Investigating the Efficacy of Chinese Cupping and Static Stretching to Increase Hamstring Extensibility in Asymptomatic Individuals with Hamstring Tightness: A Pilot Study

Jodan Garcia, PT, DPT, OCS, FAAOMPT; [1] Kathryn Maeder, BS, SPT; [1] Katherine Hamil, PT, DPT; [1] John Isaac Smith, PT, DPT; [1] Giangoc Tran, BSEd, SPT; [1] Raphael Rahman, BS, SPT[1]; Bradley Farrell, PhD[1]
[1]Georgia State University, Department of Physical Therapy

ABSTRACT

Objective: To analyze the effects of Chinese cupping with static stretching versus static stretching alone on hamstring flexibility in healthy young adults. ***Background:*** Evidence gathered from previous studies demonstrate benefits from passive stretching on hamstring flexibility, but there are no significant benefits from Chinese cupping. There is no current study investigating the effects of Chinese cupping combined with static stretching on hamstring flexibility. ***Methods:*** A total of 21 healthy subjects were randomly assigned to either the control group (static stretching) or intervention group (cupping and static stretching) for a period of biweekly data collection lasting 6-8 weeks. ***Results:*** Both control and intervention groups showed improvement in hamstring flexibility for the data collections, however there was no significant difference found between the groups. ***Conclusion:*** The hypothesized superior therapeutic benefit of the clinical use of cupping therapy with static stretching is not supported. There would need to be further clinical-based research done to explore the effects of cupping on hamstring extensibility before it can be used in a clinical setting.
Key Words: Chinese Cupping, Hamstring Flexibility, Static Stretching, Myofascial Release, Cupping Physical Therapy, Chinese Cupping Hamstring

Background

The hamstring muscles (biceps femoris, semitendinosus, and semimembranosus) are major muscles of the lower extremity that cross both the hip and knee joints. These muscles play important roles in movements involving the lower body such as ambulation, jumping, and standing, as they are primary knee flexors and aid in hip extension. Due to their multi-joint feature and the constant tension they are subjected to under certain postural positions, the hamstrings are susceptible to shortening, resulting in stiffness and loss of range of motion.[7] Tightness of the hamstring muscles can cause insufficient biomechanics during functional movements such as bending and lifting, as well as the functional movements mentioned above.[6] This can eventually result in postural asymmetries.[8] Furthermore, lack of hamstring flexibility can lead to major musculoskeletal injuries, especially amongst athletes.[1] Due to these reasons, it is critical to improve inadequate hamstring flexibility and maintain the improvements in order to maximize biomechanical efficiency of bodily movements and function. Stretching has been the main focus in literature when exploring the best intervention to improve hamstring flexibility. A single-blinded, randomized control trial study performed by Nishikawa et. al. in 2016 examined the immediate effects of passive and active stretching of the hamstrings to improve flexibility in healthy young adults and compared these effects to that of a control group. Both active and passive stretching protocols involved having the participants in supine position with 90° of hip flexion. An examiner passively extended the participants' knees to stretch the hamstrings in the passive stretching group, whereas the participants extended their own knees in the active stretching group. Both stretching groups performed 3 sets of the hamstring stretch with 10 seconds per set, while the control group did not perform any interventions. The results found that both passive and active stretching overall increased hamstring flexibility. However, statistical analysis revealed that there is a greater significant difference in pre and post-measurements in the passive stretching group compared to that of active stretching.[2] In addition, a systematic review done by Medeiros et. al., found that static stretching of the hamstrings, regardless of parameters, is effective in improving hamstring flexibility compared to the control groups, which did not undergo any intervention.[3]

More recent research studies have investigated the effects of traditional Chinese cupping on hamstring myofascial decompression and release. A cohort-design study conducted by Williams et. al. in 2019 evaluated the effects of cupping on hamstring flexibility in healthy young adult soccer players.[4] Participants in the cupping group received 7 minutes of therapeutic cupping, in which four 2-inch diameter cups were placed on trigger points of the hamstring muscle bellies. Participants in the control group did not receive any intervention. The results showed no significant difference in pre and post-measurements of hamstring flexibility when compared to the control group. In another study performed in 2020, Schafer et. al. analyzed the effects of cupping on the flexibility of the biceps femoris on healthy adults. In this study, four cups were placed on the posterior thigh along the pathway of the biceps femoris for 10 minutes while the participants are in prone position. These results were similar to those found by the Williams et. al. soccer player study, such that the cupping therapy did not have an effect on the range of motion of the biceps femoris.[4,5] Thus, evidence from current literature shows no significant improvements or change in hamstring flexibility with traditional Chinese cupping.

Although the aforementioned research studies explored single strategies in enhancing the flexibility of the hamstring muscles, there has been no consensus in the current literature regarding the effects of combined strategies. This current pilot study aims to explore and expand the existing findings regarding the optimal intervention to improve hamstring flexibility in healthy young adults. We will be investigating the effects of combined traditional Chinese cupping and static stretching and comparing it to static stretching alone. The findings of this study can potentially provide physical therapists guidance towards the most effective therapeutic approach in enhancing functionality through myofascial release of the hamstrings in patients with decreased hamstrings flexibility. We hypothesize that cupping combined with static stretching will yield a greater difference between pre and post-measurements of hamstring flexibility than that of static stretching alone.

Methods

Subjects for this study were recruited using convenience sampling from the Georgia State University Doctorate of Physical Therapy classes of 2021 and 2022. Both groups were presented with a recruitment script by the researchers that provided details on the purpose of the study, the potential risks and benefits, and the time commitment involved. Subjects in both classes were then given a full week to decide if they wanted to participate, and were instructed to either email or directly approach researchers to indicate interest. Once a subject indicated interest in participating, they were given a health history questionnaire and informed consent form to fill out. Once these forms were completed and turned in by the interested subject, the researchers worked with them to schedule an eligibility exam within a week to determine if the subject met the inclusion criteria to participate.

The subject was included in the study if they demonstrated decreased hamstring flexibility based on the hamstring 90/90, were at least 18 years of age, and enrolled as a student in the Georgia State University's Doctorate of Physical Therapy program's class of 2021 or 2022. Subjects were excluded from the study if they met any of the following criteria: experienced a recent hamstring injury or strain, was currently exhibiting hamstring pathology, produced a negative hamstring 90/90 test, has history of knee or hip orthopedic surgery, or was pregnant.

The hamstring 90/90 test, sometimes referred to as the passive knee extension test, was chosen as the primary outcome measure for this study because it is a commonly utilized test in physical therapy practice. The interclass correlation reliability (IC) value is reported to be .90-.99.[9]

The hamstring 90/90 test was conducted by having the subject lay supine on a mat. The subject's hip was then flexed to 90 degrees and stabilized with a box beneath the buttocks. Next, the patient was asked to actively extend the knee as far as possible. This angle was measured using a goniometer, with the stationary arm lined up with the greater trochanter, the axis at the lateral femoral epicondyle, and the moving arm in line with the lateral malleolus (Figure 1). The subject was told to relax, and then the knee of the testing limb was passively extended by the researcher until the end feel was reached. This angle was also measured by a goniometer and recorded. The reference values used to indicate reduced hamstring flexibility are as follows:

Men:
Passive: >32.2˚
Active: >33.0˚
Women:
Passive: >27.3˚
Active: >28.9˚

Subjects who met these values for at least one lower extremity were considered to have a positive hamstring 90/90 test. The extremity with a positive hamstring 90/90 test was consistently used as the subject's testing limb throughout the study. The testing limb was defined as the extremity with a positive hamstring 90/90; if both of the subject's extremities were positive hamstring 90/90, the extremity with the larger angle of restriction was used.

Participants selected for this research study included young female and male adults between the ages of 20 to 35 years old. Once all participants were selected from each class, they were randomly assigned to either the intervention or the control group. The subjects and researchers were not blind to the group assignment. The data collection for each class was conducted separately, therefore there were 2 intervention groups (n=11) and 2 control groups (n=10) total, with 1 intervention and 1 control group for each respective class. The class of 2021 subjects were tested for 8 weeks during October-December of 2019, while the class of 2022 subjects were tested for 6 weeks during February-March of 2020. The second round of data collection that occurred during 2020 was cut slightly short due to restrictions enacted by Covid-19 precautions. Both groups were instructed to come in for data collection 2x a week at designated times (typically between 11am-1pm). Both groups were tested at the same time in the same location. Data collection typically lasted between 40-60 minutes. All participants had a compliance rate of at least 91.66% (missed none or only one session) with the exception of one subject in the cupping intervention group (missed 3 sessions, 75% compliance).

For both groups, an initial measurement was taken at the beginning of each data collection. This was done using a goniometric measurement of the hamstring flexibility of the given limb via the hamstring 90/90 test. These initial values were recorded under the appropriate coded name for the subject (subjects' names were eliminated from official data documents to preserve anonymity).

After the initial measurements were taken, the subjects in the control group were asked to complete the static hamstring stretching routine. The exercises in this routine are ones commonly used in the clinic to promote increased hamstring flexibility, and include the following:

1. Seated hamstring stretching: 45 seconds
    a. Subject seated on table in long-sitting position, leans trunk and arms forward over legs towards toes and hold for allotted time (Figure 2)
2. Standing legs crossed: 45 seconds per side
    a. Subject stands and crosses one foot over the other so that legs are crossed, bends at waist and reaches arms down towards floor and hold for allotted time. Performed both with right leg over the left leg and left leg over the right leg (Figure 3)
3. Supine towel hamstring stretching: 45 seconds
    a. Subject lying on their back with towel gripped in both hands and held across foot of testing limb. Towel is used to lift and pull the outstretched testing limb towards the chest (Figure 4)

The use of the 45-seconds duration of each static stretch was based on the results of a study carried out by Bandy and Irion.[10] Furthermore, these three specific stretches were selected because they can easily be performed and replicated in the clinical setting with no extensive training or expensive equipment. In addition, the extended position of the knee joint and the flexed position hip joint stretches and lengthen the hamstring muscles at both joints, allowing for optimal stretch. Once these exercises were completed, the hamstring 90/90 goniometer measurements were re-measured and recorded.

For the intervention group, the subjects were instructed to lay prone while four cups were applied to the semitendinosus and biceps femoris (used palpation insertions and origins of semitendinosus and biceps femoris to properly place the cups). The cups were drawn up to approximately 1.6 cm from the origin and insertion of each muscle and then left on the subjects for 7 minutes. The cups were placed 1.6 cm from the origin and insertion of each muscle to ensure the cups were placed on the muscle belly (Figure 5). Once the cupping time was completed, the subjects were asked to complete the same set of static stretches as the control group. Hamstring 90/90 measurements were re-measured and recorded for each cupping subject once the stretches were completed.

The data collected for this study was statistically analyzed using IBM Statistical Package for the Social Sciences (SPSS) software. All protocols and relevant study documents were approved by the Georgia State University IRB before the study commenced.


Figure 2: Performance of the seated hamstring stretching.


Figure 1: Performance of the hamstring 90/90 test with goniometry measurement at the appropriate landmarks.


Figure 3: Performance of the standing cross-legged hamstring stretching.

Figure 4: Performance of the supine hamstring stretching with a towel.

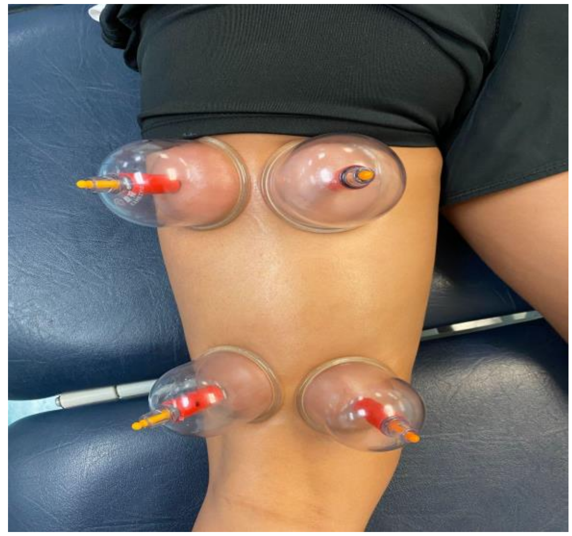

Figure 5: Placement of cups 1.6 cm from the origin to the insertion of semitendinosus and biceps femoris muscles.

Results

Initial data collection

Overall results were mixed in the context of changes in observable flexibility. There was a significant increase in flexibility over time (week 1, $p< 0.001$) and within session (pre/post, $p< 0.001$) regardless of group. This indicates that either intervention could improve flexibility in a short or long-term analysis. There were no significant interaction effects between pre/post tests and the control group ($p=0.210$) or between weeks and control group ($p=0.364$). Mean difference in hamstring goniometric measurements between the two groups was 1.77˚ with the control group exhibiting a smaller angle of change. Mean difference between baseline and post intervention measures was 7.052˚, meaning across both groups they gained ~7˚ of flexibility over the course of the study. When looking at the difference between cupping and stretching groups, there was no statistically significant difference found ($p=0.734$) for improving the hamstring extensibility.

Secondary data collection

Much like the initial data set, the secondary data set revealed no significant differences between stretching group and cupping group for the improvement of hamstring extensibility ($p=0.559$). This data set did show a significant difference ($p=0.008$) between groups before any intervention was administered, which could be attributed to difference in the total number of subjects for each group. There was a significant effect ($p<0.001$) of time across all subjects similar to the first data set. There was no significant interaction between time and subjects for each group.

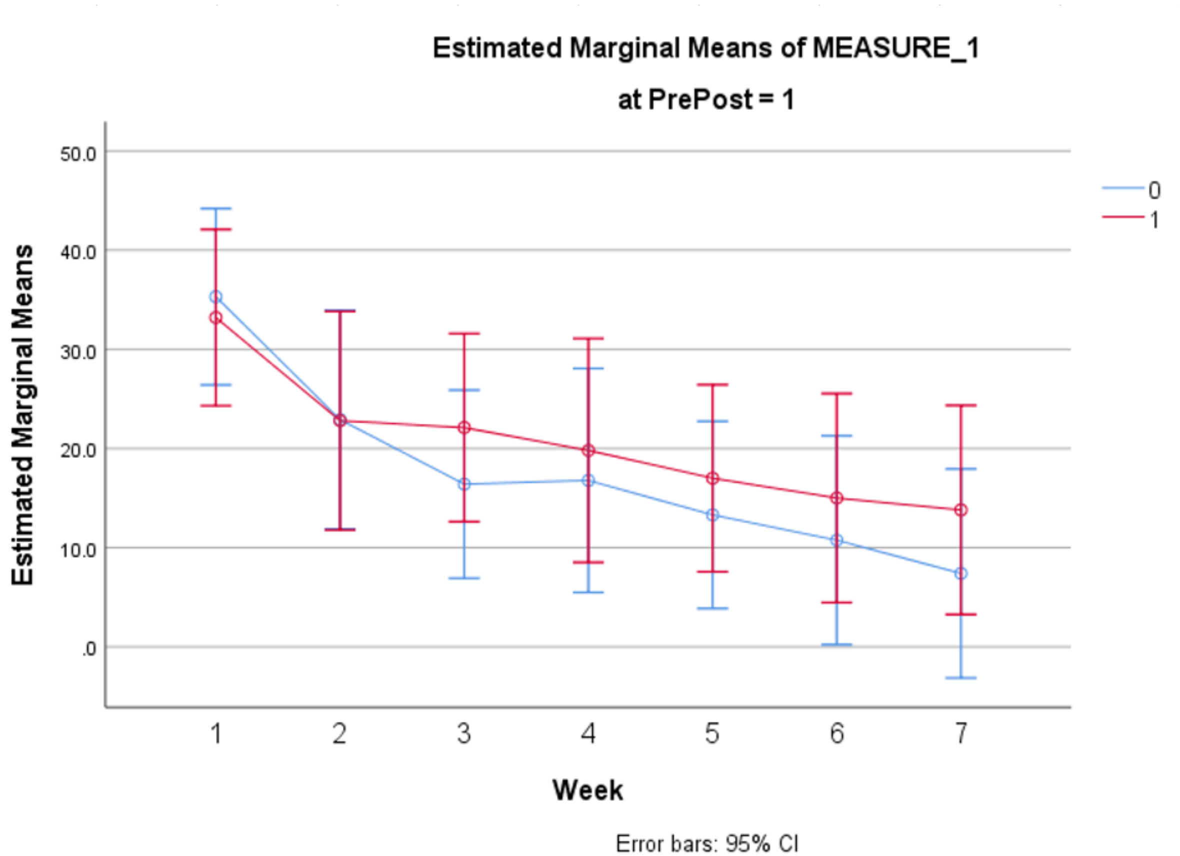

Figure 1. Weekly Baseline (showing weekly average hamstring 90/90 score of the experimental group (red) vs the same score for the control group (blue)

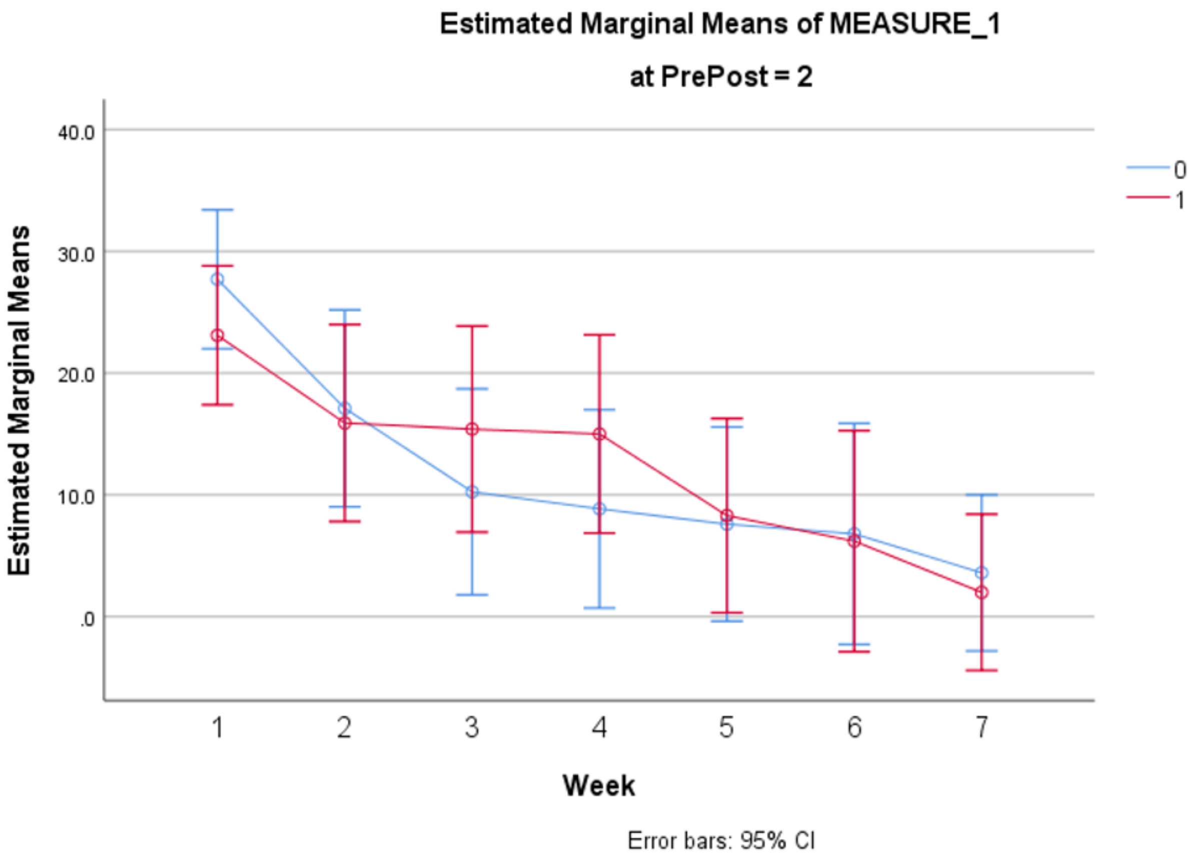

Figure 2. Weekly Post-intervention (showing weekly average hamstring 90/90 score of the experimental group (red) vs the same score for the control group (blue)

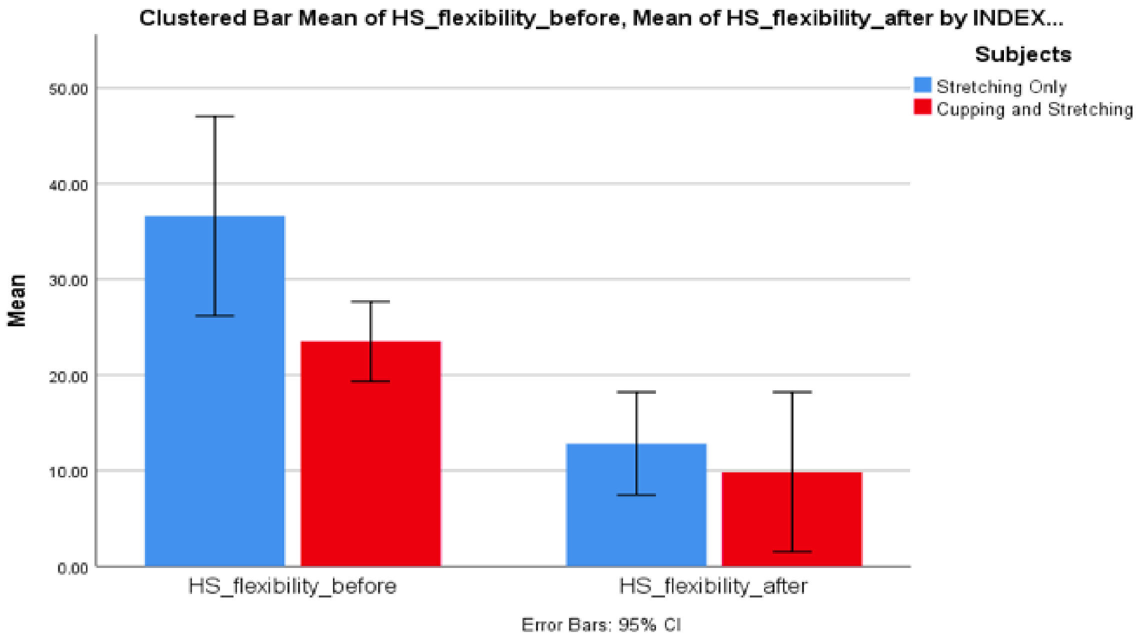

Figure 3. Mean changes in hamstring flexibility from initial baseline to final data point

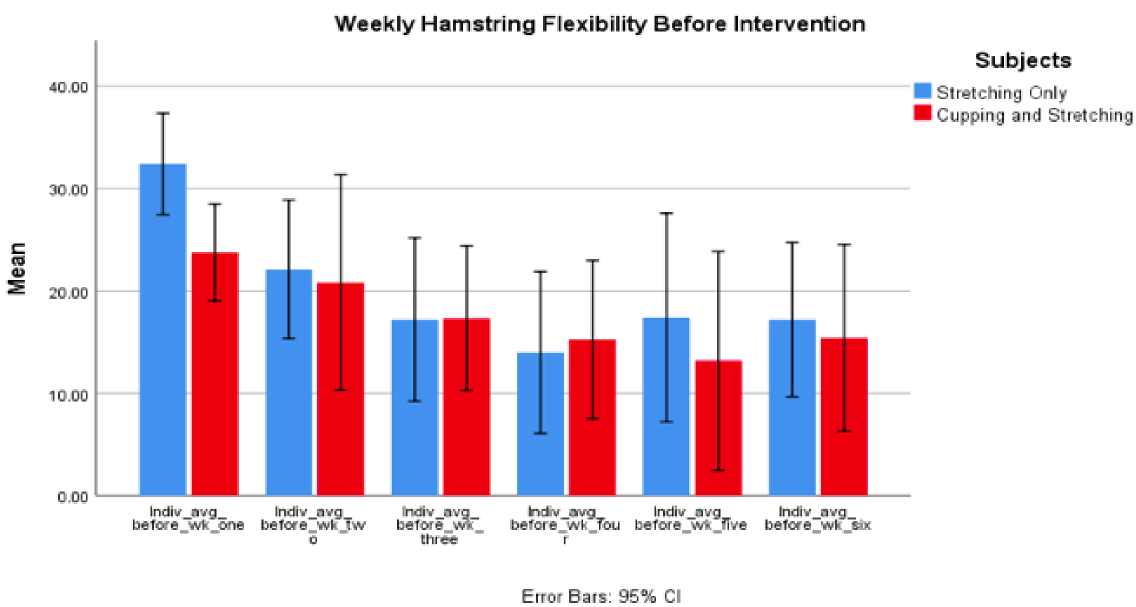

Figure 4. Weekly Hamstring Flexibility Pre-Intervention

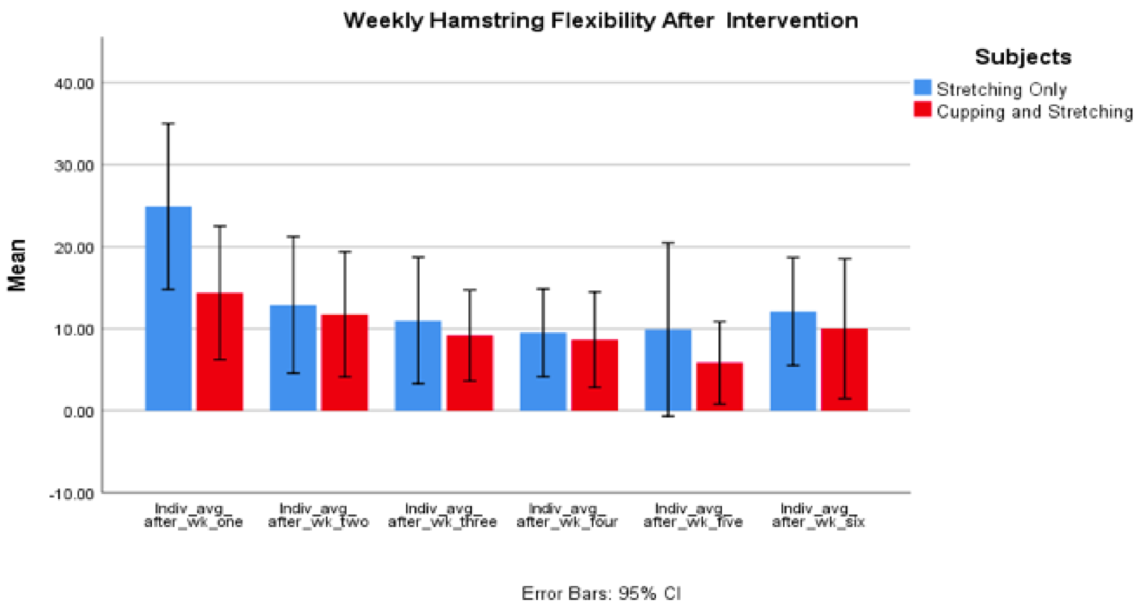

Figure 5. Weekly Hamstring Flexibility Post-intervention

Discussion

Based on the findings of this study, there is a difference between groups over time, as well as a difference between groups from session to session. The pre/post test data difference shows an increase, but more data would be needed to confirm this difference. However, there is not a significant difference between groups in the final results. Both groups improved their hamstring flexibility throughout the study. Due to the small sample size of this study, a bigger sample size is necessary to effectively conclude if Chinese cupping will significantly improve hamstring 90/90 scores compared to stretching alone.

Limitations

As mentioned in the methods section of this study, each group met twice a week to undergo either stretching alone or stretching and cupping session. The research group did not have an ability to control the amount of stretching the subjects might have performed outside of the intervention meeting time.

The small sample size was also another limitation to this study and its ability to provide statistical power to the study. The small sample size may have contributed to the lack of statistical significance between the intervention and control group of this study. The intervention groups and control groups were not blinded from each other, as both groups met at the same time in the same location to perform their assigned intervention.

Measurements were typically taken by the same researcher, but measurements were occasionally taken by a different researcher, which may have resulted in interrater variability in the measurements taken throughout the study. Measurements were only taken from a single limb of each individual. Results could have had more statistical significance if measurements were taken bilaterally from each individual.

Time was another limiting factor in this study. Because the groups only came in for measurements twice per week, this could be a factor contributing to the lack of statistical significance between groups. The global pandemic of COVID-19 was also another limitation of this study. The pandemic escalated during the second round of data collection, thus data collection was shortened by two weeks.

Future Scope

Although improvements were demonstrated in both the experimental and control groups, a larger sample size is needed to determine if a clinically significant difference exists between Chinese cupping with static cupping and static stretching alone. The addition of more treatment sessions would also be beneficial for gathering more conclusive evidence in future studies.

Conclusion

The aim of this study was to measure and compare the effects of Chinese cupping and static stretching on hamstring extensibility relative to only static stretching. The results did show that cupping increased the hamstring extensibility over time; however, it did not show a significant difference compared to stretching alone. In both the intervention and control groups, the data indicated that both interventions improved hamstring flexibility over time. Cupping may not have provided extra benefit, but it did not add a detriment either. In addition, around the 3rd week the data for both groups starts to plateau; this further demonstrates similarity in results between cupping therapy with stretching and static stretching alone. Therefore, the hypothesized superior therapeutic benefit of the clinical use of cupping therapy with static stretching is not supported. There would need to be further clinical-based research done to explore the effects of cupping on hamstring extensibility before it can be used in a clinical setting.

References

1. Croisier JL, Forthomme B, Namurois MH, Vanderthommen M, Crielaard JM. Hamstring muscle strain recurrence and strength performance disorders. *Am J Sports Med*. 2002;30(2):199-203. doi:10.1177/03635465020300020901
2. Nishikawa Y, Aizawa J, Kanemura N, et al. Immediate effect of passive and active stretching on hamstrings flexibility: a single-blinded randomized control trial. *J Phys Ther Sci*. 2015;27(10):3167-3170. doi:10.1589/jpts.27.3167
3. Medeiros DM, Cini A, Sbruzzi G, Lima CS. Influence of static stretching on hamstring flexibility in healthy young adults: Systematic review and meta-analysis. *Physiother Theory Pract*. 2016;32(6):438-445. doi:10.1080/09593985.2016.1204401
4. Williams JG, Gard HI, Gregory JM, Gibson A, Austin J. The Effects of Cupping on Hamstring Flexibility in College Soccer Players. J Sport Rehabil. 2019;28(4):350-353. doi:10.1123/jsr.2017-0199
5. Schafer MD, Tom JC, Girouard TJ, Navalta JW, Turner CL, Radzak KN. Cupping Therapy Does Not Influence Healthy Adult's Hamstring Range of Motion Compared to Control or Sham Conditions. *Int J Exerc Sci*. 2020;13(3):216-224. Published 2020 Feb 1.
6. Shoukat H, Arshad HS, Sharif F, Fatima A, Shoukat F. Effects of different stretching times on range of motion in patients with hamstring tightness: A randomised control trial. *Annals of King Edward Medical University*. 2017;23(4). doi:10.21649/journal.akemu/2017/23.4.554.559
7. Lim KI, Nam HC, Jung KS. Effects on hamstring muscle extensibility, muscle activity, and balance of different stretching techniques. J Phys Ther Sci. 2014;26(2):209-213. doi:10.1589/jpts.26.209
8. Jandre Reis FJ, Macedo AR. Influence of Hamstring Tightness in Pelvic, Lumbar and Trunk Range of Motion in Low Back Pain and Asymptomatic Volunteers during Forward Bending. Asian Spine J. 2015;9(4):535-540. doi:10.4184/asj.2015.9.4.535
9. Cook C. Soft Tissue Mobilization. In: *Orthopedic Manual Therapy*. 2nd ed. Harlow: Prentice Hall; 2012:484.
10. Bandy WD, Irion JM. The effect of time on static stretch on the flexibility of the hamstring muscles. Phys Ther. 1994;74(9):845-852. doi:10.1093/ptj/74.9.845