International Journal of Physical Education, Sports and Health 2023; 10(2): 503-511

P-ISSN: 2394-1685
E-ISSN: 2394-1693
Impact Factor (RJIF): 5.38
IJPESH 2023; 10(2): 503-511

www.kheljournal.com
Received: 21-02-2023
Accepted: 22-03-2023

Bhagyashri Nalage
Intern, college of physiotherapy, MMC, WH, Miraj Maharashtra, India

Dr. Chintan Solanki
Assistant professor, College of Physiotherapy, MMC, WH, Miraj, Maharashtra, India

Corresponding Author:
Bhagyashri Nalage
Intern, college of physiotherapy, MMC, WH, Miraj Maharashtra, India

Effect of sub occipital muscle inhibition technique versus PNF stretching on hamstring flexibility in college going students: A comparative study

Bhagyashri Nalage and Dr. Chintan Solanki

Abstract
Hamstring tightness is significant contributor to lumbar spine problem, low back pain, Patellofemoral pain and other musculoskeletal issue. Prevalence of hamstring tightness is high in college going students. PNF stretching technique integrate active muscle contraction into stretching maneuver to inhibit or facilitate muscle activation to improve flexibility. The sub occipital muscle inhibition technique is method of relaxing the fascia by applying soft tissue pressure to the suboccipital region of the head, which increases hamstring flexibility through reflexive relaxation of my fascia as hamstring and sub occipital muscle and hamstring connect through a fascial linkage.

Method: 50 subjects who fulfilled selection criteria were randomly divided into two groups (25 in each). Group A received sub occipital muscle inhibition technique and Group B received PNF stretching (Contract relax method). Outcome measures Passive knee extension test and Back Saver Sit and Reach test were measured before and after the treatment intervention. The treatment was given for 6 consecutive days.

Result: Statistical analysis for between groups was done using independent t test. Sub occipital muscle inhibition technique and PNF stretching were having significant effects on PKET and BSSRT in both groups. The final analysis proves that both the groups were clinically significant but it shows non – significant difference between the groups. (P value > 5%).

Conclusion: The present study concludes that sub occipital muscle inhibition technique and PNF stretching both are equally effective in improving hamstring flexibility in college going students.

Keywords: College going students, Hamstring flexibility, PNF Stretching, sub occipital muscle inhibition technique

1. Introduction
Flexibility of joint is related to the extensibility of muscle that cross over the joint and based on the ability to relax and ability to stretch [3]. It is important component of physical conditioning program along with muscle strength and endurance training. [2]

Reduced muscle extensibility cause muscle tightness which leads to decrease in muscle flexibility. [3] Muscle tightness, or reduced extensibility, is a sign of adaptive shortening of both the contractile and non –contractile component of muscle. [2] Muscle may become less flexible as result of a sedentary lifestyle or low amount of physical activity [5]. Muscle tightness influences the length tension relationship the limbs shock absorbing ability [4].

The hamstring muscle is a double-jointed muscle that participates in both hip extension and knee flexion movements. The hamstring muscle is crucial for both daily tasks and endeavors, as well as regulated movements. [5] Hamstring is the one of the most commonly tense muscles. [6] A tight hamstring restrict the blood vessels, which worsen the muscles ability to operate at their best [5]. Tightness of hamstring has significant impact on body alignment on seated posture. Hamstring tightness are associated with posterior rotation of the pelvis in standing due to attachment of hamstring muscle is on ischial tuberosity. Tightness of hamstring result in posterior pelvic tilt which result in back pain [1]. Hamstring tightness is significant contributor to lumbar spine problem, low back pain and injuries. [6] Patellofemoral pain is exacerbated by tight hamstrings due to higher compressive force during the swing phase of gait. Hamstring tightness increases likelihood of recurrent injury, decreases the performance of athletics, causes post exercise pain and impair athlete coordination [1].

Prevalence of hamstring tightness is high among college going students of age group 18-25 years [1]. Males are more likely than female to have the tight hamstring [5]. It has been determined that more hours spent in sitting for extended period of time may result in hamstring tightness. Hours of sitting and lumbar lordosis angle were shown to be significantly correlated. The curvature of lumbar spine alters i.e. decreases lumbar lordosis angle among college going students who spend long period of time in sitting position. [13] Low back injury could occur if specific motions are made after long period of sitting. Hence awareness of hamstring stretching is important to prevent musculoskeletal problem. [1] Prolonged sitting is a component of sedentary lifestyle, and those engage in it need to an additional physical exercise to encourage postural adjustment [14].

Passive knee extension and Back saver sit and reach test are generally considered acceptable test to measure hamstring tightness. And both test are valid and reliable to asses hamstring flexibility.

Hamstring tightness can be treated using a variety of method, including the muscle energy technique, position release technique, myofascial release technique, and various stretching techniques. The suboccipital muscles contain rectus capitis posterior major, rectus capitis posterior minor, rectus capitis posterior major, obliquus capitals superior, obliqus capitis inferior [12]. The ability of the Dura to move along its attachment sites can potentially limit the range of motion available to the lower limb. Release of the suboccipital muscles causes inhibitory reflexes to relax the agonists, resulting in relaxation of the suboccipital muscles. The sub-occipital muscles are thought to cause an increase in Dura length, thereby increasing the ROM available to the lower limb. [2] A neural system connects the hamstring and suboccipital muscles, and the suboccipital muscles pass through the dura mater. This is known as superficial back line (SBL), which connect the lower extremities, trunk, neck and head and protect the entire posterior surface of the body as well as providing important function of body up righting. Plantar fascia, gastrocnemius, hamstring, erector spinae, epi-cranial fascia, and other muscles and fascia are included in superficial back line. As the tone of hamstring muscle reduced (passively, with a fascial treatment, or with active movement) the amplitude of hip flexion increases, and decreasing the tone of suboccipital muscle [12]. The suboccipital muscles regulate the posture of hamstring muscles [6].

It was recently reported that hamstring flexibility increased as a result of an intervention targeting the suboccipital muscles. The suboccipital muscle inhibition (SMI) technique is a method of relaxing tension in the four muscles located between the occiput and axis that regulate the upper cervical vertebra these muscles are known to be associated with regulating body posture [2]. The suboccipital muscle inhibition technique is method of relaxing the fascia by applying soft tissue pressure to the suboccipital region of the head. This technique can be easily apply to the patient while he or she is lying comfortably. It has been reported that when the tone of the suboccipital muscle falls, the tone of the knee flexor also falls. This is due to the fact that the hamstring and the suboccipital muscle linked by a single neural system that runs through duramater known as superficial back line. [4] Previous studies investigated the immediate effect of suboccipital muscle inhibition technique in subjects with short hamstring syndrome and concluded that SMI technique modifies hamstring flexibility [2].

PNF is a positive, integrated approach developed by Knot and Voss in 1968 that is a more advanced form of flexibility that involves both stretching and contraction of the muscle group being targeted. The primary goal of PNF techniques is to improve functional movement through muscle group facilitation, inhibition, strengthening, and relaxation [5]. PNF is basically a muscular mobilization technique that uses muscle facilitation and inhibition. The occurrence of the inverse stretch reflex, which demonstrates autogenic inhibition of muscle, is manifested by the Golgi tendon organ. GTOs are found in a muscles tendon near its tendinous insertion. Their function is to monitor muscle tension, and stimulation of GTO because the muscle associated it to relax. [21] PNF stretching is more advanced technique to improve flexibility. Before stretching, PNF enhance muscular relaxation and enhance ROM by inducing relaxation and voluntary muscle contraction to reduce reflexive component which cause muscle relaxation [3]. PNF stretching is simple to use and widely used in clinical settings. PNF stretching is an efficient method for increasing both passive and active flexibility. PNF stretching is based on optimizing muscle relationships in order to achieve a greater stretch. Hold-relax, contract-relax, and contract-relax antagonist-contracts are PNF stretching techniques for increasing muscle flexibility. All of these techniques involve alternating periods of agonist and antagonist contraction and relaxation.[9] In Contract relax (CR) stretching, the target muscle is lengthened and then held in that position while the participant contracts the target muscle isometrically to its maximum for an allotted amount of time. This was followed by a shorter relaxation of the TM, which usually included a passive stretch [8].

There are various studies showing effectiveness of suboccipital muscle inhibition technique and PNF stretching technique individually.

So the purpose of the study is compare effectiveness of suboccipital muscle inhibition technique versus PNF stretching technique in college going student

2. Materials and methodology

2.1 Study Type: A Comparative study.
2.2 Type of sampling: Simple random sampling
2.3 Sample size: 50
2.4 Study duration: 6 months
2.5 Study setting: Colleges in Miraj city

2.6 Method of collection

50 college going students of age group between 18-25 years participated. Subjects with less than 75 degree of popliteal angle on PKE test, both males and females were included. Subjects with hamstring injury for at least past 1 year, any neurological, musculoskeletal, cardiorespiratory, neck pathology, vestibular disorder and participating in fitness program were excluded.

The intervention and methodology was explained to all participant. Institutionally approved written consent was taken from all participant. This study was conducted as single blinded. 50 subjects were randomly divided into two groups (25 in each). Group A received sub occipital muscle inhibition technique and Group B received PNF stretching (Contract Relax method). Outcome measures Passive knee extension test and Back Saver Sit and Reach test were measured before and after the treatment intervention. The treatment was given for 6 consecutive days.

2.7 Intervention

Group A: Suboccipital muscle inhibition technique

The therapist sits at the end of the table with patient supine with eyes closed. Therapist finger placed under the subject's head, pads of the therapist finger on the projection of the posterior arch of atlas which might be palpated between external occipital protuberance and spinous process of axis. There should be the 90 degree flexion of metatarsophalangeal joint. The upward pressure toward the subject's nose was applied. The technique is applied for 5 minutes, single session given for 6 days per week for 1 week.

Fig 1: Suboccipital muscle inhibition

Group B: PNF stretching (Contract Relax)

Patient position is supine on plinth. The examiner flexes subject's hip joint to maximum flexion while maintaining the knee joint in full extension.5 seconds of isometric contraction was given followed by 10 second of relaxation. During 10 second of relaxation examiner slowly extends knee into newly gained range. The process was performed twice so that cycle of 30 second is completed.

30 second rest between each cycle was given. Five cycles of 30 second each were performed.

Fig 2: Contract relax method

2.8 Outcome Measures

All subjects were assessed before and after the end of 6 days intervention.

1. Passive knee extension test (PKE) (Reliability-0.89)

In passive knee extension test patient was positioned in supine with ipsilateral hip and knee 90^0 and contralateral leg flat on table. Then examiner extend knee passively to maximum extension. And the angle is measured by goniometer, by another examiner.

Fig 3: PKE test

2. Back saver sit and reach test (BSSRT)

The subjects sit at the sit and reach box and fully extended one leg so that the sole of the foot was flat against the end of the box. The subjects bent the other leg so that the sole of the foot was flat on the floor with the knee and hip at 90º and 45º, respectively. They placed the right hand over the left, and slowly reached forward as far as they could by sliding their hands along the measuring board. The BS was administered with each leg extended in a counterbalanced order to ensure that asymmetry would not bias the test results.

3. Result and Discussion

The data was entered using Microsoft excel 2013, and it was analyzed using SPSS version 23.The normality testing of data was done by Shapiro-wilk test. The comparison of pre and post intervention within group on PKET and BSSRT done using paired T test. The comparison between groups was done using independent T test

Table 1: Normality test using Shapiro-Wilk

Variable	Time frame	Group A		Group B	
		z-value	p-value	z-value	P-Value
PKET Right	Pre	0.928	0.080	0.937	0.128
	Post	0.899	0.050	0.856	0.050
	Diff	0.933	0.102	0.968	0.597
PKET Left	Pre	0.884	0.058	0.890	0.051
	Post	0.873	0.050	0.901	0.050
	Diff	0.893	0.053	0.925	0.065
BSSRT Right	Pre	0.959	0.388	0.916	0.052
	Post	0.983	0.932	0.931	0.094
	Diff	0.950	0.256	0.968	0.590
BSSRT Left	Pre	0.987	0.978	0.894	0.051
	Post	0.960	0.413	0.912	0.053
	Diff	0.964	0.499	0.922	0.058

Data set is normally distributed as all the variables have indicated non-significant outcome in the observation. The researcher shall use parametric test for data analysis purpose in the following sections.

Table 2: Show Particular, Group A, Group B and Total

Particular		Group		Total
		Group A	Group B	
Gender	Male	5	3	8
	Female	20	22	42
Total		25	25	50

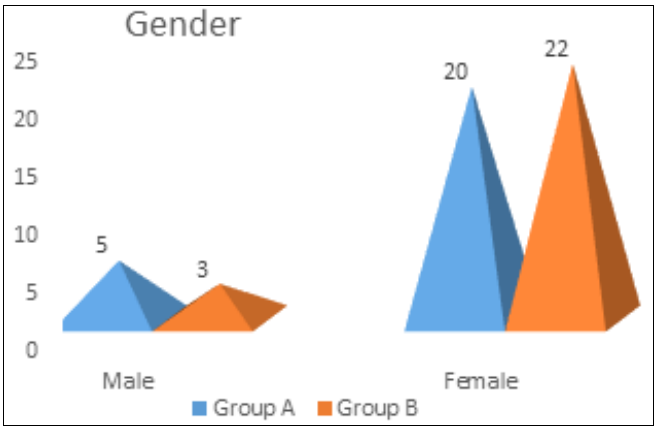

Fig 4: Gender

Independent sample test

Table 3: Comparison of Groups with mean age by independent t test

Variables	Groups	Mean	SD	T-Value	p-value
Age	Group A	21.12	1.64	0.959	0.343
	Group B	20.64	1.89		

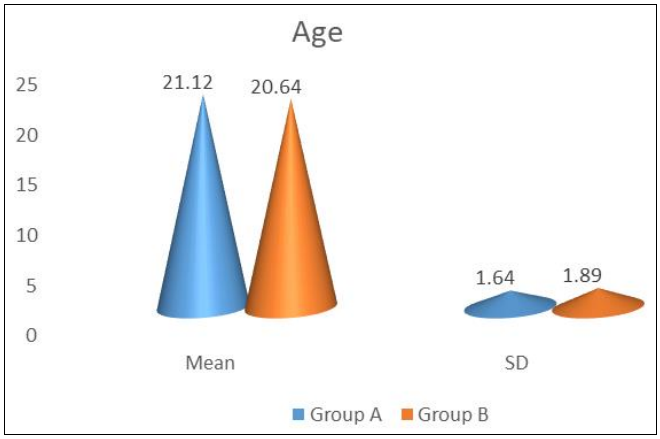

Fig 5: Age

Table 4: Comparison of Groups with mean BMI by independent t test

Variables	Groups	Mean	SD	T-Value	P-Value
BMI	Group A	21.72	4.22	1.215	0.230
	Group B	23.07	3.62		

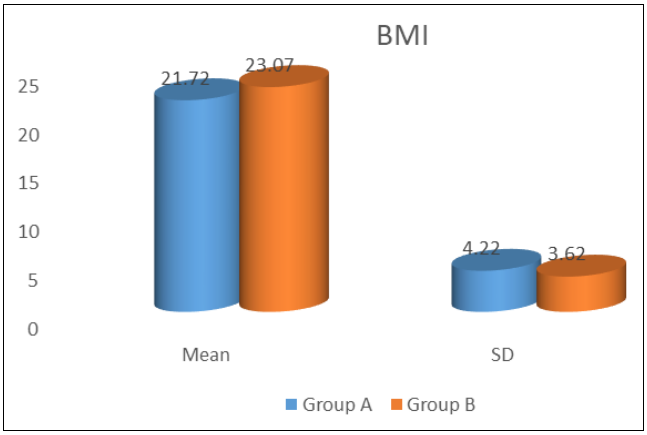

Fig 6: BMI (Body Mass Index)

Within group Pre and post test

Comparison of pre-test and post-test PKET Right scores in two Groups by paired sample t test.

Table 5: Show Groups, Times, Mean, SD, SD Deficient, Effect size, T-Value and P-Value

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	T-Value	P-Value
Group A	Pre-test	57.92	7.39	30.88	6.79	4.54	22.738	0.001*
	Post-test	88.80	2.29					
Group B	Pre-test	58.68	7.40	30.68	7.05	4.35	21.772	0.001*
	Post-test	89.36	2.08					

The PKET Right mean value in group A indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 4.54 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

The PKET Right mean value in group B indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 4.35 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

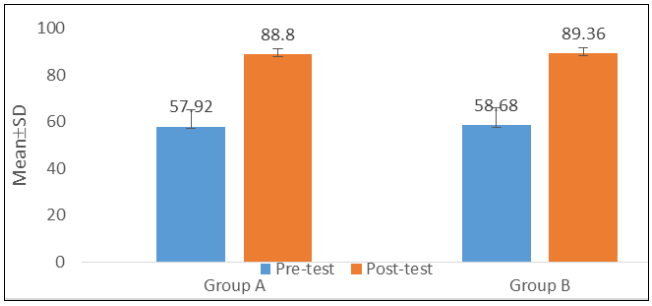

Fig 7: Comparison of pre-test and post-test PKET right scores in two groups

Table 6: Comparison of pre-test and post-test PKET Left scores in two Groups by paired sample t test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	T-Value	P-Value
Group A	Pre-test	59.68	9.86	29.00	9.35	3.10	15.509	0.001
	Post-test	88.68	2.70					
Group B	Pre-test	60.04	8.75	29.68	8.64	3.43	17.167	0.001
	Post-test	89.72	0.79					

The PKET left mean value in group A indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 3.10 value

which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

The PKET left mean value in group B indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 3.43 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

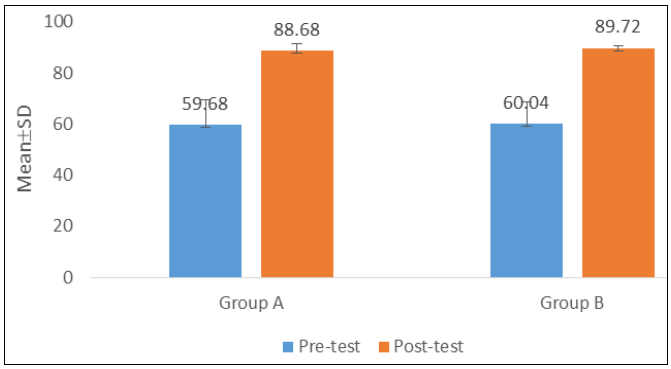

Fig 8: Comparison of pre-test and post-test PKET left scores in two groups

Table 7: Comparison of pre-test and post-test BSSRT Right scores in two Groups by paired sample t test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	T-Value	P-Value
Group A	Pre-test	17.00	4.74	14.36	3.72	3.86	19.312	0.001
	Post-test	31.36	6.05					
Group B	Pre-test	15.88	5.15	14.24	4.10	3.48	17.385	0.001
	Post-test	30.12	5.83					

The BSSRT Right mean value in group a indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the limited consistency with post treatment value which is more than pre value. The effect size or Cohen's D indicates 3.86 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

The BSSRT Right mean value in group B indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 3.48 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

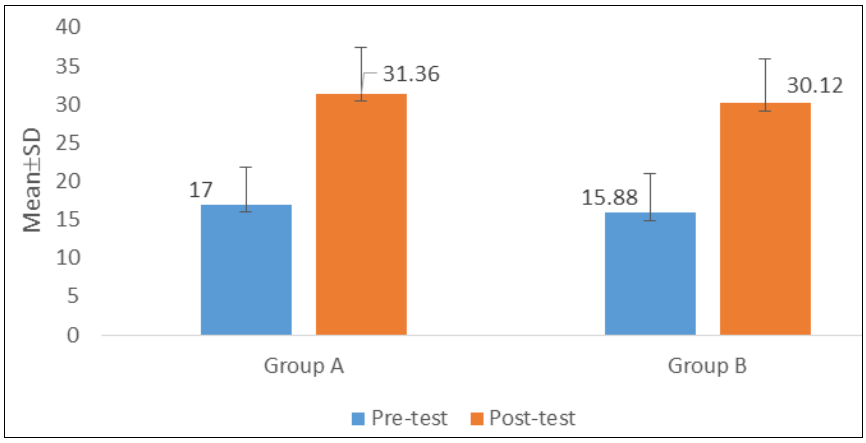

Fig 9: Comparison of pre-test and post-test BSSRT right scores in two groups

Table 8: Comparison of pre-test and post-test BSSRT Left scores in two Groups by paired sample t test

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	T-Value	P-Value
Group A	Pre-test	17.24	4.32	14.04	3.96	3.54	17.713	0.001
	Post-test	31.28	6.13					
Group B	Pre-test	16.08	5.38	14.04	4.55	3.09	15.427	0.001
	Post-test	30.12	6.13					

The BSSRT Left mean value in Group A indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the limited consistency with post treatment value which is more than pre value. The effect size or Cohen's D indicates 3.54 value which is assumed to be very high in effect size as per

the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

The BSSRT Left mean value in group B indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 3.09 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

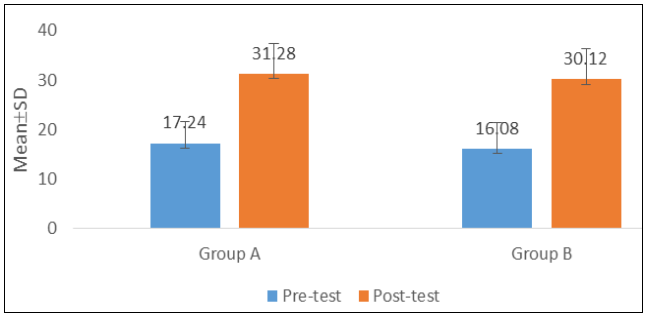

Fig 10: Comparison of pre-test and post-test BSSRT left scores in two groups

Table 9: Between groups independent test for Group Statistics using independent t test

Variable	Time	Group	Mean	SD	t-value	p-value
PKET Right	Pre	Group A	57.92	7.39	0.363	0.718
		Group B	58.68	7.40		
	Post	Group A	88.80	2.29	0.905	0.370
		Group B	89.36	2.08		
	Diff	Group A	30.88	6.79	0.102	0.919
		Group B	30.68	7.05		
PKET Left	Pre	Group A	59.68	9.86	0.137	0.892
		Group B	60.04	8.75		
	Post	Group A	88.68	2.70	1.846	0.071
		Group B	89.72	0.79		
	Diff	Group A	29.00	9.35	0.267	0.791
		Group B	29.68	8.64		
BSSRT Right	Pre	Group A	17.00	4.74	0.800	0.428
		Group B	15.88	5.15		
	Post	Group A	31.36	6.05	0.738	0.464
		Group B	30.12	5.83		
	Diff	Group A	14.36	3.72	0.108	0.914
		Group B	14.24	4.10		
BSSRT Left	Pre	Group A	17.24	4.32	0.841	0.405
		Group B	16.08	5.38		
	Post	Group A	31.28	6.13	0.669	0.506
		Group B	30.12	6.13		
	Diff	Group A	14.04	3.96	0.001	0.999
		Group B	14.04	4.55		

From the above table it is observed that between groups analysis is non-significant for all variable across all time frames at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups.

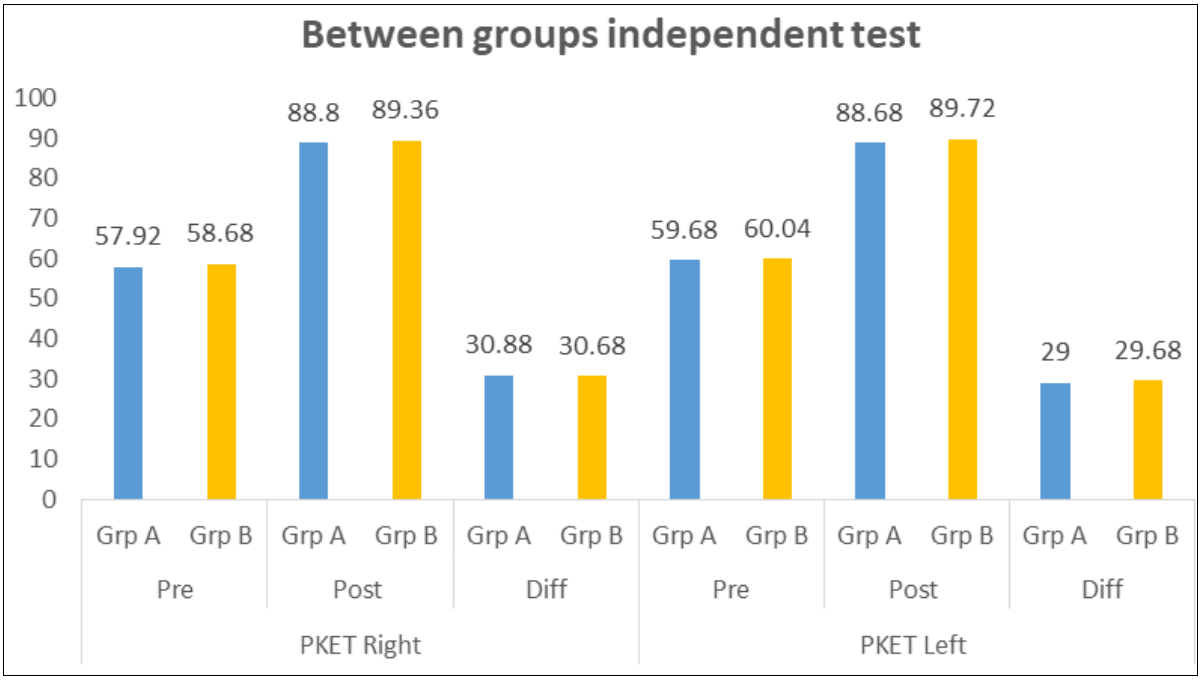

Fig 11: Between group's independent test

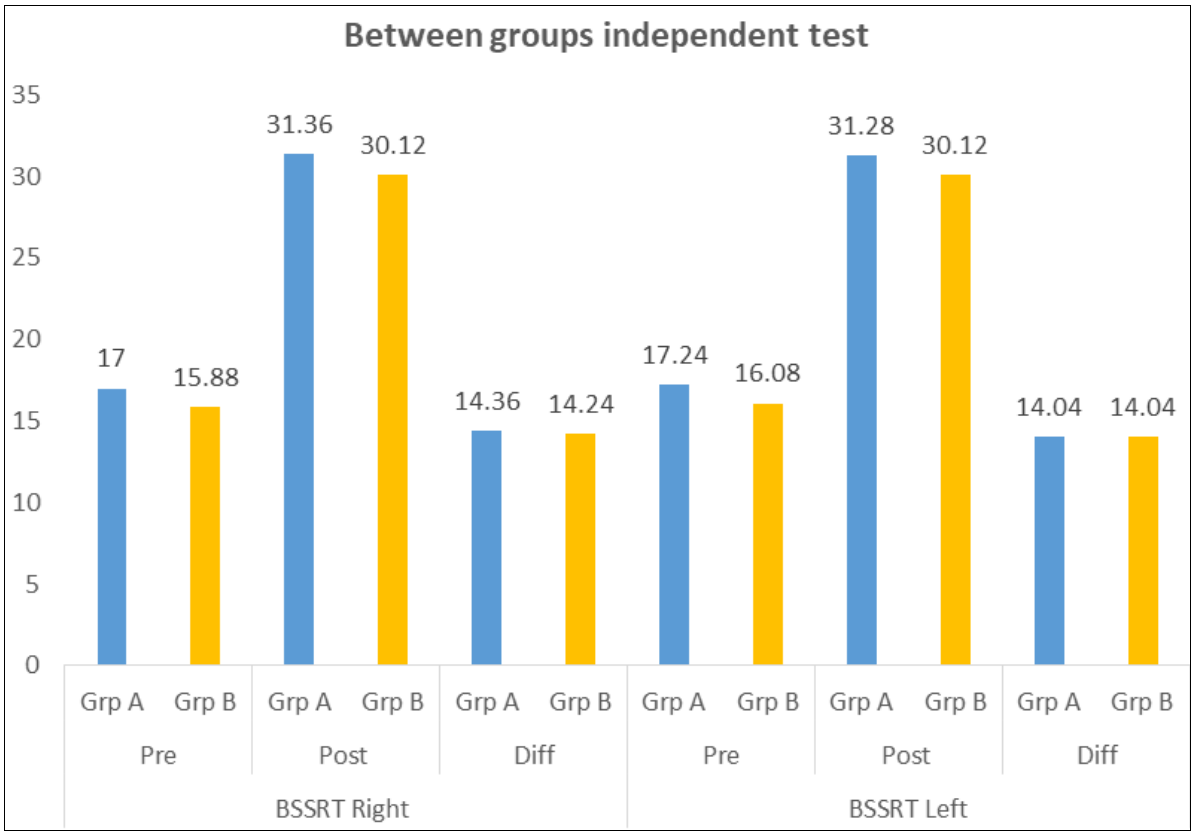

Fig 12: Between group's independent test

4. Discussion

The purpose of this study was to compare the effectiveness of suboccipital muscle inhibition technique versus PNF stretching (contract relax method) on hamstring flexibility in college going students.

In this study 50 subjects (25 in each group) were participated. Out of total participants an age group of 18-25 years and were selected according to inclusion criteria and subjects were randomly divided into 2 groups. Group A consist of 20 female and 5 male. Group B consist of 22 male and 3 male. Mean age in Group A and Group B was 21.12 and 20.64 years respectively. Mean BMI in Group A and Group B was 21.72 and 23.07 respectively. Pre intervention measurements Passive knee extension test and back saver sit and reach test score were taken on first day.

Subjects of group A were treated with suboccipital muscle inhibition technique; Group B were treated with PNF stretching (contract relax method). In the results a marked improvement in Passive knee extension test and back saver sit and reach test on both right and left side is seen, after the treatment of 6th session.

Bhagyashri K Koli studied prevalence of hamstring tightness in in college going students and concluded that prevalence of hamstring tightness is very high in the college going students and awareness of stretching techniques are very necessary to prevent complication among them.[1] Reetika Yadav, Ruchi Basista concluded that an increase in hours of prolonged sitting may cause hamstring tightness. They found significant correlation between hours and lumbar spine posture (lordosis). Long sitting hours or prolonged sitting of the collegiate students change the curvature of the lumbar spine that leads to a decrease in lumbar lordosis (flat back). [13] According to this previous studies the college going students were recruited, because hamstring tightness is very high among them due there sedentary lifestyle and prolonged sitting

The First objective of study was to study effect of suboccipital muscle inhibition technique on hamstring flexibility in college going students. In this study statistically significant improvement in flexibility of hamstring was seen in Group A after post intervention assessment. The possible mechanism is suboccipital muscle and hamstring connected through myofascial linkage called as superficial back line which connect entire posterior surface of body. So when the tension in the suboccipital muscle decreases which result in reduction in tightness of hamstring muscle.[4][6] Henry Pollard stated that manual therapy of neck may play role in treatment of extra-spinal lower limb musculoskeletal condition.[19] Hingaragia Dharti compare Effectiveness of suboccipital muscle inhibition technique with static stretching and static stretching alone on hamstring flexibility and agility and concluded that suboccipital muscle inhibition technique along with static stretching can be practiced to improve hamstring flexibility and agility in young adult. Hamstring tightness will occur from any myofascial chain stresses that may exist in superficial back line. Addressing any of the structure in superficial back line which include hamstring and subocciopital muscle may have favourable impact on entire line [2] this is due to myofascial chain connection and dural mechanism. [18] Rooju Vanchani et.al. Stated that suboccipital muscle inhibition technique and MET both technique are effective in improving hamstring flexibility. But muscle energy technique has more effect in improving hamstring flexibility. [4] Pramod Jagtap and Shubhangi manadale studied effect of suboccipital muscle inhibition technique on hamstring flexibility concluded of suboccipital muscle inhibition was effective in improving hamstring tightness. [6]

The second objective of study was to study effect of PNF stretching on hamstring flexibility in college going students. In current study the flexibility of hamstring muscle is increases in Group B. This is due to PNF is primarily a muscle mobilization technique that employs muscle

facilitation and inhibition. PNF is based on the occurrence of the inverse stretch reflex. The Golgi tendon organ manifests this reflex, which demonstrates autogenic inhibition of a muscle. GTOs are found in the tendon of a muscle near its tendinous insertion. Their function is to monitor muscle tension and stimulation of GTO cause relaxation of the muscle associated with it.[18]When the muscle is in isometric contraction in their lengthened range, a high amount of tension is produced which can result in activation of GTO, which cause relaxation of muscle. Previous studies shows that PNF to be related with greater electromyography activity in the muscle being stretched when compared to static stretch. (Kumar P, Maitra M) [21]. Dr Sumer Shah et al. conducted study on comparing the effect of static, ballistic and contract relax stretching on hamstring flexibility in young individual Concluded that contract relax method is more effective in improving hamstring flexibility in young individual.[8] Nagarwal AK, et al. conducted A comparison between two PNF techniques on hamstring flexibility, concluded that PNF hold relax and PNF contract relax antagonist contract relax method are equally effective in in improving hamstring flexibility.[3] Karthikeyan Rajendra et.al Conducted study on static stretching VS hold relax technique on sustainability of hamstring flexibility in sedentary living college going student and concluded that static stretching and hold relax stretching are equally effective in improving flexibility of hamstring.[7]

The third objective of this study was to compare effect of suboccipital muscle inhibition technique and PNF stretching on hamstring flexibility in college going students. In this study both technique groups showed statistically significant improvement in flexibility but pre-test and post-test when compared between both groups was found to be non – significant which support the null hypothesis. The present study showed that the suboccipital muscle inhibition and PNF stretching (contract relax method) are equally effective in improving hamstring flexibility in college going student.

In this study both techniques are almost statistically equally effective in improving hamstring flexibility in college going students. But advantages of suboccipital muscle inhibition is more comfortable i.e. less painful to patient, less energy consuming and less time consuming as compared to PNF stretching.

5. Conclusion

The present study concludes that suboccipital muscle inhibition technique and PNF stretching both are equally effective in improving hamstring flexibility in college going students.

6. Appendix

Ethical clearance letter

Consent form

7. Acknowledgement

I take this wonderful opportunity to thank all the “Hands” which have joined together to make this project a Success.

It’s my great pleasure and privilege to express my deep-felt gratitude to our respected Principal Dr. Aakanksha JOSHI and Guide Dr. Chintan Solanki who immensely helped me and rendered their advice, precious time, constant encouragement, knowledge and relevant information regarding my study, and whose suggestion and guidance has enlightened me on this subject. I express my sincere thanks to all the teaching & nonteaching staff of the Miraj Medical Centre, College of Physiotherapy. I would also thank the medical students for willingly accepting to be part of this project and sparing their precious time for it. I would like to thank my parents for their blessings, love, constant support, affection and encouragement.

Praise and Glory to the God Almighty who is the source of strength, foundation of my knowledge and the source of inspiration in every walk of life.

8. References

1. Koli BK, Anap DB. Prevalence and severity of hamstring tightness among college student: A cross sectional study. International Journal of Clinical and Biomedical Research. 2018 Apr, 15:65-8.
2. Hingarajia Dharti, Effectiveness of suboccipital muscle inhibition technique on hamstring flexibility and agility – An experimental study. Intrenational Journal of Creative Research Thoughts. 2022.
3. Nagarwal AK, Zutshi K, Ram CS, Zafar R, Hamdard J. Improvement of hamstring flexibility: A comparison between two PNF stretching techniques. International Journal of Sports Science and Engineering. 2010;4(1):25-33.
4. Rooju Vacchani, Himashi Sharma. Effectivenes of suboccipital muscle inhibition technique versus muscle energy technique on hamstring flexibility in college going students. International Journals of Research and Review. 2021
5. Yadav H, Lehri A, Scholar P. Effect of proprioceptive neuromuscular facilitation on flexibility in males with hamstring tightness. International Journal of Health Sciences & Research (Www. Ijhsr. Org). 2019;9(5):191.
6. Jagtap PK, Mandale SD. The effect of suboccipital muscle inhibition technique on hamstring tightness patients. Journal of Evolution of Medical and Dental Sciences. 2015 Apr, 23;4(33):5682-90.
7. Rajendran K, Thiruvevenkadam IA, Nedunchezhiyan A. Static stretching vs hold relax (PNF) on sustainability of hamstring flexibility in sedentary living college students. Int J Physiother Res. 2016;4(2):1436-43.
8. Shaha S, Sharath UR. Comparing the effect of static, ballistic and contract-relax stretching on hamstring muscles flexibility in young individuals.
9. Yildirim MŞ, Filiz TU, Kabayel DD, Necdet SÜ. The cut-off values for the diagnosis of hamstring shortness and related factors. Balkan medical Journal. 2018 Sep 1;35(5):388-93.
10. Cayco CS, Labro AV, Gorgon EJ. Hold-relax and contract-relax stretching for hamstrings flexibility: A systematic review with meta-analysis. Physical Therapy in Sport. 2019 Jan 1;35:42-55.
11. Reurink G, Goudswaard GJ, Oomen HG, Moen MH, Tol JL, Verhaar JA, et al. Reliability of the active and passive knee extension test in acute hamstring injuries. The American Journal of Sports Medicine. 2013 Aug;41(8):1757-61.
12. Kwon SH, Chung EJ, Lee J, Kim SW, Lee BH. The Effect of Hamstring Relaxation Program on Headache, Pressure Pain Threshold, and Range of Motion in Patients with Tension Headache: A Randomized Controlled Trial. International Journal of Environmental Research and Public Health. 2021 Sep, 27;18(19):10137.
13. Yadav R, Basista R. Effect of Prolonged Sitting on Hamstring Muscle Flexibility and Lumbar Lordosis in Collegiate Student. Int. J Health Res. 2020;10:280-9.
14. Chaitow Leon. Muscle Energy Techniques, Third

Edition. Churchill Livingstone, Edinburg. An introduction to muscle energy techniques. 2006.
15. Sung- Hak Cho, PhD, PT, Soo- Han Kim, PhD, PT, Du-Jin Park, and PhD. The Comparison of the immediate effects of application of the suboccipital muscle inhibition and self myofascial release techniques in the suboccipital region on short hamstring. Journal of Physical Therapy Science; c2015.
16. Sieun Park, Wootaek Lim. Effects of proprioceptive neuromuscular facilitation stretching at low-intensities with standing toe touch on developing and maintaining hamstring flexibility. Journal of Bodywork and Movement Therapies; c2020.
17. Patterson P, Wiksten DL, Ray L, Flanders C, Sanphy D. The validity and reliability of the back saver sit-and-reach test in middle school girls and boys. Research Quarterly for exercise And Sport. 1996 Dec, 1;67(4):448-51.
18. Hack G, et al. Anatomical connection between rectus capitis posterior minor muscle and dura mater. Spine. 1994;19:2421-4.
19. Pollard H, Ward G. A study of two stretching techniques for improving hip flexion range of motion. Journal of manipulative and physiological therapeutics. 1997 Sep, 1;20(7):443-7.
20. Jennie Glibert Hartman, Marilyn Looney. None referenced and criterion - referenced validity and reliability of back saver sit and reach test. Measurement in Physical Education and Exercise Science; c2003.
21. Kumar P, Moitra M. Efficacy of muscle energy technique and PNF stretching compared to conventional physiotherapy in program of hamstring flexibility in chronic nonspecific low back pain. Indian J Physiother Occup Ther: An Int. J. 2015 Jul;9(3):103.