the study determined that there were no significant differences in hamstring flexibility after to using The Stick™. Justification for this may have been that only the acute effects were tested and the 1 session of 2 minutes just prior to testing was not enough for the muscles or the fascia to see any significant change. Several strong points of this study include the number of subjects tested; the double-blind, placebo controlled experimental design; and the randomization of pretesting interventions for each subject. The one major downfall being that only the acute effects were tested. Further research testing the long term or more chronic effects of The Stick™ needs to be done in order to determine if the device can increase ROM over a longer period of time.

In support of the results from Mikesky et al. a study in 2004 was conducted to determine the immediate effects of soft tissue massage to improve hamstring flexibility. Barlow, Clarke, Johnson, Seabourne, Thomas, & Gal, concluded that changes in hip ROM and hamstring flexibility after receiving a single short duration massage of the hamstring muscle group were small when compared to the group that did not receive massage. The authors suggest that one massage intervention may not be enough to have any significant effect on muscle properties and improve flexibility. This study further concludes that a longer intervention period is needed to determine if soft tissue massage techniques can significantly improve hamstring flexibility (Barlow, Clarke, Johnson, Seabourne, Thomas, & Gal, 2004).

Barnes (1997) explained the theory that myofacial release will in fact increase flexibility and joint ROM. The function of The Stick™ is to apply deep manipulation of soft tissue to a person without the need of another person in a safe, effective manner. To date only one peer-reviewed report has been published either supporting or refuting the efficacy of The Stick™. That study tested the acute effects of The Stick™ on Strength, Power, and Flexibility (Mikesky et al. 2002). The Stick™ may prove to be a viable tool to use in clinical settings if it does increase hamstring flexibility. The Stick™ is a very easy tool for people to use in their homes and can be safely used without professional supervision. With the solid and supported theory behind the effects of The Stick™ the focus of this research is "Does hamstring length increase with the use of the stick?"The null hypothesis presented by this researcher is that use of The Stick™ over a 3-week period of time will show no significant effects on hamstring flexibility during a standard 90-90 test.

Methods

Subject Recruitment

Prior to recruiting of subjects, the researcher gained approval from the Florida Gulf Coast University IRB. The sampling method that was be used is non-probabilistic convenience sampling. Twenty participants were recruited from Florida Gulf Coast University via flyers posted in the College of Health Professions building and through word of mouth at the fitness center located on campus. On the flyers there was a short description of the study as well as the inclusion and exclusion criteria for participants.

The population selected to participate in this research study met all aspects of specific inclusion criteria. The inclusion criteria: The subject must be between the ages of 18 and 30, the subject must be a student at Florida Gulf Coast University, when performing the 90-90 straight

leg test the subject must be between 30° and 5° of full knee extension and without pain when manually measured using a goniometer, and the subject must be recreationally physically active. Recreationally physically active for this study was defined as participating in 3 or more days per week of recreational physical activities such as sports or exercise. Prior to participation, the subject read and signed an informed consent form that outlined all aspects of the study as well as the risks involved. Along with meeting all aspects of the inclusion criteria, subjects must not have met any aspects of the exclusion criteria. Exclusion criteria for this research study included: Any musculoskeletal injury within the past 12 months involving the back, pelvis, or lower extremities that caused them to either see a physician, miss work, or sit out from physical activity, individuals with medical conditions that might lead to deep vein thrombosis, the subject must not be currently participating in a structured flexibility program, no previous use of The Stick™ by the subject, and the subject must have a Body Mass Index (BMI) < 29.9.

Research Design

The research design used was repeated measures, within subjects design. Subjects acted as their own control, comparing right leg measurements to their left leg measurements, dismissing the need for a separate control group. (Descriptive statistics was generated for independent and dependent variables. Further data analysis was performed using SPSS software and an independent samples t-test. The acquired information was t-statistics and p-value to identify statistically significant changes in hamstring length from before use of The Stick™ to after using it for 3 weeks.)

Subjects

Twenty recreationally active college students from Florida Gulf Coast University volunteered to participate in this study (age: 21.35 ± 8, BMI: 24.4 ± 9.3). Participants consisted

of thirteen males and seven females. Two male participants were unable to complete the final data collection aspect of the study. Eighteen (n=18) subjects completed the entirety of the study.

Procedure

Hip flexion ROM in this study was measured directly using a manual goniometer and the 90-90 straight leg raising test, causes for a positive test are subjects who cannot extend their knee within 20° of full extension (Magee, 2006). A manual goniometer provides good concurrent validity and good test-retest reliability when used for measuring hip ROM. Conventional manual goniometers can be used with confidence for longitudinal assessments (intraclass correlation coefficients of 0.90 and higher) (Nussbaumer, Leunig, & Glathorn, 2010). Subjects performed a dynamic warm up on an exercise bike at 50 rpm for 5 minutes with the seat level adjusted to be even with the greater trochanter while standing. Within 2 minutes of their dynamic warm up the subject was supine on the table and was instructed to flex both hips to 90° while the knees are bent. The subjects grasped behind their knees with both hands to stabilize their hips at 90° of flexion. The subject actively extended each knee in turn as much as possible (Magee, 2006). The therapist then aligned the goniometer with the center of the fulcrum over the lateral epicondyle of the femur. The proximal arm of the goniometer was aligned with the lateral midline of the femur and the distal arm lined up with the lateral midline of the fibula. The mean of three measurements was used for base line data. For normal flexibility in the hamstrings, knee extension should be within 20° of full extension.

Subjects attended an instructional session on the proper use of The Stick™ prior to the start of the study. The session had a licensed physical therapist in attendance and assured that each subject thoroughly understands the proper technique and method for use of the device. The researcher demonstrated proper technique on each participant and the participants were then able

to perform proper use on the researcher to understand the pressure to be applied. A video was provided with detailed demonstrations as well as instruction for the subject during the study.

Subjects performed twenty progressively deeper passes over the right hamstrings only (about 30 seconds per area) as per manufacturer's instructions. The separate areas of the hamstring that were covered were the medial, middle, and lateral aspects of the hamstring. Each pass began at the proximal origin of the muscle distally to the respected insertion. The intervention was performed one time per day, 5 days per week, for 3 weeks. Subjects were instructed to perform the intervention during the early evening between 4:00pm and 9:00pm to allow proper warm up of the hamstring muscles through daily activities. Subjects were given a log sheet to effectively document with areas for them to write in the day, time, position, and additional comments they may have about their use. End of week submissions of progress to the researcher conducting the study were required. Subjects were able to communicate via email to ensure adherence. To ensure validity, the researcher was blinded to the pre-test and post test data, as well as the compliance progress sheets until after the study was concluded. A designated researcher was in charge of collecting the progress sheets.

Data Analysis

Means and SDs of measurements were calculated using SPSS software and descriptive statistics. A within subjects independent samples t- test was used to analyze the data. An alpha level of $p < .05$ was the level of significance.

Results

Eighteen subjects completed all requirements for this study. Two of the twenty subjects were dropped for not being available for the posttest measurement. Intervention was performed on all eighteen subjects' right hamstrings, and their left hamstrings were used as the control. The

mean values for the pretest and posttest measurements of the experimental (right) group for degrees from full knee extension during the 90-90 straight leg raise test were 17.09° ± 6.36 and 13.66° ± 5.75 respectively. The mean values for the pretest and posttest measurements of the control (left) group were 17.92° ± 6.12 and 17.16° ± 5.76 respectively. Mean change in the experimental (right) knee from full extension of the subject (M = 3.43, SD = 4.15) was significantly greater than the mean change in the control (left) knee from full extension (M = .76, SD = 2.56, *p*= .026). Results are shown in Table 1.

Table 1: Descriptive statistics

	Experimental (Right) (n 18)		Control (Left) (n 18)	
	Mean	SD	Mean	SD
Pre-Test	17.09	6.36	17.92	6.12
Post-Test	13.66	5.75	17.16	5.76
Mean Change	-3.43	4.15	-0.76	2.56

Discussion

The null hypothesis that use of The Stick™ over a 3-week period of time will show no significant effects on hamstring flexibility during a standard 90-90 test was rejected. The experimental (right) leg that implemented the 3 week protocol using The Stick™ showed significantly greater gains in flexibility than the control (left) leg.

The improvement in flexibility using The Stick™ is supported by the multiple studies that were previously conducted by Huang et al. (2010) and Hopper et al. (2004)utilizing soft tissue mobilization and foam rolling. Although the reasons for improved hamstring flexibility using The Stick™ still may remain unclear, the theory of improving blood flow by resolving

trigger points and scar tissues adhesions to increase muscular flexibility suggested by the manufacturer continues to be valid.

Although many forms of stretching and exercising have proven effective to increase muscle flexibility, utilizing The Stick™ in conjunction with other flexibility programs may prove to be more effective. The ease of use of The Stick™ may prove appealing to those who are unable to get on the floor and perform static stretching or any other type of flexibility exercises. The simplicity and portability of The Stick™ allows it to easily be implemented in any type of flexibility program.

This study was limited to selecting healthy, active, and injury free college students who were not currently involved in a flexibility program. Therefore, the findings are most applicable to a similar sample and population. Further research is needed to determine if an even older sample (e.g. elderly subjects) or someone who is not recreationally physically active can achieve similar improvements in hamstring flexibility using The Stick™.

Another limitation was the sample size used. Because this was the first study of its kind that examined the effects of The Stick™ over a three week period of time, the smaller sample sized displayed significantly positive results which can hopefully allow further studies to expand on the sample size as well as inclusion criteria.

Table 2: Descriptive statistics: Male versus female

	Mean Change	Standard Deviation	N
Male: Right Leg (Experimental)	-1.94°	2.95	11
Male: Left Leg (Control)	-0.91°	2.93	11
Female: Right Leg (Experimental)	-5.76°	4.87	7
Female: Left Leg (Control)	-0.52	4.87	7

Conclusion

The increasing popularity of ergogenic aids for improved muscle function is changing the way that we address flexibility, strength, power, and overall muscular health. The results of this study concluded that use of The Stick™ can significantly improve hamstring flexibility when used over a three week period of time. Based on the information obtained from this study The Stick™ may be a viable option for people looking to improve hamstring flexibility for rehabilitation or prehabilitation applications, or who are seeking an alternative to traditional stretching techniques.

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