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Effect of 4 Weeks Suboccipital Muscle Inhibition Technique on Hamstring Tightness in Male Recreational Basketball Players - A Clinical Trial

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Abstract

Hamstring muscle injuries are common injuries in all the athletes especially those who are involved in high speed running and kicking and are cause of muscular tightness .Hamstring tightness leads to hamstring injuries and hamstring injuries are the most common type of injury among athletes.

This study was intended to know the long term effect of suboccipital muscle inhibition technique on hamstring tightness in recreational male Basketball players .

Objective: To evaluate the effect of 4 weeks suboccipital muscle inhibition technique on hamstring tightness in recreational male basketball players.

Methods: 49 subjects with hamstring tightness were included in the study. All the subjects were given . Sub occipital muscle technique (thrice a week) for four weeks (12 sessions) .Outcome measures used were (PAT) Popliteal Angle measurement and Sit and Reach test. The baseline values were assessed on pre- intervention and immediately after one week followed by post intervention after fourth week.

Results: The data was statistically analysed using Kolmogrov Smirnov test and WIlcoxon matched paired test. All the scores did not follow a normal distribution. Therefore, Wilcoxon matched pair test was applied. Pre and post mean difference values of right and left popliteal angle (PAT) scores were 31.35±4.33 to 37.18±4.72 and 31.10±4.39 to 37.04±4.90 respectively. Whereas, in Sit and Reach test the score was 15.23±2.74 to 11.59 ±2.59.It showed statistical significant difference ($p<0.05$) in both the outcome measures.

Conclusion: Present study concluded that the suboccipital muscle inhibition technique improved hamstring muscle flexibility as measured with PAT angle (active knee extension test) and Sit and Reach test in subjects with hamstring tightness.

Keywords: Hamstring tightness, Suboccipital inhibition technique, Popliteal angle test, Sit and reach test, Basket ba 1.

Introduction

Flexibility is a key component for injury prevention and rehabilitation. Flexibility has been traditionally considered

as an important component of human physical fitness 1..Good muscle flexibility allows muscle tissue to accustom more stress and strain which would help in reducing injuries and may enhance performance. Flexibility is derived from the Latin term 'flexibilis' which means to bend 2 and has been technically defined as the ability of a muscle to lengthen , allowing one joint or more to move through a range of motion (ROM), and is considered to be as an essential component of normal biomechanical functioning. If the resting length of a muscle is altered, the capacity of a muscle to develop maximum tension is also affected 3,4. A more acceptable definition of flexibility is "the intrinsic property of the body tissues, which determines the ROM attainable without injury at a joint or a group of joint .Limited flexibility has been shown to predispose a person to several musculoskeletal overuse injuries and ultimately affects a person's level of function 5 .The hamstrings are the muscle group that tends to get shorten. The hamstrings are the dynamic stabilizers at the knee. The intrinsic predisposing factor of hamstring injury is the lack of flexibility. The majority of the hamstring muscle injuries occur in the biceps femoris muscle, mainly at the musculo-tendinous junction. The hamstrings cross over the two joints when tight muscle fails to pass through full physiological amplitude in the influence of rapid tensed situations and hence leads to hamstring injuries6.Lack of flexibility may cause severe hamstring injuries like strains which are caused by rapid contraction of the muscle during a ballistic action or a violent stretch 7.The flexibility of the hamstring muscle should be sufficient to the extent because the tightness of the hamstring can ultimately lead to various problems like patellofemoral pain syndrome which is a commonly found injury in the athletes and abnormal pelvic tilting.. Hamstring tightness increases the patellofemoral compressive force because of the increase passive resistance during the swing phase of the ambulation and running 8.Hamstring muscle injuries are common injuries in all the athletes especially those who are involved in high speed running and kicking and are cause of muscular tightness. Another common risk factor associated with the hamstring injuries is the hamstring weakness. It is suggested that the too little muscle strength in the hamstring can produce sufficient force and counter the productive force from the quadriceps in multiple movements. Muscular tightness is frequently postulated as an intrinsic risk factor for the development of a muscle injury. Inability to achieve greater than 160° of knee extension with hip at 90° of flexion is considered to be as hamstring tightness. Hamstring tightness causes posterior pelvic tilt and decreases the lumbar lordosis as they are attached to the ischial tuberosity. Hamstring tightness leads to hamstring injuries and hamstring injuries are the most common type of injury among athletes 9. Hamstring stretches are routinely used as part of a pre-exercise routine, usually after anaerobic warm-up 10.A study stated that a "lack of hamstring flexibility" was the single most important characteristics of hamstring injuries in athletes 11.Maintaining the flexibility of hamstring muscle is important for general and athletic population and of utmost importance for health care professionals, to achieve this goal one needs to know the most effective and efficient technique to gain hamstring flexibility 12.The suboccipital muscles acts significantly in postural control which in turn affect the results of tests involving the straight leg raise test (SLR test). There are some fascial connections between sub occipital muscles with dura mater and C2 vertebra. The continuity of the neural system links the dura mater inserted into the suboccipital muscles and the hamstring muscle .As there is fascial continuity, fascial restriction of one part of the body causes stress in another parts of the body. 13ll players.

The connection between the suboccipital muscles and the hamstrings is via posterior superficial back line. SBL is a continuity of the fascial fabric from the sole of the foot to the forehead. Therefore, the SBL contains the suboccipital muscles, the hamstrings, short toe flexors (lumbricals,flexor digitorumbrevis flexor accessories) sacrotuberous ligament , erector spinae and epicranial fascia are included in the superficial back line 14.2. Materials and methodology :-Under convenient sampling , 49 subjects were recruited from Belagavi Basketball club. All subjects read and signed an informed consent form approved by the Institutional review of the university.Inclusion criteria included male gender between 18 years to 25 years. Subjects involved in recreational basketball game with hamstring tightness and subjects were willing to participate. Exclusion Criteria were history of lower limb injury/fracture or surgery, subjects with neurological impairement , Inflammatory condition that could affect the joint range of motion, Subjects using medications that could affect the measurements (eg. Muscle relaxants) and cervical ligament instability.2.1Outcome measures:-Popliteal angle measurement (Active knee extension test) and Sit and reach test.2.2 Intervention:Suboccipital Muscle Inhibition Technique (SMI):-With the patient supine, the therapist position was at the head of the table and palms of hands were placed under the subject's head, pads of therapist's fingers on the projection of the posterior arch of the atlas which is palpated between the external occipital protuberance and spinous process of axis vertebra. The therapist locates with the middle and ring fingers of both hands the space between the occipital condyles and the spinal process of the second cervical vertebra. Then, with the metacarpophalangeal joints in 90º flexion, therapist rested the base of the skull on hands. Pressure was exerted upward and toward the therapist. The pressure was maintained for 2 minutes until tissue relaxation was being achieved. During the SMI technique, to prevent the sub-occipital muscle tone the subject was asked to keep his eyes closed to avoid eye movements. The treatment was continued for 12 alternative days and before the intervention and at the end of 1st and 12th session post treatment assessment was done with Popliteal angle (active knee extension) test and sit and reach test 15.Statistical analysis:The statistical analysis was done using the normality test i.e. Kolmogrov smirnov test. It was found non- normality in all the variables. Therefore , the data were analyzed by using non-parametric test (Wilcoxon matched pairs test) for comparison of different time points with SPSS 20 statistical software and the level of significance was set up at <0.001.3.Results :Present study aimed to find out the long term effect of SOMIT on the hamstring tightness in recreational basketball players.49 recreational basketball players were included in the study after screening for inclusion and exclusion criteria.The outcome measures used were namely Popliteal angle measurement (active knee extension) and Sit and reach test.The base line values for all 49 subjects were recorded initially. Also after the application of SOMIT values on 1st session and at the end 12th session using the outcome measures were done. Pre-post values were analysed. It was seen that all the variables of pre-test and post-test scores did not followed a normal distribution. Hence, non-parametric Wilcoxon matched pairs test were applied between time points .The total numbers of subjects recruited in study based on inclusion criteria were 49.The present study included all the male gender. Age of the all subjects in the study as per the inclusion criteria was between 18 to 25 years with a mean age of (20.61). The mean weight score of the mean weight of the subjects was 65.33±9.63.The mean BMI score of the mean BMI of the subjects is 23.27 kg/m2. Which were found to be healthy normal. So, majority of the subjects

were not obese. The mean height (cms) score of the mean height of the subjects was 168.45 cms . So, Average height of the study subject suggested that nobody was of short stature.Mean Right Popliteal Angle scores at baseline was 31.35±4.33at the end of 1st session was 34.10±4.50 and at 4th week it was37.18±4.72.Mean change from pre-intervention to 4th week was -5.84± 2.29.There was -18.62% change from pre-intervention to 4thweek post-intervention which was significant (p=0.0001) when analyzed byWilcoxon matched pairs test.Mean Left Popliteal Angle scores at baseline was 31.10±4.39,at the end of 1st session was 33.84±4.47 and at 4th week it was 37.04 ±4.90. Mean change from pre-intervention to 4th week was -5.94± 2.22.There was -19.09% change from pre-intervention to 4th week post-intervention which was significant (p=0.0001) when analyzed by Wilcoxon matched pairs test.Mean Sit and Reach test scores at baseline was 15.23±2.74,at the end of 1st session was 13.36±2.69 and at 4th week it was 11.59±2.59. Mean change from pre-intervention to 4th week was 3.64±1.18. There was 23.92% change from pre-intervention to 4th week post-intervention which was significant (p=0.0001) when analyzed by Wilcoxon matched pairs test.Hence the results of the present study states that the application of SOMIT does optimize the flexibility of the tight hamstring muscles4.Discussion :-In the present study 65 male subjects with hamstring tightness were screened out of which 49 individuals with mean age of 20.61 ± 2.19 were selected.Gender is the major component which plays an important role in flexibility of the hamstring muscle thereby enhancing the athletes performance. A study showed that the prevalence of the hamstring tightness was found in higher rates among male athletes who were engaged in contact sports 16. Similar trend was seen in the present study where only male subjects were recruited for the study.This study was conducted to evaluate the long term effect of the suboccipital muscle inhibition technique in the subjects with hamstring tightness..In the present study, there was a significant increase in the Popliteal angle measurement (active knee extension) and sit and reach test was found to be effective after the intervention which in turn proved improvement in the flexibility of the hamstring muscles.A comparative study of dynamic soft tissue mobilization v/s passive stretching technique was conducted to improve the flexibility of the hamstrings in cricket players using PAT as an outcome measure. There was an increase in the PAT. This study supports the present study where PAT was used as gold standard and a significant change was found 17.Present study suggested that majority of the subjects were not obese or overweight. All were leanly built which is an essential component in sport performance. Average height of the study subjects suggested that nobody was of short stature. As for optimal performance in basketball, height plays an important role.This study coincides with the research results of Apracio et al and supports his empirical hypothesis 18.Another hypothesis that could increase the flexibility of the hamstring muscles may be due to the relaxation of the suboccipital muscle covered by superficial back line 19.In basketball subjects of either hamstring or quadriceps will impair performance .Hence, it is necessary that athlete is fit enough or injury free to achieve optimal performance.In present study during the suboccipital muscle inhibition technique there is a pull/traction maintained with the help of the middle and ring finger during the entire procedure to feel the tension of the soft tissue and remove the muscle resistance by continuously straining and relaxing , which is ultimately compared to peeling on' Onion'.It was also reported that the suboccipital muscles are the 'Proprioceptors monitors' that contribute significantly to the regulation of head posture and they have the most number of muscle spindles in the human body 20Although, for the evaluation of the elasticity of the hamstrings, other authors have used the

Popliteal Angle Test, using the techniques like stretching of the hamstring muscles or contraction-relaxation techniques 21, the results revealed statistically significant increase in the popliteal angle measurement.Similar results were seen in the present study where the Popliteal angle measurement showed statistically significant.A study reported that the Rectus Capitis Posterior Minor muscle, which has 36 muscle spindles per /gram is known to greatly contribute in the regulation of posture and the extent of tension 22A study was done using proprioceptive neuromuscular facilitation technique on suboccipital muscles and on hamstring muscles to measure the elasticity with the SLR test as an outcome measure. Our findings after application of the suboccipital inhibition technique revealed an increase in the extensibility similar to that by Scleip23.A study investigated shedding light on the sub occipital muscles. The superficial backline (SBL) begins from the sole of the foot and continues on the top of the skull with the epicranial fascia .Scleip considers if the tone of the suboccipital muscle is inhibited (actively or passively with a fascial treatment) the length of the hamstrings will be increased. Present study involved inhibition of the tone of sub occipital muscles which in turn improved the flexibility of the hamstrings 24.A study proposed a ‘sensory theory’ which supports the fact that such a distant technique (suboccipital region) can have an immediate effect on the flexibility and the pressure pain threshold of the hamstrings 25.In the present study long term effect was analysed and the result coincided with the short term effect of the SOMIT on hamstrings flexibility.A pilot study was conducted to assess the effect of SOMIT on the patients with whiplash and showed improvement in the amplitude of the elbow joint to the neurodynamic test of the median nerve but did not affect neck pain or grip strength. Further he explained that at suboccipital level the fascial intervention seems to cause disturbance of the gamma loop that perpetuates the trapezius hyperactivity through the influence that the technique exerts on the posterior elongated hole and, thus, on the spinal nerve (cranial nerve XI). Moreover, relaxation of the dural system resulting from the suboccipital inhibition provides a greater path of the elbow during the ULTT-126.A study reported that the application of an atlanto-occipital thrust manipulation or SOMIT targeted to the suboccipital muscles led to an immediate increase in pressure pain thresholds over latent TrPs in the masseter and temporalis muscles and an increase in maximum active mouth opening 27.Nevertheless, another study showed that the SOMIT followed by cranio-cervical flexion exercise proved effective in improving forward head posture and induce downstream effect from the neck to the trunk and shoulders in subjects with forward head posture 28.A report that the fascial system forms a set of compartments that envelop, separate and support the muscles, bones, viscera, blood vessels and nervous system, and can be compared to a system of tubes concentrically placed inside one another29.These findings supports the present study where after the application of SOMIT showed the distant effect on the tightness of the hamstring muscles.A study was done for estimating the hamstring flexibility on recreationally active young adults . It proved that reproducibility and criteria related validity of the sit and reach test has coefficient of variation (CV) 8.74% and intra-class correlation coefficient (ICC) 0.92. 30.A study was done to know the reliability and validity of active knee extension test / Popliteal angle test . The test was found as the gold standard test for the measurement of hamstring flexibility with intra-tester reliability (ICC) of 0.94 31.In accordance to this study, present study utilized the PAT test.Hence, the above mentioned studies showed that PAT and Sit and Reach test was reliable and valid to measure the tightness of the hamstring muscle which was used in the present study.

Table: 1 Age, Height, Weight and BMI Distribution

Variables	Min	Max	Mean ± SD
Age (in yrs)	18.00	25.00	20.61 ± 2.19
Height (cm)	148.00	201.00	168.45 ± 11.45
Weight (kg)	42.00	90.00	65.33 ± 9.63
BMI(kg/m^2)	17.00	29.04	23.27 ± 2.70

Table 2: Comparison of pretest, posttest 1st session and posttest 12th session right Popliteal angle scores by Wilcoxon matched pairs test.

Time points	Mean ±SD	Mean Diff.	SD Diff.	% of change	Z-value	p-value
Pretest	31.35±4.33					
Posttest 1st session	34.10±4.50	-2.76	1.35	-8.79	5.9078	**0.0001***
Pretest	31.35±4.33					
Posttest 12th session	37.18±4.72	-5.84	2.29	-18.62	6.0927	**0.0001***
Posttest 1st session	34.10±4.50					
Posttest 12th session	37.18±4.72	-3.08	2.24	-9.04	5.9048	**0.0001***

*p<0.05

Table 3: Comparison of pretest, posttest 1st session and posttest 12th session left Popliteal angle scores by Wilcoxon matched pairs test

Time points	Mean ± SD	Mean Diff.	SD Diff.	% of change	Z-value	p-value
Pretest	31.10±4.39					
Posttest 1st session	33.84±4.47	-2.73	1.82	-8.79	5.9052	**0.0001***
Pretest	31.10± 4.39					
Posttest 12th session	37.04±4.90	-5.94	2.22	-19.09	6.0928	**0.0001***
Posttest 1st session	33.84± 4.47					
Posttest 12th session	37.04± 4.90	-3.20	2.25	-9.47	6.0927	**0.0001***

*p<0.05

Table 4:Comparison of pretest, posttest 1st session and posttest 12th session Sit and reach test scores by Wilcoxon matched pairs test

Time points	Mean ± SD	Mean Diff.	SD Diff.	% of change	Z-value	p-value
Pretest	15.23±2 .74					
Posttest 1st session	13.36±2.69	1.88	0.83	12.32	5.9052	**0.0001***
Pretest	15.23± 2.74					
Posttest 12th session	11.59±2.59	3.64	1.18	23.92	6.0926	**0.0001***
Posttest 1st session	13.36± 2.69					
Posttest 12th session	11.59±2 .59	1.77	1.15	13.23	6.0927	**0.0001***

*p<0.05

Figure1: Comparison of pretest, post-test 1st session and post-test 12th session right popliteal angle score

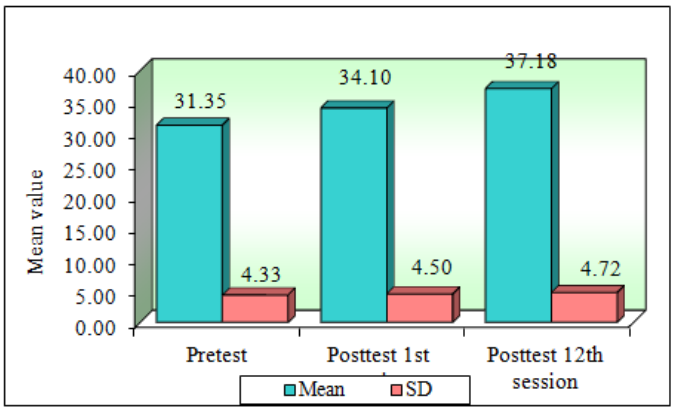


Figure 2:: Comparison of pretest,post-test 1st session and post-test 12thsession left poplitealangle score

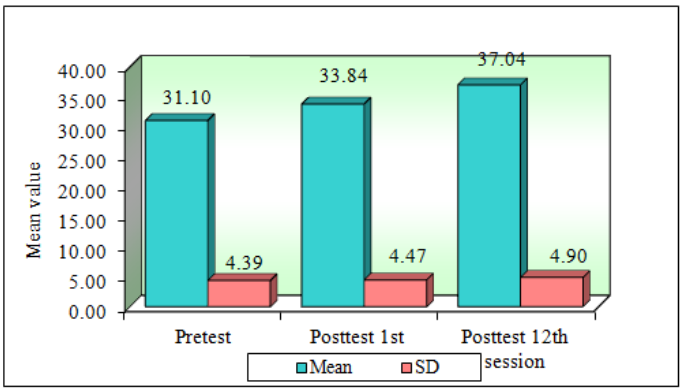
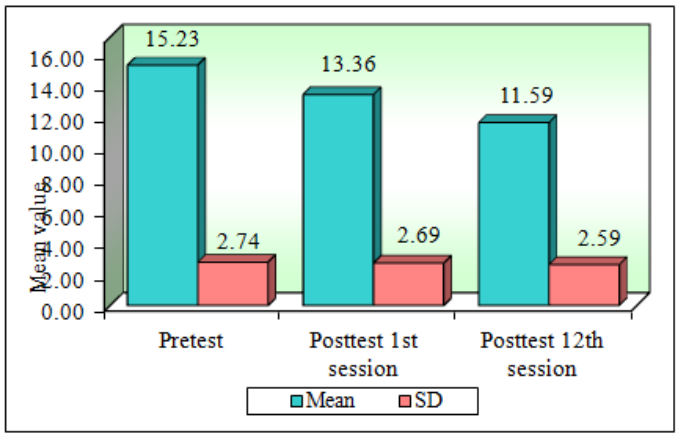


Figure 3: Comparison of pretest, posttest 1st session and posttest 12th session Sit and reach test scores :-



Conclusion

Present study concluded that the suboccipital muscle inhibition technique improved the hamstring muscle flexibility as measured with Popliteal angle (active knee extension test) and Sit and Reach test in subjects with hamstring tightness which is simple, easy to adopt and

reliable test to assess the extensibility of the hamstrings and enhance the performance of the basketball players.

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