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IMMEDIATE EFFECT OF STATIC STRETCH WITH KINESIO TAPING VS MUSCLE ENERGY TECHNIQUE WITH KINESIO TAPING ON HAMSTRING FLEXIBILITY IN ATHLETE

- A COMPARATIVE STUDY

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Abstract:

Background : Hamstring tightness—where one cannot completely extend the knee while the hip is flexed is prevalent in 40.17% of young college students. Flexibility for this muscle can be improved using two primary methods: Static stretching is the most common technique that directly lengthens the muscle, while the Muscle Energy Technique (MET) uses the muscle's own energy through gentle isometric contractions to achieve relaxation and subsequent lengthening via the mechanism of autogenic or reciprocal inhibition.

Aim : To compare the immediate effect of static stretching with Kinesio taping vs muscle energy technique with Kinesio taping on hamstring flexibility in athletes.

Methodology : Participatnts were briefed about the nature of the study and the intervention. Their informed written consent were taken. 116 participants were selected based on criteria. Pre and post treatment outcome measures, passive knee extension test and NPRS were measured. Participants were randomly divided into two groups with n=58 in each group. Group A is Static stretching with KT and Group B is MET with KT.

Result : Result proves that both the groups were clinically significant but MET with KT was the better effect than static stretching with KT.

Conclusion : MET with KT and static stretching with KT were significant in terms of clinical outcome ,hence the study concluded that the Static stretching with KT as well as MET with KT are effective , but the higher the Effect size better is the clinical improvement post treatment. It is simple and easy to apply on hamstring tightness subjects.so it can be implemented clinically as well.

Key Words : hamstring tightness, muscle energy technique, static stretching, kinesio taping,

I. INTRODUCTION

Flexibility is the ability to perform movements in the joints of the body with an appropriate range of motion, which is important for performing any kind of movement.(1) In addition to increasing the risk of ailments like low back pain, plantar fasciitis, muscular imbalances, tightness, and increased susceptibility to injuries, decreased flexibility can also lead to inefficiencies at work and negatively impact an individual's static and dynamic balance.(1) It has been demonstrated that issues including muscular imbalances, injuries, patellar tendinopathy, patelofemoral pain, and low back pain are associated with inadequate hamstring flexibility.(2) Static and ballistic stretching, proprioceptive neuromuscular facilitation (PNF), Kinesio tape (KT) applications, muscle energy techniques, foam rollers, and instrument-assisted soft tissue mobilizations are some of the

techniques used to release hamstring tightness and improve athletic performance and range of motion (ROM) in different training regimens.[2] Muscle flexibility aids in maintaining equilibrium when engaging in daily activities including sitting, running, bending, and walking.[1]

All athletes, but particularly those who engage in sprinting, jumping, and kicking, frequently have hamstring problems. Usually, high-speed activities or sprinting are the cause of injuries. Other sports including dance, ice skating, weightlifting, and water skiing can also result in avulsion fractures of the ischial tuberosity. During intense exercises, the majority of hamstring injuries happen suddenly when the athlete feels discomfort in the back of the leg. This generally happens when you're sprinting.[3] Athletes most commonly suffer from hamstring strains, which are caused by injuries to the semitendinosus, semimembranosus, and biceps femoris, three muscles that cover the posterior thigh.[4]

MUSCLE ENERGY TECHNIQUE :

In manual therapy, MET involves the patient actively contracting a particular muscle against a precise, clinician-controlled counterforce. The exercise is followed by passive stretching and rest.[1] This method is frequently used to promote circulation, strengthen and lengthen muscles, loosen up tense articulations, and decrease edema.[1] It has been shown that MET works better than static stretching to increase the flexibility of shortened muscles.[1] MET can be used to increase local circulation, strengthen weak musculature, mobilize joint limitations, relieve discomfort, stretch tight muscles and fascia, and reduce muscle tonus.[1] MET is a process that includes a patient's voluntary contraction of their muscle at different intensities in a precisely controlled direction.[1]

STATIC STRECHING :

Static stretching, a popular technique for stretching, involves elongating soft tissues just past their point of resistance and maintaining the extended posture for a while with a constant stretch force. For many years, static stretching has been thought to be a safer alternative to ballistic stretching and is widely acknowledged as an efficient way to improve flexibility.[5]The most common intervention to improve muscular flexibility and range of motion is static stretching, which is a technique predominantly employed to lengthen muscles.[1] Measurement of the hamstring muscle length is done with the ankle-knee extension test.[1]

KINESIO TAPING :

According to Kase, Kinesio taping is a structured wrapping method that uses Kinesio tape to avoid sports injuries and lessen discomfort, edema, and muscle spasms. It is a thin, elastic tape that, when stretched to 120–140% of its initial length, becomes extremely elastic and reduces mechanism restrictions in comparison to traditional tape. Taping is frequently used to help sportsmen avoid injuries.[6]The aim of this study was to evaluate the effects of various taping procedures on hamstring flexibility in relation to Kinesio taping (KT).[6] The biceps femoris was taped using two different techniques: the tape was applied without any stress, and the muscle was inhibited.[6]

PASSIVE KNEE EXTENSION :

The aim of the passive knee extension test (PKET) is to assessing the joints range and quality of movement specially its end-feels. Additionally the test can measure tightness of hamstring muscle. Measures of hamstring flexibility are clinically significant for both predicting the outcome of a hamstring injury and tracking recovery from one.[1]

MATERIALS AND METHODOLOGY :

For this comparative study 116 athletes were participates voluntary. The inclusive criteria were aged 18-30 years without any past hamstring injury atleast 2-3 years and the athletes with hamstring tightness. The exclusive criteria were past hamstring injury, skin allergy and sensitivity, any H/O nerve injury or PIVD and athletes above 30 years. The material used Pen, Paper, Consent form, Data collection sheet, Kinesio tape, Sanitizer, Universal goniometer, Gloves, Towel

OUTCOME MEASURE :

PASSIVE KNEE EXTENSION TEST
reliability [ICC: 0.97-0.98].

Position of patient is spine lying
Procedure : The patient is lying down with the hip of the leg being evaluated at a 90-degree angle.On the exam table, the opposing leg remains flat. With the patient's ipsilateral hip still in 90 degrees of flexion, the physician extends the knee until the hamstring muscle reaches the maximum allowable strain. After that, a goniometer is used to measure the knee angle.
Goniometer Placement : The fulcrum is placed on lateral epicondyle of femur. The moving arm pointed towards the lateral malleolus and the stationary arm is pointed toward to the greater trochanter.

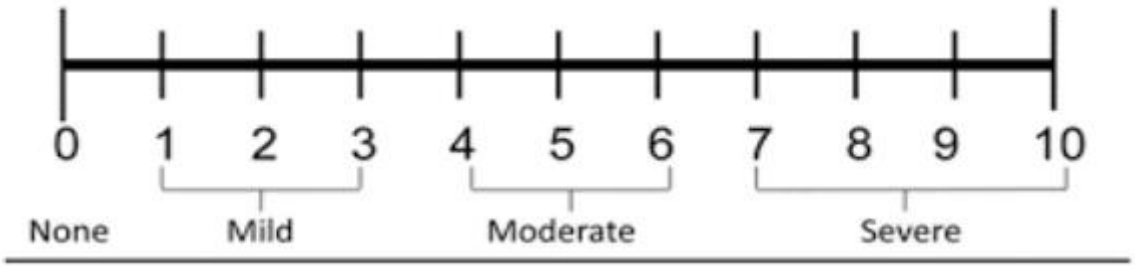
Starting position of passive knee extension test :

After passive knee extension :

NUMERICAL PAIN RATING SCALE

Reliability [ICC: 0.80 -0.95]

Rate your pain by choosing the number that best describes your pain :



PROTOCOL:

STATIC STRETCHING:

The Passive Static Stretching was used to assist "Group A."• Position of Subject: Lie on the back.• Standing by the bedside is the therapist's position.• Method: The individual was urged to lie down on a bed and unwind completely. Up until the subject's hamstring muscle could tolerate further stretching, the therapist himself flexed their hip and extended their knee. With one leg fully extended on the bed while the test was being conducted on another, the therapist held this position for at least 30 seconds before placing the tested leg back on the bed. Three times every 30 seconds is the treatment frequency per day. Duration of treatment: one session.

MUSCLE ENERGY TECHNIQUES:

• Muscle Energy Techniques were used to facilitate "Group B" concurrently. • Method employed: "POST ISOMETRIC RELAXATION"; autogenic inhibition • Standing next to the bed is the therapist position. Subject: Lying on the back • Method: The therapist extended the testing leg's flexed knee after fully flexing the hip, with the therapist's shoulder resting on the back of the lower leg while they faced the head of the table. The therapist resists the patient's active contraction by using their shoulder. The therapist asked the patient to flex their knee and extend their hip, which created a downward pressure against the resistance of the therapist. As a result, the patient's hamstring muscle contracted isometrically. • The patient was then instructed to hold the position for five to ten seconds, during which they were also asked to breathe in and hold it for five to ten seconds.Following this effort, the therapist instructed the patient to relax the leg and exhale. While the patient did this, a light stretch was given to take up any remaining slack until the new barrier was reached. The therapist then maintained this new barrier, and the process was repeated five more times, beginning from this new barrier. Treatment frequency: five times for five seconds, holding for twenty-five percent of the patient's strength; treatment duration: one session.

KINESIO TAPING:

The participants were in a standing position with their trunk bent and their knee extended. KT with a width of 5 cm was given to the hamstring muscles using the fascia technique, from the ischial tuberosity to the back of the knee with 25% tension. After that, the medial and lateral sides of the knee were wrapped with the Y-shaped tape. Every day for four weeks, the participants' right extremity hamstrings were stretched using the PNF technique's "contract-relax" method. In addition, the semitendinosus, semimembranosus, and biceps femoris of the participants' right lower extremities hamstring muscles (Group I) were treated with KT gold elastic therapeutic bands. Since there was no stretching involved in the application of the tape, its elasticity trait was eliminated.

STASTICAL ANALYSIS

Normality test using Shapiro-Wilk

Variable	Time Frame	Group A Static stretching with kinesio taping		Group B MET with kinesio taping	
		z-value	p-value	z-value	p-value
PKET Right	Pre	0.861	0.001	0.888	0.001
	Post	0.911	0.001	0.922	0.001
PKET Left	Pre	0.917	0.001	0.914	0.001
	Post	0.913	0.001	0.905	0.001
NPRS Right	Pre	0.881	0.001	0.881	0.001
	Post	0.855	0.001	0.847	0.001
NPRS Left	Pre	0.873	0.001	0.880	0.001
	Post	0.850	0.001	0.836	0.001

TABLE NO : 1 Shows the mean, standard deviation, z-value and p-value of both the outcome measures between the both groups, pre and post test respectively.

Statistical analysis for the present study was done using statistical package of social sciences (SPSS) version 23 so as to verify the results obtained. For this purpose data was entered into excel spread sheet, tabulated and subjected to statistical analysis. Various statistical measures such as mean, standard deviation and test of significance such as paired and unpaired test were used. Comparison of the pre intervention and post intervention outcome measures within the group and between the groups was performed using independent and dependent test respectively based on normality distribution of data sets. Normality of pre and post scores in group A and group B was done by using Shapiro-Wilk test as the sample size is less than 2000. The pre-test and post-test scores of all variables in Group A and Group B do not follow normal distribution as the p-value is not greater than 0.05. Therefore, the non-parametric tests were applied. To find out the effect within the group, paired sample Wilcoxon test is used. For Between groups, independent sample Mann Whitney test is used. Probability values <0.05 were considered minimal statistically significant and values < 0.01 and 0.001 were considered highly significant and very highly significant respectively.

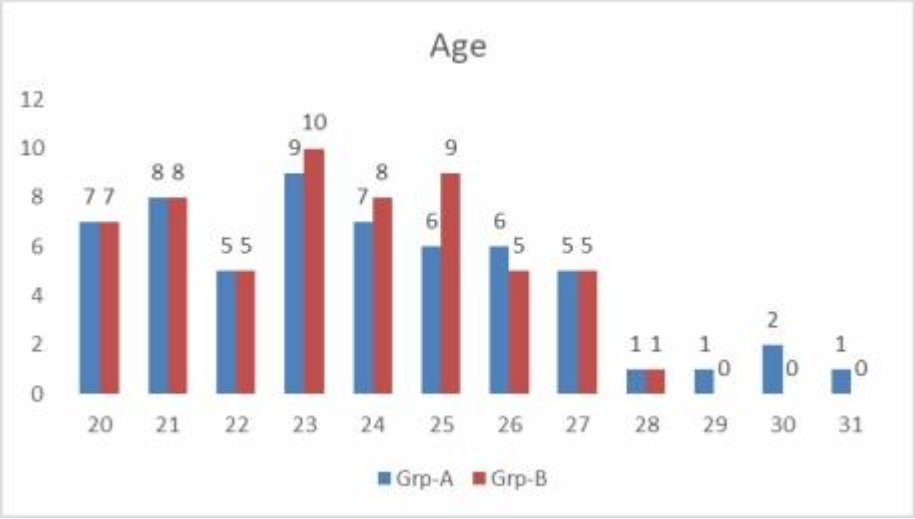
Particular		Group		Total
		Grp-A	Grp-B	
Gender	Male	58	58	116
Total		58	58	116

TABLE NO : 2 Shows baseline data of group A and group B

GRAPH NO : 1 Shows baseline data of group A and group B

		Group		Total	Chi square	p-value
		Grp-A	Grp-B			
Age	20.00	7	7	14	4.810	0.940
	21.00	8	8	16		
	22.00	5	5	10		
	23.00	9	10	19		
	24.00	7	8	15		
	25.00	6	9	15		
	26.00	6	5	11		
	27.00	5	5	10		
	28.00	1	1	2		
	29.00	1	0	1		
	30.00	2	0	2		
	31.00	1	0	1		
Total		58	58	116		

TABLE NO : 3 shows mean and standard deviation of baseline data [age]

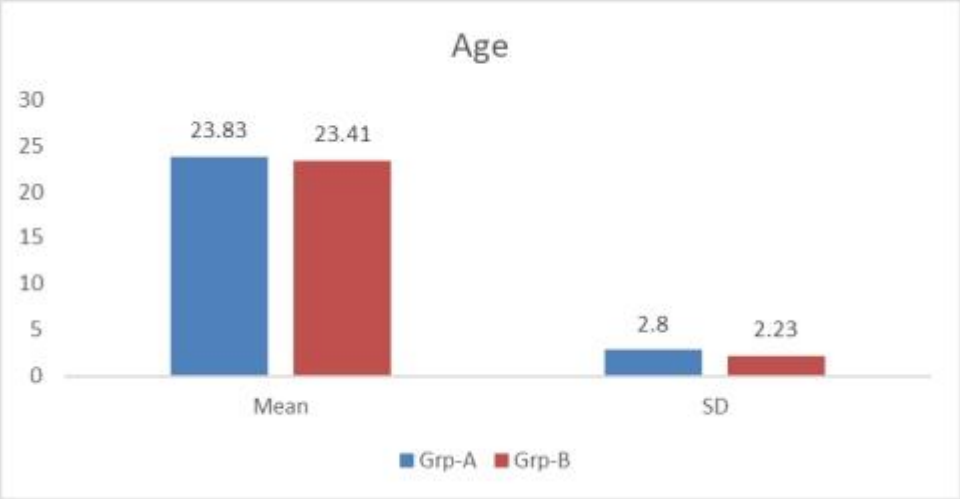


GRAPH NO : 2 shows mean and standard deviation of baseline data [age]

Comparison of Group A and Group B with Age using independent samples test

Variable	Group	Mean	SD	z-value	p-value
AGE	Grp-A	23.83	2.80	0.529	0.597
	Grp-B	23.41	2.23		

TABLE NO : 4 Shows Comparison of group A and group B with age independents sample test



GRAPH NO : 3 Shows Comparison of group A and group B with age independents sample test

Within group Pre and Post-test

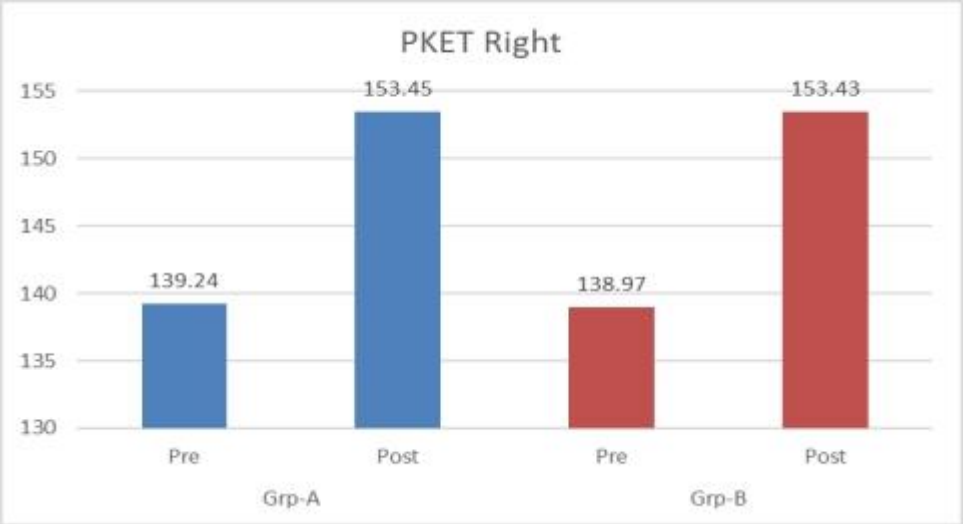
Comparison of pre-test and post-test scores of PKET Right by paired sample Wilcoxon test or dependent test

Group	Time	Mean	SD	Mean Diff.	SD Diff.	% of change	Effect size	z-value	p-value
Grp-A	Pre	139.24	4.16	14.21	3.43	10.19	4.14	6.708	0.001
	Post	153.45	3.68						
Grp-B	Pre	138.97	4.20	14.47	3.32	10.41	4.36	6.688	0.001
	Post	153.43	3.81						

TABLE NO 5 : Shows mean value for passive knee extension test of right side both the groups pre and post .

The 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 to pre value. The effect size or Cohen's D indicates 4.14 value which is assumed to be very high in effect size as per the standard parameters of reference. Proportional % of change indicates 10.19% changes post intervention. 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 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 to pre value. The effect size or Cohen's D indicates 4.36 value which is assumed to be very high in effect size as per the standard parameters of reference. Proportional % of change indicates 10.41% changes post intervention. 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



GRAPH NO : 4 Shows mean value for passive knee extension test of right side both the groups pre and post .

Within group Pre and posttest

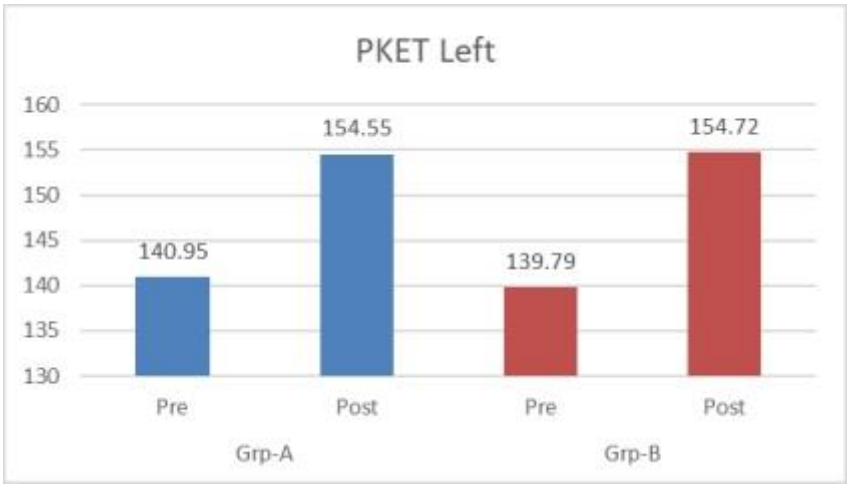
Comparison of pre-test and post-test scores of PKET Left by paired sample Wilcoxon test or dependent test

Group	Time	Mean	SD	Mean Diff.	SD Diff.	% of change	Effect size	z-value	p-value
Grp-A	Pre	140.95	5.21	13.60	3.85	9,64	3.54	6.667	0.001
	Post	154.55	4.01						
Grp-B	Pre	139.79	4.79	14.93	3.97	10.68	3.76	6.703	0.001
	Post	154.72	4.09						

TABLE NO 6 : Shows mean value for passive knee extension test of left side both the groups pre and post .

The 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 to 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. Proportional % of change indicates 9.64% changes post intervention. 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 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 to pre value. The effect size or Cohen's D indicates 3.76 value which is assumed to be very high in effect size as per the standard parameters of reference. Proportional % of change indicates 10.68% changes post intervention. 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



GRAPH NO :5 Shows mean value for passive knee extension test of left side both the groups pre and post .

Within group Pre and posttest

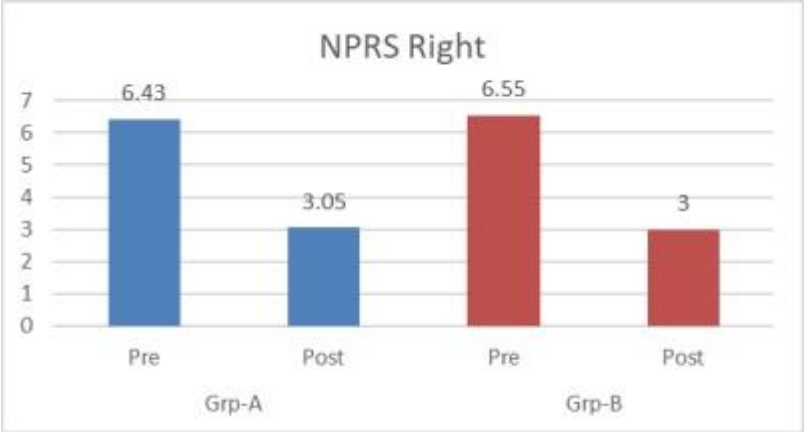
Comparison of pre-test and post-test scores of NPRS Right by paired sample Wilcoxon test or dependent test

Group	Time	Mean	SD	Mean Diff.	SD Diff.	% of change	Effect size	z-value	p-value
Grp-A	Pre	6.43	0.94	3.38	0.56	52.56	6.07	6.825	0.001
	Post	3.05	0.87						
Grp-B	Pre	6.55	0.94	3.55	0.57	54.19	6.26	6.820	0.001
	Post	3.00	0.84						

TABLE NO :7 Shows mean value for numerical pain rating scale of right side both the groups pre and post .

The mean value in group A indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 6.07 value which is assumed to be very high in effect size as per the standard parameters of reference. Proportional % of change indicates 52.56% changes post intervention. 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 mean value in group B indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 6.26 value which is assumed to be very high in effect size as per the standard parameters of reference. Proportional % of change indicates 54.19% changes post intervention. 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.



GRAPH NO : 6 Shows mean value for numerical pain rating scale of right side both the groups pre and post .

Within group Pre and posttest

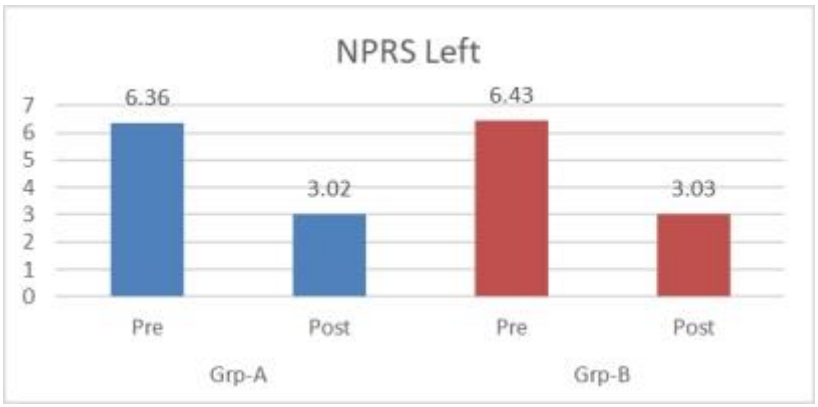
Comparison of pre-test and post-test scores of NPRS Left by paired sample Wilcoxon test or dependent test

Group	Time	Mean	SD	Mean Diff.	SD Diff.	% of change	Effect size	z-value	p-value
Grp-A	Pre	6.36	0.87	3.34	0.69	52.51	4.85	6.779	0.001
	Post	3.02	0.89						
Grp-B	Pre	6.43	0.96	3.40	0.56	52.87	6.06	6.840	0.001
	Post	3.03	0.90						

TABLE NO : 8 Shows mean value for numerical pain rating scale of left side both the groups pre and post

The mean value in group A indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 4.85 value which is assumed to be very high in effect size as per the standard parameters of reference. Proportional % of change indicates 52.51% changes post intervention. 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 mean value in group B indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 6.06 value which is assumed to be very high in effect size as per the standard parameters of reference. Proportional % of change indicates 52.87% changes post intervention. 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.



GRAPH NO :7 Shows mean value for numerical pain rating scale of left side both the groups pre and post

Between group analysis

Comparison of Group A and Group B with pre-test and post-test scores by independent samples Mann Whitney test

Group	Time Frame	Group	Mean	SD	z-value	p-value
PKET Right	Pre	Grp A	139.24	4.16	0.105	0.916
		Grp B	138.97	4.20		
	Post	Grp A	153.45	3.68	0.060	0.952
		Grp B	153.43	3.81		
PKET Left	Pre	Grp A	140.95	5.21	0.939	0.348
		Grp B	139.79	4.79		
	Post	Grp A	154.55	4.01	0.316	0.752
		Grp B	154.72	4.09		

TABLE NO :9 Shows mean comparison of passive knee extension test pre and post between group .

From the above table it is observed that between groups analysis is non-significant for PKET Right pre time frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups.

From the above table it is observed that between groups analysis is non-significant for PKET Right post frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups

From the above table it is observed that between groups analysis is non-significant for PKET Left pre time frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups.

From the above table it is observed that between groups analysis is non-significant for PKET Left post frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups

GRAPH NO : 8 Shows mean comparison of passive knee extension test pre and post between group .

Between group analysis

Comparison of Group A and Group B with pre-test and post-test scores by independent samples Mann Whitney test

Group	Time Frame	Group	Mean	SD	z-value	p-value
NPRS Right	Pre	Grp A	6.43	0.94	0.683	0.495
		Grp B	6.55	0.94		
	Post	Grp A	3.05	0.87	0.281	0.778
		Grp B	3.00	0.84		
NPRS Left	Pre	Grp A	6.36	0.87	0.441	0.659
		Grp B	6.43	0.96		
	Post	Grp A	3.02	0.89	0.023	0.981
		Grp B	3.03	0.90		

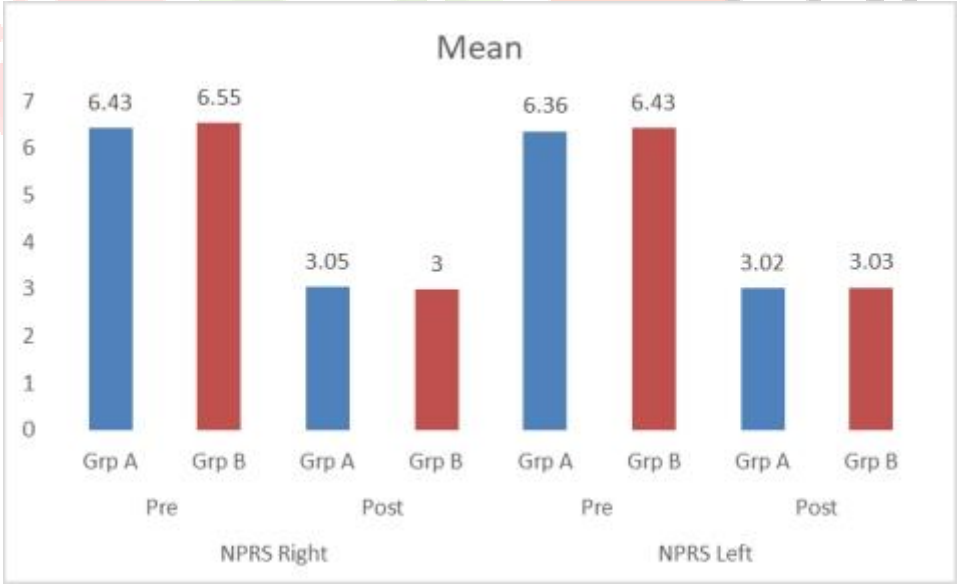
TABLE NO :10 Shows mean comparison of numerical pain rating scale pre and post between group .

From the above table it is observed that between groups analysis is non-significant for NPRS Right pre time frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups.

From the above table it is observed that between groups analysis is non-significant for NPRS Right post frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups

From the above table it is observed that between groups analysis is non-significant for NPRS Left pre time frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups.

From the above table it is observed that between groups analysis is non-significant for NPRS Left post frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups



GRAPH NO : 9 Shows mean comparison of numerical pain rating scale pre and post between group .

Comparison of treatment outcome based on Effect size

Variable	Group	Effect size	Result
PKET Right	Group A	4.14	Group B is better
	Group B	**4.36**	
PKET Left	Group A	3.54	Group B is better
	Group B	**3.76**	
NPRS Right	Group A	6.07	Group B is better
	Group B	**6.26**	
NPRS Left	Group A	4.85	Group B is better
	Group B	**6.06**	

TABLE NO :11 Shows comparison of treatment outcome based on effect size.

Based on the paired sample test and Effect size, we could conclude that Group B is better as it indicated better outcome post treatment than group A

Note: higher the Effect size better is the clinical improvement post treatment

DISCUSSION :

The focus of this study was to compare the effect of static stretching with KT versus muscle energy technique with KT on hamstring hamstring flexibility in athletes. The result of the present study shows that hamstring flexibility improved in both groups post intervention. Manual treatment includes MET. By using the muscles' own energy in the form of mild isometric contractions, MET uses autogenic or reciprocal inhibition to stretch and relax the muscles. Static stretching is a passive approach where the therapist does all the work; in contrast, MET is an active technique where the patient participates actively.

A study stated that the variations in the connective tissue show mechanical properties associated with both elastic and viscous constituents. Creep is the temporary lengthening of the connective tissue during the stretch period (viscoelastic property).[1] The reasons of increased flexibility after MET may be the result of biomechanical or neuro-physiological changes or increased stretch tolerance.[1]

METs are a type of manual treatment that is thought to improve joint mobility in addition to muscular flexibility by requiring an active contraction of the muscles against a regulated resistance. On the other hand, static stretching involves maintaining a muscle in a prolonged, tense position for a predetermined amount of time. The effectiveness of these therapies in enhancing hamstring flexibility is where they differ. According to earlier research, patients who actively participate in METs—which require their participation in the treatment—may experience better results than those who only perform static stretching. This is likely because METs activate the neuromuscular system, which may enable longer-lasting flexibility gains.[13]

Previous studies shows that Athletes have found that foam rolling is a useful tool for muscle rehabilitation. However, several investigations have shown that MET is a more efficient method than static stretching for increasing the extensibility of muscles that are shortened [19–21]. An effective method of increasing muscular flexibility for athletes is to use MET in conjunction with a foam roller, as the recovery effect is regarded as one of their main concerns.[14] The efficacy of MET on hamstring flexibility in normal indian college males.G-A (10): The subjects received MET treatment. G-B (10): The subjects were retained as controls, receiving no intervention. Treatment lasted 5 days. The popliteal angle was measured before and after treatment to assess outcome. The study found a substantial improvement in popliteal angle ($p<.001$). MET has been shown to dramatically enhance hamstring flexibility. This study shows that MET is an effective strategy for developing muscular flexibility.[15]

There was study done to find out Prevalence and severity of hamstring tightness among college student**.** Tightness was assessed using the AKE test. College students were more likely to have hamstring discomfort. The study found a significant frequency of hamstring tightness among college students aged 18-25.[7] Stretching causes elongation of the muscle spindle. Passive static stretching activates the Golgi tendon organ, which reduces muscle tension and allows the parallel elastic component to extend. study suggests that stretching aims to minimize resistance and enhance joint range of motion by inhibiting reflex activation.[16] During post-isometric relaxation, the Golgi tendon organ responds to a forceful muscular contraction against equal counterforce. The GTO sends an afferent nerve signal to the dorsal root of the spinal cord, where it interacts with an inhibitory motor neuron. By inhibiting the firing of efferent motor neurons, muscle tone lowers and the agonist relaxes and lengthens[16].

Participants with low pain thresholds experienced difficulty during static stretching, but those who got MET reported less complaints of pain during the technique. This might be attributed to lower contraction force and increased range, resulting in less intrinsic force on the muscle. Individuals with a low pain threshold can use MET for stretching.[16]

Kinesio taping [KT] was recommended to expand the space between the skin and muscle tissue, elevating the skin. This therapy relieves pain by increasing blood and lymphatic flow and promotes ROM by restoring muscle function.[17] In our study, KT was applied to the muscle group for 4 weeks, and as a result, there was a reduction in hamstring tightness as well as an increase in the degree of active knee extension. Muscle stretching for 3-4 weeks does not change the muscle's viscoelastic structure; it only affects its stretching tolerance and normal range of motion. When practiced on a regular basis, this stretching exercise lowers the central neuromuscular inhibition, resulting in improved flexibility.[8] The KT treatment improves blood flow under the location it is applied to, and the range of motion is enhanced because the Kt activates the cutaneous mechanoreceptors of muscle and myofascial tissues.[8]

CONCLUSION :

It was concluded that static stretching with kinsio taping versus muscle energy technique with kinesio taping both are effective in improving knee ROM and decreasing hamstring tightness among the athletes population but muscle energy technique is more effective compared to static strething in improving with less duration effectively .

LIMITATIONS :

The regular followups could enable in understanding the immediate changes, but du eto time constraints of the population, the follow ups were not possible.

FUTURE SCOPE :

1. Varied athlete population can be analyzed for the the similar changes
2. Long term effects can be monitored for better ubderstanding and planning of rehabilitatio protocols

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LIST OF ABBRVATIONS :

MET	MUSCLE ENERGY TECHNIQUE
KT	KINESIO TAPING
PKET	PASSIVE KNEE EXTENSION TEST
ROM	RANGE OF MOTION
NPRS	NUMERICAL PAIN RATING SCALE
RT	RIGHT
LT	LEFT
VS	VERSUS

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