Comparative Analysis of Suboccipital Muscle Inhibition Technique and Static Hamstring Stretching in Normal Healthy Individuals with Hamstring Tightness: A Randomised Clinical Trial

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KEYWORDS

Hamstring muscle tightness, Suboccipital muscle inhibition, static hamstring stretching, active knee extension test, forward flexion distance test

ABSTRACT:

BACKGROUND

Hamstring tightness is a major contributing factor for lower back pain, lumbar spine disorders and sports related injuries. Many studies has been done to improve the flexibility of hamstring muscle by various techniques such as different stretching techniques myofascial Release Therapy, neuro-muscular therapy and Muscle Energy Technique etc. All of these technique mentioned act at the hamstring muscle level to provide its effectiveness. In a present study we aimed at to find out the effectiveness of suboccipital muscle inhibition technique for improving tightness in hamstring muscle. Hence this study is done to find out the effectiveness of applying suboccipital muscle inhibition technique on distant muscle flexibility in turn to prove the distant muscle relationship. Study is done with the aim to find whether suboccipital muscle inhibition technique can be used along with conventional methods for improving tightness of hamstring muscle.

AIM

To compare the effectiveness of suboccipital muscle inhibition technique and static hamstring stretching in normal individuals with hamstring tightness.

Methods

In this comparative study total 165 individuals were screened for tightness of hamstring. Individuals who satisfied the inclusion criteria were selected from the normal healthy population. A total of 100 healthy subjects of both genders between the age of 18 and 25 were recruited in this trial. After doing block randomization subjects were assigned to two groups ,in Group A 50 subjects were given suboccipital muscle inhibition technique for 5 sessions for 5 consecutive days. Another group 50 subjects were given static stretching to both the lower limbs for 30 seconds followed by 15 seconds relaxation, for 5 sessions for 5 consecutive days.

RESULTS

Active knee extension test using Mann Whitney U test in both suboccipital muscle inhibition technique and static hamstring stretching group shows no difference(p=0.623) for pretreatment, while significant result immediately post treatment (0.002) and statistically significant result in baseline parameters after 5 sessions of treatment (0.000)

Forward flexion distance test using Mann Whitney U test in both suboccipital muscle inhibition technique and static hamstring stretching group shows no significant difference(p=0.088) for pretreatment and also for immediately post treatment (0.893) but shows statistically significant result in baseline parameters after 5 sessions of treatment (0.009)

CONCLUSION

Suboccipital muscle inhibition technique and static hamstring stretching are both effective in improving the flexibility of hamstring muscle. The Suboccipital muscle inhibition technique is more effective compared to static hamstring stretching in normal healthy individuals with hamstring tightness.

1. Introduction

Muscle tightness is the most common condition in normal healthy individuals and in that Hamstring is one of the commonest muscles often get tight.Hamstring tightness increases apparently from childhood up to age 40-49 years with higher incidence in males than females.[1] Overall 68 %of people are affected by hamstring tightness.It has been found that prevalence of hamstring tightness is very high in college going students of age group of 18-25 years.[2] Hamstring tightness causes more burdens on the back

which results in improper motion patterns in the lumbopelvic region. Hence hamstring tightness serve as a cause of lower back pain and it is also a common characteristic of back pain patients.[3]

The biomechanics of hamstring muscle is complex as it cross over two joints hip and knee, which increases patella femoral compressive forces during ambulation this results in varying degree of muscle damage and ultimately various hamstring injuries.[4] Also the muscle tightness considered as one of the intrinsic limiting factor for optimal physical performance in various sports activities. [5] Hence tightness of this muscle can play a role in sports related injuries,lumbar spine disorders and general lower back pain in both adolescence and adult population.

As the consequences produced from tightness of hamstring muscle are relatively high it becomes an important biomechanical component to be considered for treatment approach.Various treatment techniques are available to treat hamstring tightness such as muscle energy technique, position release technique, myofacial release techniques and different stretching techniques. Some authors have changed their view to look towards the treatment approach for hamstring tightness and they used suboccipital muscle inhibition technique to improve flexibility of hamstring muscle.

The importance of suboccipital muscle inhibition technique for cases of upper cervical spine treatment is well accepted but its relationship with other structures has not yet completely identified. So it becomes important to study the treatment of one region and its influence not only locally where treatment is taking place but also globally in distant region.

Erika Quintana Aparicio, et al, very first time studied the effectiveness of the suboccipital muscle inhibition technique for treating hamstring tightness.[6]The study suggested the possible hypothesis that relate hamstring muscle to suboccipital muscle are postural control of suboccipital muscles,connection of suboccipital muscles with dura mater and presence of myofacial chains that links the connective tissue fascia and muscles along specific lines in the body. The relation of cervical spine to hip movements and suboccipital muscles to hamstring muscles is still not well established. The study done by Aparicio in 2009 has used the suboccipital muscle inhibition technique for treating hamstring tightness and identified the immediate effect of the suboccipital muscle inhibition technique. Very limited literature is available to support this study.

In light of this the attempt is made to find out the effectiveness of suboccipital muscle inhibition technique on distant muscle flexibility in turn to prove the distant muscle relationship. Additionally not much studies till date has compared the effects of suboccipital muscle inhibition technique with any other method for treating hamstring tightness. So the study is attempted to compare the effect of suboccipital muscle inhibition technique with static stretching in individuals with hamstrings tightness. Taking into account the lack of evidence on remote effects of suboccipital muscle inhibition technique the present study is done to prove the effectiveness of suboccipital muscle inhibition technique in hamstring tightness and to support its effectiveness as other conventional methods.

2. Methodology

Method Of Data Collection

The study was conducted at department of orthopaedic physiotherapy, Study was conducted for the duration of two years. To minimize the any possible bias of gender and activity level the subjects were selected from different sources.

Total 165 individuals of both the genders were screened for the study. Out of which. 45 were excluded as per exclusion criteria as Individuals with neck pain, Individuals with history of neck trauma, Individuals with herniated disc, lumbar protrusion, Individuals with low back pain Individuals with fracture of lower limb, Individuals with cervical ligament instability, Individuals with vertebra bacillary artery syndrome and 8 individuals were not willing to participate in study. A total of 112 normal healthy individuals of both genders between the age group of 18 and 25 years and popliteal angle greater than 50 degrees were recruited in this trial. Amongst them 8 participants from static hamstring stretching group and 4 participants from suboccipital muscle inhibition group discontinued after first session. A total of 100 subjects participated in the study and written informed consent was taken then baseline data

and preintervention assessment was done. After that randomization by block randomization method was done and subjects were assigned into two treatment groups Group A-50 subjects with hamstring tightness receiving suboccipital muscle inhibition technique. Group B-50 subjects with hamstring tightness receiving hamstring stretching.

For suboccipital muscle inhibition technique, the subject was asked to lie down in supine lying. The hand of the was placed behind the head of the subject with palm facing upwards and fingers flexed with finger pad positioned on posterior arch of atlas. A force was applied on the atlas in the direction of ceiling for 5 minutes with slight traction in the cranial direction for 5 minutes in each session.[7]

For static stretching, subject was asked to lie down in supine lying with 90 degrees of hip flexion. Static stretch was applied for 30 seconds at the point where tightness in the hamstring muscle was felt.[8] The treatment was continued for 5 consecutive days.

The effectiveness of interventions was assessed using the outcome measure Active knee extension test9 and forward flexion distance test.[10] To improve the reliability experimental bias was avoided by including different observer for taking measurement in the study. The observer was blind about the groups. Three repetitions were performed and an average of the three was taken as the final reading for Popliteal Angle and forward flexion distance test. The post treatment assessment was done immediately post treatment and after 5 sessions.

Statistical Analysis

Data were analysed using SPSS Version 20. The chi-square test was used to check for any statistical difference in age, BMI between two groups. Wilcoxon signed rank test was applied to compare AKE and FFD before treatment, immediately post treatment and after 5 sessions. Mann-Whitney U test was considered to compare parameters of AKE and FFD test as both are ordinal data. Mann-Whitney U test along with Bonferroni correction was used to compare post treatment changes in AKE and FFD test between two groups. The level of significance was set at 0.009.

3. Results

A total of 100 subjects were included in the study out of which 50 were assigned to Group A and 50 were assigned to Group B. After completion of the session the collected data was analysed statistically using .The within group comparison of change in popliteal angle and fingertip to floor distance test pre and post intervention was assessed by paired t test. The between group comparison of chane in popliteal angle and fingertip to floor distance test was assessed by unpaired t test.

TABLE 1: BASELINE DATA

CATEGORIES	GROUP A	GROUP B
NO.OF SUBJECTS	50	50
	MEAN±*SD*	MEAN±SD
AGE	22.3±2.05	21.2±2.36
BMI	25.11±3.01	25.89±2.78
GENDER female:Male	3:2	3.2:1.8

Table:2: Inter-Group Comparison of Active knee extension (Popliteal angle) on Right side in Group A (Suboccipital Muscles Inhibition) and Group B (Bilateral Hamstring Stretching) at pre-treatment , post- treatment & After 5 session :

AKE Right	Group	N	Mean ± S.D.	Z-value	p-value
Pre-treatment	Group A	50	60.22±3.58	0.44	P=0.660
	Group B	50	59.92±3.88		NS
Post-treatment	Group A	50	56.02±3.21	3.092	P=0.002
	Group B	50	58.26±3.25		SS
After 5 session	Group A	50	51.96±2.95	6.552	P=0.000
	Group B	50	56.44±2.52		SS

Table:3:Inter-Group Comparison of Active knee extension (Popliteal angle) at LEFT in Group A (Suboccipital Muscle Inhibition technique) and Group B (Bilateral Hamstring Stretching technique) at pre-treatment, post- treatment & After 5 session:

AKE Left	Group	N	Mean ± S.D.	Z-value	p-value
Pre-treatment	Group A	50	59.36±3.14	1.352	P=0.623
	Group B	50	60.39±4.15		NS
Post-treatment	Group A	50	56.30±2.90	3.058	P=0.002
	Group B	50	58.52±3.39		SS
After 5 session	Group A	50	52.44±3.51	5.966	P=0.000
	Group B	50	56.76±3.08		SS

Table:4: Inter-Group Comparison of FFD in Group A (Suboccipital Muscles Inhibition) and Group B (Bilateral Hamstring Stretching) at pre-treatment, post- treatment & After 5 session:

	Group	N	Mean ± S.D.	Z-value	p-value
Pre-treatment	Group A	50	22.1±3.81	1.705	P=0.088
	Group B	50	20.52±4.89		NS
Post-treatment	Group A	50	18.64±3.29	0.135	P=0.893
	Group B	50	18.79±4.26		NS
After 5 session	Group A	50	15.35±3.32	2.62	P=0.009
	Group B	50	17.38±3.93		SS

TABLE 1: Table 1 shows baseline characteristics of both the groups, there was not much significant difference between Group A and Group B at the baseline.

TABLE 2 &TABLE 3: Table 2 and Table 3 shows the results of Active knee extension test on right and left side respectively for both the groups, significant difference was seen after interventions as popliteal angle decreases hamstring tightness also decreases which indicate that both the techniques are effective. In addition to this SMIT shows better effect than static hamstring stretching group.

TABLE 4: Table 4 shows changes in fingertip to floor distance test between both the groups and reveal that Suboccital muscle inhibition technique showed better improvement than static hamstring stretching.

4. Discussion

In the present study marked improvement in the outcome measures (AKE and FFD) were found in both the groups treated bilaterally with suboccipital muscle inhibition technique and the other treated with static stretching technique. This proves the efficacy of both the treatment techniques in increasing the length of hamstrings muscles in normal healthy individuals. In addition on comparison of these groups for their effectiveness, it is found that there is a significant difference observed in almost all the outcome parameters bilaterally.

These findings showed that the interventions focalized at a distance from the musculature i.e treating the suboccipital muscles for increasing the hamstring length was found to be effective. This is of special importance as local site stretching techniques may cause aggravation of the local inflammatory response resulting in further muscle spasm and guarding.

Pollard and Ward(1997)[11] suggested a different approach i.e cervical spine treatment that might avoid compressing or stretching irritable structures but still produce an increase in hip flexion range of motion and hamstring extensibility. Pollard and Ward reported change in the extensibility of hamstring muscle following application of cervical isometrics contract relax technique. Hence the study find out the remoteness of the site of treatment to the region of effect but there was lack of explanation for this effect.

The present study along with these studies suggested new approach to the treatment of impaired hamstring extensibility and encouraged further investigation of remote effect of cervical treatment favoring the authors who concluded that manual therapy of neck may have a role to play in treatment of extra spinal lower limb musculoskeletal conditions. Dr Rasika Panse et al, 2018 studied the effect of Suboccipital Muscle Inhibition and Neural Flossing Techniques on Hamstring Flexibility in Young Adults. It was concluded that Hamstring tightness and stretch pain reduced significantly when

combination of suboccipital muscle inhibition and neural flossing technique was given in young adults.[12]

Many researchers said that the positive results obtained may be because of direct connection of dura mater with rectus capitis posterior minor muscle. The naturally occurring physical connection between suboccipital muscle and dura mater at atlantooccipital junction has been demonstrated in recent studies. Gary et al noted the presence of myodural bridge connecting rectus capitis posterior minor muscles to the dura mater.[13] Normally the axis of the spine is properly aligned and the dural membrane retains its position. But when facets of atlas and axis are jammed together one side they fail to open on the other side this draws the vertebra towards the side of fixation which drags the dura towards it causing overstretching of dural membrane. This results in the decrease in hip flexion range of motion.[14,15] The myodural bridge act as a dynamic connection transmitting forces from suboccipital muscles to the dura mater.[16] Thus application of suboccipital muscle inhibition technique has an important role in improving this reduced hip range of motion.

In addition the suboccipital muscles have the highest density of muscles spindles particularly, the rectus capitis posterior minor muscle, which is 36 muscle spindles per gram, thus this muscle is known to contribute regulation of posture and the degree of tension.[17] Hence Suboccipital muscle inhibition technique is a method of relaxing tension in suboccipital muscles located between occiput and axis which regulates the upper cervical vertebra. The evidence suggest that when the tone of suboccipital muscle falls then the tone of knee flexors such as hamstring also decreases due to relaxation of myofascia. This is because hamstring and suboccipital muscles are connected by neural system which passes through the dura mater called as superficial back line.[18]

In the present study, suboccipital muscle inhibition technique was found effective in improving the flexibility of tight hamstring muscle in normal healthy individuals. Also when comparing with static hamstring stretching the suboccipital muscle inhibition technique was found superior to it. The previous studies done has shown immediate effect of this technique so this study has used follow up of 5 sessions and suboccipital muscle inhibition technique was found to be effective at the end of 5th session also.

This study implies that suboccipital muscle inhibition technique can be used to treat hamstring tightness in lower back pain patients in order to avoid aggravation of pain caused by stretching of hamstring muscle. Also in the athletes with hamstring strain suboccipital muscle inhibition technique can be a better choice of treatment. Very limited studies had been done to prove this distance muscle relationship. So future studies are needed in order to find out long term effect of suboccipital muscle inhibition technique and justify the exact cause of effect of suboccipital muscle inhibition technique on hamstring muscle tightness.

5. Conclusion

Suboccipital muscle inhibition technique and static hamstring stretching are both effective in improving the flexibility of hamstring muscle. However, Suboccipital muscle inhibition technique shows better effects in improving hamstring flexibility when compared to static hamstring stretching in normal healthy individuals with hamstring tightness. Thus suboccipital muscle inhibition can be chosen over stretching along with the conventional methods of treatment for hamstring tightness.

Limitatons

1. The study has been done for short duration so longterm effect cannot be predicted from the study.

2. Study /has included large female sample size though hamstring tightness is more prevalent in male population.

3. Immediate post treatment assessment was done for 1st and 5th session it was not done for 5 consecutive sessions.

Conflicts of interest

All authors have no conflicts of interest to declare.

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SUBOCCIPITAL MUSCLE INHIBITION TECHNIQUE GROUP MASTER CHART

0					SUBOCCIPITAL MUSCLE INHIBITION TECHNIQUE													
				Active knee extension test (0)											Finger -floor distance test (cm)		
				Right side					Left side								
Sr no	Age	Gender	BMI	pre	post	imme %	after 5	final %	pre	post	imme%	after 5	final%		pre	post	after 5
				treatment	treatment	change	sessions	change	treatment	treatment	change	sessions	change		treatment	treatment	sessions
1	22	F	28.46	59	56	3.33333	53	6.6667	55	48	7.77778	50	5.55556		21	18	17
2	19	F	25.31	57	57	0	55	2.2222	59	55	4.44444	54	5.55556		20	16	15.5
3	20	M	23.67	61	59	2.22222	53	8.8889	62	61	1.11111	55	7.77778		24	22	11.5
4	21	F	21.58	64	54	11.1111	51	14.444	60	56	4.44444	48	13.3333		20.5	17	12
5	20	F	17.95	57	56	1.11111	52	5.5556	59	57	2.22222	54	5.55556		19.5	17	14
6	24	F	22.75	65	61	4.44444	53	13.333	68	64	4.44444	58	11.1111		22	21	18
7	25	M	25.56	69	65	4.44444	53	17.778	62	57	5.55556	51	12.2222		28	22	14
8	24	M	26.34	60	54	6.66667	51	10	65	60	5.55556	53	13.3333		32	28.5	23
9	23	M	28.08	57	56	1.11111	51	6.6667	55	53	2.22222	50	5.55556		20.5	15.5	12.5
10	18	F	31.14	57	54	3.33333	53	4.4444	58	54	4.44444	53	5.55556		22.5	18.5	16
11	22	F	26.24	59	50	10	51	8.8889	56	53	3.33333	50	6.66667		21	18.5	17
12	18	F	22.15	55	48	7.77778	48	7.7778	61	55	6.66667	52	10		23	16	12
13	19	F	21.45	57	55	2.22222	45	13.333	60	59	1.11111	57	3.33333		25.5	21.5	20
14	26	F	25.45	62	56	6.66667	53	10	56	50	6.66667	46	11.1111		26	13.5	11
15	24	M	27.67	59	58	1.11111	53	6.6667	57	56	1.11111	53	4.44444		21	19	17.5
16	22	M	24.34	62	56	6.66667	52	11.111	60	59	1.11111	59	1.11111		22	18	16.5
17	20	F	22.89	61	57	4.44444	49	13.333	63	58	5.55556	53	11.1111		24	20	17
18	24	F	24.45	60	59	1.11111	52	8.8889	57	56	1.11111	53	4.44444		21	19	18
19	25	M	26.54	62	62	0	54	8.8889	60	59	1.11111	55	5.55556		23	21.5	18
20	21	F	29.04	70	62	8.88889	54	17.778	64	59	5.55556	42	24.4444		32	26	17
21	20	F	26.65	66	54	13.3333	57	10	63	60	3.33333	58	5.55556		27	25	20
22	24	F	23.67	56	49	7.77778	54	2.2222	57	56	1.11111	57	0		19	18.5	18
23	23	F	20.96	55	51	4.44444	52	3.3333	57	57	0	55	2.22222		18	16	16
24	24	F	19.35	59	54	5.55556	48	12.222	56	55	1.11111	48	8.88889		22	17.5	13
25	21	M	22.75	63	58	5.55556	50	14.444	68	61	7.77778	42	28.8889		26	20	13.5
26	21	M	30.23	61	56	5.55556	53	8.8889	56	53	3.33333	49	7.77778		19	13	9
27	23	F	26.61	56	56	0	56	0	58	55	3.33333	54	4.44444		17	16	15.5
28	21	M	23.45	59	57	2.22222	54	5.5556	59	58	1.11111	55	4.44444		19	17.5	16
29	22	M	22.81	59	54	5.55556	54	5.5556	61	59	2.22222	56	5.55556		24	21	18
30	24	M	24.16	56	55	1.11111	51	5.5556	57	55	2.22222	53	4.44444		21	19	17
31	26	F	24.56	56	53	3.33333	47	10	61	57	4.44444	54	7.77778		17	16.5	14
32	21	F	24.37	59	56	3.33333	48	12.222	60	57	3.33333	50	11.1111		25	17	10
33	25	M	28.48	58	57	1.11111	52	6.6667	57	56	1.11111	54	3.33333		13	12	11.5
34	23	M	28.42	61	56	5.55556	53	8.8889	59	56	3.33333	55	4.44444		23.5	21	20
35	24	F	27.67	64	55	10	53	12.222	59	54	5.55556	51	8.88889		26	20	14
36	22	F	21.74	59	57	2.22222	53	6.6667	57	54	3.33333	52	5.55556		21	20	17
37	21	F	20.86	62	58	4.44444	53	10	63	56	7.77778	51	13.3333		28	17	11
38	21	M	24.28	60	58	2.22222	57	3.3333	57	54	3.33333	51	6.66667		16	14.5	12
39	22	F	26.35	63	59	4.44444	56	7.7778	60	56	4.44444	53	7.77778		23.5	19.5	16
40	20	F	28.41	62	57	5.55556	56	6.6667	59	58	1.11111	55	4.44444		22.5	21	19
41	21	F	23.54	63	56	7.77778	53	11.111	56	55	1.11111	52	4.44444		24	21	20
42	23	M	23.35	59	59	0	54	5.5556	60	59	1.11111	55	5.55556		19	18	16
43	23	M	26.45	68	59	10	50	20	57	51	6.66667	47	11.1111		23	16	8
44	24	F	31.63	61	55	6.66667	54	7.7778	64	59	5.55556	55	10		23	22	18.5
45	26	M	22.56	57	54	3.33333	49	8.8889	57	55	2.22222	53	4.44444		16	14.5	12
46	21	M	25.26	59	54	5.55556	47	13.333	55	53	2.22222	52	3.33333		18	15	12
47	20	M	27.58	62	56	6.66667	48	15.556	63	58	5.55556	51	13.3333		25	21	17
48	22	F	29.47	64	59	5.55556	57	7.7778	60	58	2.22222	54	6.66667		24.5	23	21
49	24	F	25.01	56	53	3.33333	47	10	58	55	3.33333	51	7.77778		17.5	14	11
50	25	F	23.93	55	51	4.44444	46	10	57	56	1.11111	53	4.44444		19	17	14
Mean	22		25.11	60.22	56.02	4.66667	51.96	9.1778	59.36	56.3	3.4	52.44	7.68889		22.1	18.64	15.35
SD	2			3.55128	3.18427	3.0952	2.9255	4.1324	3.109727	2.87924	2.11298	3.4823	5.08612		3.81314	3.289438	3.32904

BILATERAL HAMSTRING STRETCHING TECHNIQUE GROUP MASTER CHART

				BILATERAL HAMSTRING STRETCHING TECHNIQUE												
				ACTIVE KNEE EXTENSION TEST (0)										Finger -floor distance test (cm)		
				Right side						Left side						
Sr no	Age	Gender	BMI	Pre	post	imme%	After 5	After 5	pre	post	imme%	After 5	After 5	pre	post	after 5
				treatment	treatment	change	session	% change	treatment	treatment	change	session	% change	treatment	treatment	sessions
1	25	F	22.48	56	55	1.111111	55	1.111111	58	58	0	56	2.222222	22	21	20
2	18	M	31.26	64	61	3.333333	53	12.22222	65	60	5.555556	53	13.33333	19	16	13
3	19	M	28.19	66	64	2.222222	61	5.555556	63	59	4.444444	56	7.777778	30	27	22
4	20	F	24.35	59	59	0	58	1.111111	60	58	2.222222	58	2.222222	22	17.5	16
5	19	M	26.45	62	60	2.222222	59	3.333333	58	55	3.333333	53	5.555556	25	21	19.5
6	20	F	27.78	55	54	1.111111	53	2.222222	61	59	2.222222	56	5.555556	21	19	17
7	20	F	31.21	62	56	6.666667	54	8.888889	68	66	2.222222	63	5.555556	22	19	18
8	18	F	26.34	56	55	1.111111	54	2.222222	57	57	0	55	2.222222	15	13	12
9	18	M	29.56	58	56	2.222222	56	2.222222	58	57	1.111111	55	3.333333	22	20	19
10	19	F	27.45	57	56	1.111111	53	4.444444	55	56	-1.11111	53	2.222222	18.5	16	15
11	18	F	31.05	55	53	2.222222	53	2.222222	60	58	2.222222	57	3.333333	19	18	17.5
12	18	F	23.56	60	55	5.555556	54	6.666667	60	60	0	58	2.222222	21.5	19.5	19
13	18	F	26.45	62	60	2.222222	59	3.333333	62	70	-8.88889	69	-7.77778	28.5	25	23.5
14	21	F	27.47	59	59	0	58	1.111111	60	58	2.222222	55	5.555556	18	17.5	16
15	22	M	29.36	62	60	2.222222	59	3.333333	64	63	1.111111	61	3.333333	22	21	20.5
16	21	M	28.62	57	56	1.111111	56	1.111111	58	57	1.111111	56	2.222222	16	14.5	14
17	23	F	27.56	64	61	3.333333	59	5.555556	60	59	1.111111	57	3.333333	24	22	21
18	24	F	24.47	63	60	3.333333	59	4.444444	61	58	3.333333	57	4.444444	18	16	16
19	24	M	26.21	54	55	-1.11111	54	0	58	57	1.111111	55	3.333333	13	12	11.5
20	24	M	28.47	55	53	2.222222	53	2.222222	59	57	2.222222	57	2.222222	12.5	12	10
21	18	F	19.49	55	55	0	54	1.111111	56	55	1.111111	56	0	15	13.5	12.5
22	18	F	17.67	62	59	3.333333	57	5.555556	64	61	3.333333	58	6.666667	23	22	21.5
23	19	M	26.89	57	57	0	56	1.111111	58	55	3.333333	55	3.333333	19	18.5	18
24	22	F	25.69	59	58	1.111111	56	3.333333	56	55	1.111111	54	2.222222	14	13	13
25	25	F	23.46	64	59	5.555556	55	10	63	59	4.444444	58	5.555556	26	24.5	21
26	21	M	27.14	71	69	2.222222	57	15.55556	68	64	4.444444	60	8.888889	31	28	25
27	22	F	24.12	67	64	3.333333	61	6.666667	64	61	3.333333	60	4.444444	28	24	21
28	19	M	27.34	55	55	0	53	2.222222	57	55	2.222222	53	4.444444	16	15	14.5
29	20	F	25.45	57	57	0	54	3.333333	59	58	1.111111	57	2.222222	17	15.5	13
30	21	M	26.63	64	61	3.333333	60	4.444444		58	-64.4444	52	-57.7778	25	24	23.5
31	18	F	22.73	62	61	1.111111	59	3.333333	60	59	1.111111	58	2.222222	23	22	21.5
32	25	F	25.48	59	58	1.111111	57	2.222222	58	56	2.222222	56	2.222222	21	19.5	18
33	23	M	24.31	58	56	2.222222	55	3.333333	56	55	1.111111	54	2.222222	18	16.5	15
34	24	F	23.41	61	59	2.222222	59	2.222222	59	57	2.222222	56	3.333333	20	18	16.5
35	22	M	27.36	60	59	1.111111	57	3.333333	64	61	3.333333	58	6.666667	24.5	22	19
36	21	F	23.16	57	56	1.111111	55	2.222222	58	57	1.111111	56	2.222222	16.5	14.5	14
37	21	F	29.49	56	55	1.111111	53	3.333333	57	55	2.222222	55	2.222222	14	13.5	11.5
38	20	F	26.38	55	57	-2.22222	57	-2.22222	58	57	1.111111	55	3.333333	13.5	13	11
39	22	F	25.28	59	58	1.111111	56	3.333333	56	54	2.222222	53	3.333333	15	13	12.5
40	21	M	28.43	64	62	2.222222	59	5.555556	61	59	2.222222	57	4.444444	26.5	24	23
41	23	F	26.18	63	61	2.222222	58	5.555556	62	60	2.222222	57	5.555556	24	21.5	18.5
42	25	M	27.35	59	58	1.111111	57	2.222222	57	56	1.111111	56	1.111111	17	15	15
43	26	F	25.38	63	61	2.222222	60	3.333333	61	58	3.333333	57	4.444444	26	23	21
44	24	M	27.93	68	65	3.333333	62	6.666667	69	68	1.111111	64	5.555556	28	26	23
45	21	F	22.56	60	58	2.222222	56	4.444444	58	57	1.111111	55	3.333333	17	18	19.5
46	20	F	21.78	56	56	0	55	1.111111	55	54	1.111111	54	1.111111	16	15	13.5
47	19	F	22.46	61	59	2.222222	56	5.555556	65	61	4.444444	58	7.777778	26	23	21
48	19	F	24.67	59	56	3.333333	55	4.444444	68	57	12.22222	57	12.22222	19	21	20.5
49	23	M	24.18	55	54	1.111111	53	2.222222	59	57	2.222222	56	3.333333	13	15	12.5
50	24	F	24.1	64	62	2.222222	60	4.444444	68	65	3.333333	63	5.555556	25	21	19
Mean	21.1		25.8958	59.92	58.26	1.844444	56.44	3.922902	60.38776	58.52	0.733333	56.76	2.688889	20.52	18.79	17.38
SD	2.36008		2.78493	3.882473	3.248446	1.596447	2.515234	2.999928	4.153033	3.395526	9.636889	3.08908	9.157308	4.85073	4.21674	3.891735

Annexure-A

CONSENT FORM

"Comparison of effect of suboccipital muscle inhibition technique and hamstring stretching in subjects withhamstring tightness."

Purpose of the study: Purpose of this study is to identify the effects of the suboccipital muscle inhibition technique in subjects having hamstring tightness by means of tests designed to evaluate the elasticity of the hamstring muscles

Risks and benefits: As such there is no risk involved in these studies and you will be getting early benifit by receiving respective treatment sessions.

Right to withdraw: You have a right to withdraw from research at any point of time without stating any reason for it.

Authorization to publish results : Results of the study may be published for scientific purpose and /or presentated to scientific groups. However you will not be identified.

Confidential: All informations about you will be kept strictly confidential an limited to the Dr.SuchetaGolhar and ShubhangiMandale. This will not be shared with any person without your consent.

Consent: I ———————————— voluntarily consent to participate in the study.All my questions have been satisfactorily answered and the risks involved have been explained to me.I reserved my right to withdraw at any instant and I have the contact address of ShubhangiMandale, if I require any further information.

Name and signature of volunteer Name and signature of witness

Date: Place:

Annexure -B

Data collection sheet

"Comparison of effect of Suboccipital Muscle Inhibition Technique and Hamstring Stretching in subjects with hamstring tightness."

Name: Subject No. :

Age:

Sex:

Occupation:

Address, Contact No.

Height:

Study Group:Group 1.Suboccipital muscle inhibition technique ☐

Group 2.Bilateral hamstring stretching ☐

Outcome measures table:

Sr.no	Outcomes		Pretreatment	Immediate post treatment	Followup After 5 session
1	Active knee extension (Popliteal angle) test	Right			
		Left			
2	Finger to floor Distance test.				