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EFFECTIVENESS OF ELECTRICAL STIMULATION AND MUSCLE ENERGY TECHNIQUE (METs) ON PAIN, PEAK TORQUE OF EXTENSOR LAG IN TOTAL KNEE REPLACEMENT SUBJECTS.

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ABSTRACT

NEED OF THE STUDY:

Extensor lag is seen in post traumatic knees as a consequences of either injury or surgery which is caused by muscular weakness, joint distension, joint stiffness and pain.[20,21]

There is limited research supporting and validating its use, as well as limited evidence to substantiate the theories used to explain the effects of muscle energy technique (METs).[23,24,25]

There is lack of evidence on Muscle energy technique (METs) for quadriceps lag in TKR subjects.

AIM:

To find out the effectiveness of electrical stimulation and muscle energy technique on pain, peak torque of extensor lag in post total knee replacement subjects.

OBJECTIVES:-

- To find out the effectiveness of METS on pain in post TKR subjects.
- To find out the effectiveness of METs on extensor lag in post TKR subjects.
- To find out the effectiveness of METs on peak torque of quadriceps in post TKR subjects.

METHODOLOGY:

- 40 samples were taken with simple random sampling and were assigned to one of the two groups ,group1 and group2 by randomized controlled trail. 20 subjects were taken into each of these groups. Control group was given electrical stimulation and conventional exercises for 3weeks, experimental group was given electrical stimulation with muscle energy techniques and conventional exercises for 3weeks. Subjects were evaluated or assessed at pre and 7th post operative day, and after 3weeks of follow up phase: pain by VAS score, extensor lag by goniometer, peak torque of quadriceps by isokinetic analyser(Biodex).

RESULTS:

- Data analysis was computed by SPSS16.0 version with p value 0.050 to find out the results of the study. The statistics shows improvement in peak torque and decrease in Extensor lag and VAS score in both control and experimental groups. There is significant improvement in experimental group compared to the control group.

CONCLUSION:

This study concludes that individually both experimental and control groups were found to be effective in improving terminal knee extension, Range of motion (ROM) and quadriceps strength after 3weeks of exercise. However when both groups were compared, there was a significance of experimental group with greater mean than control group.

KEYWORDS: OSTEOARTHRITIS (O.A), TOTAL KNEE ARTHROPLASTY (T.K.A), TOTAL KNEE REPLACEMENT (T.K.R).

INTRODUCTION

Knee osteoarthritis is the most commonly encountered type leading to pain of knee joint and disability in the elderly patient. Patients generally complaints about pain, muscle weakness, joint stiffness, instability and decrease in physical function.

Most common causes that can lead to development of osteoarthritis are age related cartilage degeneration, genetic inheritance, trauma previous inflammatory conditions, quadriceps weakness and vascular changes [1].

Osteoarthritis is a worldwide cause of pain and disability with an estimated 27millionadults in the United States living with this disease.

The prevalence of radiographic knee osteoarthritis was 19.2% and in those over 80years the figure rise up to 43.7%. A data produced by Dutch institute for public

health and prevalence of knee osteoarthritis.

In India the crude prevalence of clinically diagnosed knee osteoarthritis was higher in urban (5.5%) and than in rural community (3.3%).

Researchers also found that in last 10years of study the incidence of total knee replacement was 1.6 to 2.4 fold higher in women than in men.

Among women adult population incidence radiographic knee osteoarthritis is 2-25% per year and incidence of symptomatic radiographic knee osteoarthritis 1% per year.

Men have 45% low risk of incident to knee osteoarthritis and 36% reduced risk of Hip osteoarthritis than women. In rural India the incidence is 5.78% which is about 30% of all rheumatological problems.

Osteoarthritis of the knee may be accelerated if there is a vascular disease in the subchondral bone, either through direct ischemic effects on bone or by any alteration in cartilage nutrition. [1]

Reduction of pain and improvement in physical function and quality of life are the main expected outcome after total knee arthroplasty (TKA). Total knee arthroplasty scientific and clinical evidence support the success of TKA for the relief of knee pain and symptoms of osteoarthritis.[1]

However the functional benefits of this surgical procedure are not a convincing, because quantitative evaluation of knee function have shown that larger functional deficits persist one year after surgery and even longer.[2,3]

Quadriceps muscle weakness has been associated with decreased gait speed, balance, stair climbing ability, and ability to rise from a seated position, as well as with an increased risk of falls. [4-10]

There are wide range of treatments available to the osteoarthritis includes IFT, Wax, Ultrasound, SWD etc.,

Halim Yilimazl et al. reported cost effective and easily applicable home exercise program with no side effects including quadriceps and hamstrings strengthening and ROM exercises increase functional level, decrease severity of pain and improve quality of life.[1,16]

Santhosh Metgud et al. the main aim of in this study physiotherapy rehabilitation following knee arthroplasty were to reduce pain, to maintain or improve muscle strength, to maximize functional ability. [3, 11]

Michael p. Reiman et al. in their study concluded that hip influences the osteoarthritis knee according to this study.[12]

Muscle activation level is another area of concern regarding the interdependence of hip and knee. Because subjects with knee OA have demonstrated increased hamstring muscle activation while executing activities of daily living, exercise interventions focusing on not only quadriceps strengthening but also increased Quadriceps and hamstring muscle balance have been recommended. [12, 13]

Neuromuscular electrical stimulation (NMES) offers an innovative approach to potentially mitigate quadriceps muscle voluntary activation deficits and prevent muscle atrophy early after surgery to restore normal quadriceps muscle function more effectively than voluntary exercise alone.[14-16]

Severe voluntary activation deficits may limit improvements in muscle strength in response to rehabilitation that utilizes voluntary exercise, possibly because of the inability to generate muscle contractions of sufficient intensity to promote strength gains.

Neuromuscular electrical stimulation has the potential to override voluntary activation deficits and may even help re-educate the quadriceps muscle to contract normally.

Early intervention with intensive NMES may offer greater benefits than the initiation of NMES one month after TKA because it may be easier to prevent the decline of muscle function after surgery than to reverse losses after they occur[17,18]

NMES has been used for muscle strengthening maintenance of muscle mass and strength during prolonged periods of immobilization, selective muscle retraining, and the control of edema.

The use of NMES to prevent muscle atrophy associated with prolonged knee immobilization following ligament reconstruction surgery or injury has been extensively studied. NMES has been shown to be effective in preventing the decrease in muscle strength, muscle mass, and oxidative capacity of thigh muscles following knee immobilization [19].

It has also been reported that NMES applied to the thigh musculature during knee immobilization improves the performance on functional tasks.

There is some evidence to suggest that NMES is effective in selective strengthening of individual muscles within muscle groups or parts of muscles.

Extensor lag is seen in post traumatic knees as a consequences of either injury or surgery and the elimination of extensor lag is a treatment goal in the physical therapy program.[20,21]. Extensor lag is defined as a condition in which the active range of the knee extension is less than passive range of knee extension.

The term extensor lag is used in preference to quadriceps lag because it is suggested that there may be other factors involved in the condition besides proper functioning of the quadriceps muscles.[22,23].

It is possible that Extensor lag may be caused by muscular weakness, joint distension, joint stiffness and pain.[23,24,25].

Muscle energy technique (METs) is a manual technique developed by osteopathic medicine that is now used in many different manual therapy professions.[26].

It is claimed to be effective for a variety of purposes,

including lengthening a shortened or contracture muscle, strengthening muscles, as a lymphatic or venous pump to aid the drainage of fluid or blood, and increasing the ROM of a restricted joint.[27].

There is limited research supporting and validating its use, as well as limited evidence to substantiate the theories used to explain the effects of METs.

MET is a manual therapy procedure which involves the voluntary contraction of a muscle is precisely controlled direction at varying levels of intensity against a distinct counterforce applied by the operator .[28]

NEED OF THE STUDY

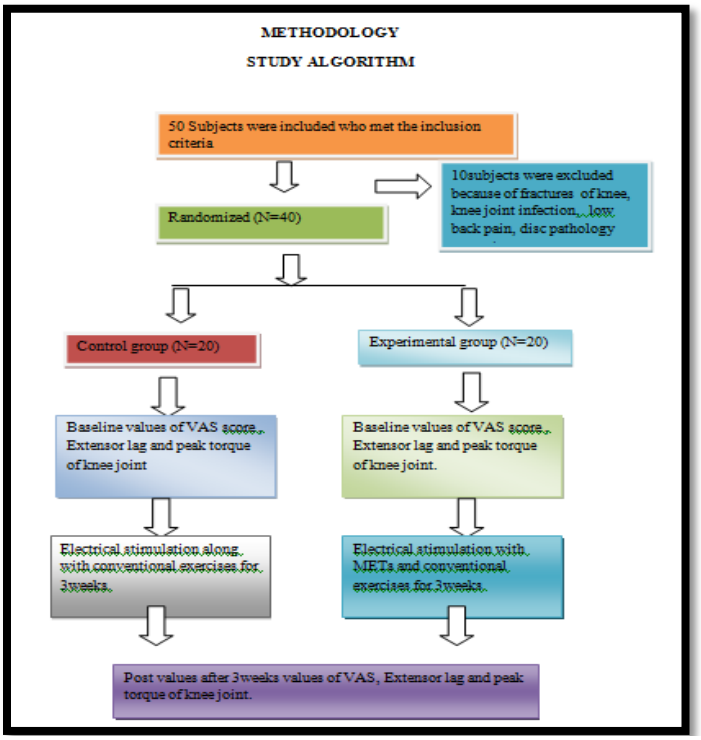
1. Extensor lag is seen in post traumatic knees as a consequences of either injury or surgery which is caused by muscular weakness, joint distension, joint stiffness and pain.[20,21]
2. There is limited research supporting and validating its use, as well as limited evidence to substantiate the theories used to explain the effects of muscle energy technique (METs).[23,24,25]
3. There is lack of evidence on Muscle energy technique (METs) for quadriceps lag in TKR subjects.

AIM OF THE STUDY

To find out the effectiveness of electrical stimulation and muscle energy technique on pain, peak torque of extensor lag in post total knee replacement subjects.

OBJECTIVES OF THE STUDY

- To find out the effectiveness of METS on pain in post TKR subjects.
- To find out the effectiveness of METs on extensor lag (ROM) in post TKR subjects.
- To find out the effectiveness of METs on peak torque of quadriceps in post TKR subjects.



MATERIALS AND METHODS

Study setup :-40 subjects with total knee replacement were taken from BIRRD hospital, Tirupati.

Study design :-Experimental study randomized clinical trial

Study duration :- 3 weeks

Sample size :- 40 subjects

Type of sampling :- simple random sampling.

CRITERIA FOR SELECTION:-

Inclusion criteria:-

- 50-65years of aged people included both (male and female)
- Patients with unilateral total knee replacement.
- Osteoarthritis knee

Exclusion criteria:-

- uncontrolled hypertension and diabetes
- BMI greater than 35kgs/m2
- Neurological impairments like epilepsy
- Contra lateral knee osteoarthritis (pain greater than 4/10 activity)
- Bilateral total knee replacement
- Cardiac pacemakers
- History of trauma (acute/ chronic) of lumbar spine, pelvis, hip, knee.
- Recent history of infective arthropathy at hip and knee

- Limb length discrepency
- Deformities in spine and lower limbs.

METHODS:

SAMPLING METHOD:

This study is started by observing many total knee joint surgery subjects who are suffering with extensor lag. The subjects were taken from BIRRD hospital, Tirupati.

In simple random sampling subjects who met the inclusive criteria were included in the study. Before study, subjects completed several self report outcome measures. A visual analogue scale is used to grade level of knee pain in pre and post therapy values of total knee replacement. Goniometry is used to measure range of motion of knee flexion and extension before and after therapy.

MATERIALS:

- Universal goniometer
- VAS scale
- Isokinetic dynamometer

OUTCOME MEASURES:

- Visual analogue scale (VAS)- To measure pain
- Extensor lag- To measure knee Range of motion
- Peak torque- To measure quadriceps strength

INTERVENTION:

40 subjects were allocated into control and experimental group.

CONTROL GROUP: receives electrical stimulations (15mins) and conventional exercises over a period of 3 weeks.

EXPERIMENTAL GROUP: receives electrical stimulations with muscle energy techniques (METS) 5reps/day, 6days a week for 3weeks and conventional exercises over a period of 3 weeks.

PROCEDURE:

This study is started by observing many total knee joint surgery subjects who are suffering with extensor lag. The subjects were taken from BIRRD hospital, Tirupati.

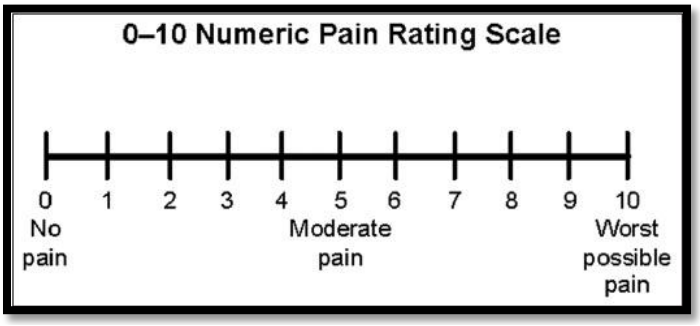
First I was taken 50 subjects who met with inclusion criteria, but 10subjects were excluded because of fractures of knee, knee joint infection, low back pain, disc pathology present. After that subjects were randomized by simple random sampling methods into two groups. Patients underwent intervention in which pre and post evaluation was done.

Before the study, I have explained about the treatment procedure and taken consent from the subjects for participation. Subjects completed several self report outcome measures. A visual analogue scale is used to grade level of knee pain in pre and post therapy values of total knee replacement. Goniometry is used to measure range of motion of knee flexion and extension before and after therapy.

Testing protocol:

VAS (Visual Analog Scale) [fig.1]is a self-completed uni-dimensional single item measure of pain intensity in the last 24 hours. The response options of pain intensity were adhere to score ''0'' represents ''No pain'', score''5-6'' represents ''moderate pain'' and score ''10'' represents ''worst imaginable pain''. VAS score is measured pre operative day , 7th post operative day and after 3weeks.

Fig. VAS



Extensor lag is measured when patient is in high sitting the hip and knee 90-90 degrees flexion,the goniometer[fig.2] is placed parallel to the (stable arm) lateral aspect shaft of femur and the movable arm is placed parallel to shaft of fibula. Ask the patient to do knee extension from 90degrees of flexion to extension. The deficiency of terminal knee extension measured by goniometer. Extensor lag is measured pre operative day, 7th post operative day and after 3weeks.

FIG. 2 GONIOMETER

Peak torque is measured by quadriceps strength through the Isokinetic Analyser [fig 5]which is measured in N-m^2. Subjects were seated upright on the testing chair with firm spacer board placed behind the back as required to position the hips sufficiently forward so that rotational axis of knee joint is in alignment with the input shaft of dynamometer. This position is comfortable and reliable for

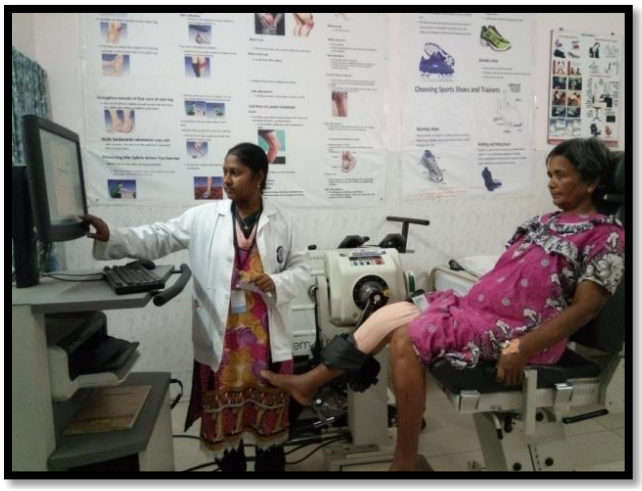
testing maximum knee flexors and extensors torque.

A Velcro strap was secured around each subjects waist and a second strap was fastened for trunk and third strap was placed just proximal to the knee to provide stabilization of the body and to reduce unwanted contribution by muscles other than those of interest.

A padded strap at distal end of the dynamometer lever arm was secured around the subjects lower leg approximately 3cm above the malleoli. Each subject performed a practice trail consisting of three submaximal knee flexion and extension at 30degrees, 60 degrees, and 90degrees. But in this study we taken peak torque of 60degrees and 90degrees knee flexion and extension. After a 30seconds to 1 minute, rest subjects were asked to ''push and pull as hard as and as fast as possible for 10 repetitions of maximal effort at each of the 2 angulations.

A 2 minute rest period was provided between each test speed. Peak toque is measured pre operative day , 7th post operative day and after 3weeks.

FIG-5 PEAK TORQUE OF QUADRICEPS BY ISOKINETIC ANALYSER.



ELECTRICAL STIMULATION:

Position of patient: supine lying

Placement of electrodes- one electrode (inactive) is placed over the inguinal region and another electrode(active) is placed over the vastus medialis muscle .[fig3]

Parameters used in the treatment were:

Wave form	: Symmetrical biphasic current
Pulse width	: 250 microseconds
Frequency	: 50pps
On: off time	: 1:3
On-time	: 15seconds
Off- time	: 45seconds
Duration of time	: 15minutes

FIG-3 ELECTRICAL STIMULATION ON POST TKR PATIENT

MUSCLE ENERGY TECHNIQUE:

Position of patient- high sitting

Starting position- at resistance barrier

In high sitting the patient limb is positioned where resistance is first perceived during flexion and at this point, the muscle energy technique is given to increase the range of motion. The patient is asked to use no more than 20% of available strength to leg away from barrier while the practitioner holds the limb firmly at the barrier. The patient should be contracting the agonist , the muscle which requires release. As patient induces and holds contraction, patient is asked to hold an inhaled breath. The contraction should be held for 7-10sec and instruction is given to patient ''now let your breath go and release your effort, slowly and completely and only when this is achieved the muscle is taken to new barrier with all slack removed but no stretch. starting from the new barrier, the procedure is repeated 5times. [fig4]

FIG-4 METS ON POST TKR PATIENT

CONVENTIONAL EXERCISES:

The frequency, duration and intensity of exercise were decided based on the patients performance and the improvements were targeted to achieve with respect to the days of the protocol.

Post operative day 1: Physiotherapy was started after knee surgery.

Breathing exercises, Ankle pumps: subject was asked to move the ankle up and down, Static quadriceps exercises, Static hamstring exercises.

Post operative day 2-3: Deep breathing exercises

Ankle pumps: subject was asked to move the ankle up and down,

Heel slides: while lying supine subject was asked to slowly slide the heel towards the buttocks and then straighten the leg.

Static Quadriceps exercises: subject was asked to tighten the knee and hold for a count of 5 and relax.

Static hamstring exercises: subject was asked to press his heel on the towel hold for a count of 5 and relax.

Straight leg raising: subjects was asked raises the leg straight up in the air without bending the knee in supine.

Quadriceps drills: subject was asked to raise the leg up straight up with subject in sitting at the edge of the bed. Subject was made to sit up in bed and also made to walk a few steps with a walker.

Post-operative day 4: Subject gradually started to do the exercises with minimum assistance. And was independently moving around with a walker for a small distance.

Post-operative day 7: Range of motion at the knee was 90 degrees. Subject was walking

independently with walker. Subject was trained to climb up and down the stairs.

2-3 Weeks: Subject was encouraged to walk with cane. Strengthening exercises were started for hip and knee muscles using free weights.

By the end of 3week: Subject was walking without support. Subject was independent in his activity of ADLS.

STATISTICAL ANALYSIS AND RESULTS

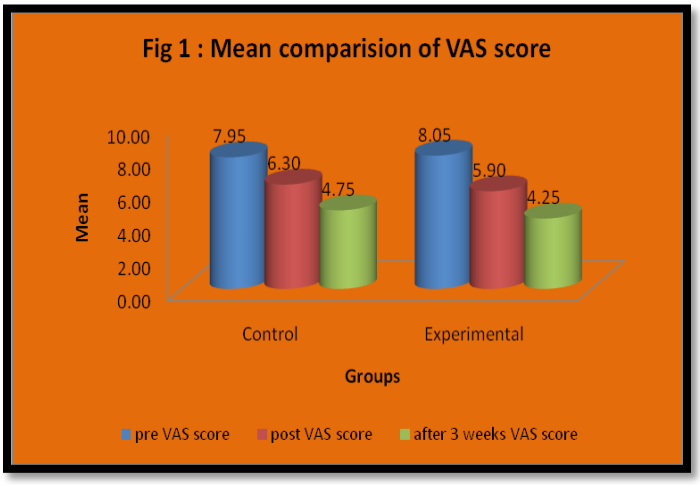
Statistics were done by using SPSS version 16.0 with p value 0.050 to find out the results of the study. The statistics shows improvement in peak torque and decrease in Extensor lag and VAS score in both control and experimental groups. There is significant improvement in experimental group compared to the control group. The details of the improvement in all parameters were tabulated in the following tables and graphs.

TABLE1:- SHOWING THE MEAN WITH STANDARD DEVIATION OF VAS SCORE IN TKR PATIENTS ON 3 DIFFERENT PHASES OF SURGERY.

Mean, S.D and t- Value : VAS score comparison						
		N	Mean	Std. Deviation	t-value	p value
CONTROL VAS SCORE	pre VAS score	20	7.95	0.69	11.000	0.050
	post VAS score	20	6.30	0.80		
	pre VAS score	20	7.95	0.69	20.566	0.050
	after 3 weeks VAS score	20	4.75	0.44		
	post VAS score	20	6.30	0.80	10.100	0.050
	after 3 weeks VAS score	20	4.75	0.44		
EXPERIMENT VAS SCORE	pre VAS score	20	8.05	0.69	10.302	0.050
	post VAS score	20	5.90	0.79		
	pre VAS score	20	8.05	0.69	16.088	0.050
	after 3 weeks VAS score	20	4.25	0.64		
	post VAS score	20	5.90	0.79	7.906	0.050
	after 3 weeks VAS score	20	4.25	0.64		

Statistical significant at 0.05 level of significance ($p<0.05$)

GRAPH 1:- MEAN COMPARISON OF VAS SCORE IN CONTROL AND EXPERIMENTAL GROUPS



We observed that with regards to measure t-test for knee pain by VAS score showed statistically significant improvement after 3 weeks of treatment programme in experimental group than control group.

Comparison of VAS score in control and experimental group

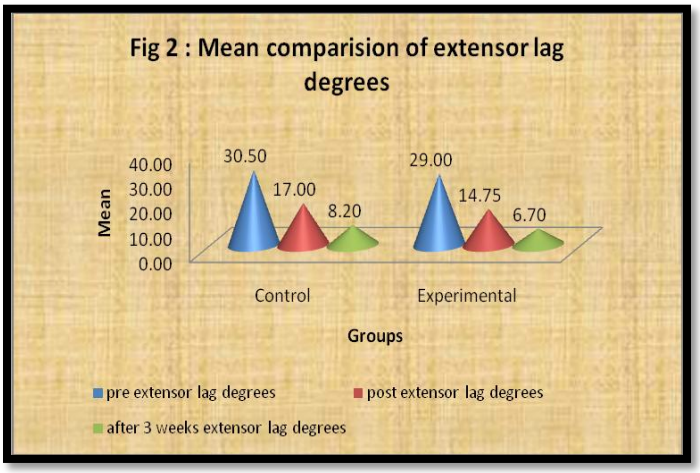
	Control	Experimental
pre VAS score	7.95	8.05
post VAS score	6.30	5.90
after 3 weeks VAS score	4.75	4.25

TABLE -2: SHOWING MEAN WITH STANDARD DEVIATION OF EXTENSOR LAG IN TKR SUBJECTS ON 3 DIFFERENT PHASES OF SURGERY:

Mean, S.D and t- Value : Extensor lag (degree) comparison						
		N	Mean	Std. Deviation	t-value	p value
CONTROL Extensor lag (degree)	pre extensor lag degrees	20	30.50	4.26	10.283	0.050
	post extensor lag degrees	20	17.00	2.51		
	pre extensor lag degrees	20	30.50	4.26	19.554	0.050
	after 3 weeks extensor lag degrees	20	8.20	1.36		
	post extensor lag degrees	20	17.00	2.51	23.974	0.050
	after 3 weeks extensor lag degrees	20	8.20	1.36		
EXPERIMENTAL Extensor lag (degree)	pre extensor lag degrees	20	29.00	4.17	17.105	0.050
	post extensor lag degrees	20	14.75	3.43		
	pre extensor lag degrees	20	29.00	4.17	24.842	0.050
	after 3 weeks extensor lag degrees	20	6.70	1.53		
	post extensor lag degrees	20	14.75	3.43	12.369	0.050
	after 3 weeks extensor lag degrees	20	6.70	1.53		

Statistical significant at 0.05 level of significance (p<0.05).

GRAPH -2: MEAN COMPARISON OF EXTENSOR LAG IN CONTROL AND EXPERIMENTAL GROUPS:



We observed that with regards to measures t-test for extensor lag of knee showed statistically significant improvement after 3weeks of treatment programme in experimental group than control group.

Comparison of Extensor lag in control and Experimental groups:

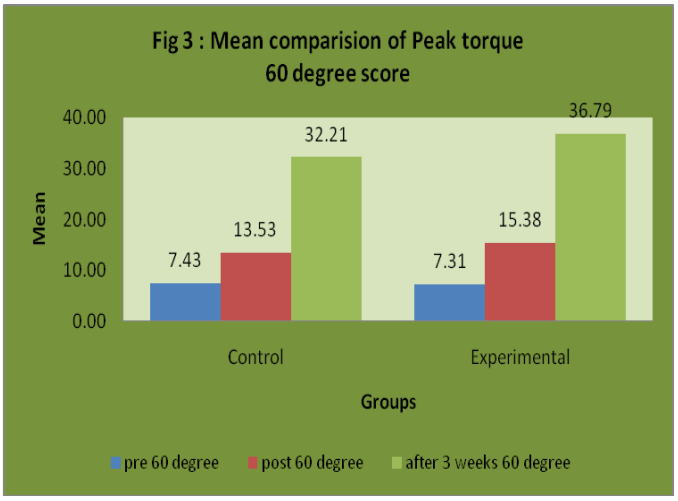
	Control	Experimental
pre extensor lag degrees	30.50	29.00
post extensor lag degrees	17.00	14.75
after 3 weeks extensor lag degrees	8.20	6.70

TABLE -3: SHOWING THE VALUES OF MEAN WITH STANDARD DEVIATION OF PEAK TORQUE 60 DEGREES IN TKR PATIENTS ON 3 DIFFERENT PHASES OF SURGERY.

Mean, S.D and t- Value : peak torque 60 degrees comparison						
		N	Mean	Std. Deviation	t-value	p value
Control Peak torque 60 degrees	pre 60 degree	20	7.43	1.09	12.576	0.050
	post 60 degree	20	13.53	2.45		
	pre 60 degree	20	7.43	1.09	16.428	0.050
	after 3 weeks 60 degree	20	32.21	6.92		
	post 60 degree	20	13.53	2.45	17.423	0.050
	after 3 weeks 60 degree	20	32.21	6.92		
Experimental Peak torque 60 degrees	pre 60 degree	20	7.32	0.79	17.817	0.050
	post 60 degree	20	15.38	2.38		
	pre 60 degree	20	7.32	0.79	21.733	21.733
	after 3 weeks 60 degree	20	36.79	6.38		
	post 60 degree	20	15.38	2.38	20.512	0.050
	after 3 weeks 60 degree	20	36.79	6.38		

Statistical significant at 0.05 level of significance (p<0.05).

GRAPH -3: MEAN COMPARISON OF PEAK TORQUE 60 DEGREE SCORE IN CONTROL AND EXPERIMENTAL GROUPS:



We observed that with regards to measures t-test for peak torque 60 degrees of knee showed statistically significant improvement after 3weeks of treatment programme in experimental group than control group.

Comparison of peak torque 60 degree score in control and experimental groups:

	Control	Experimental
pre 60 degree	7.43	7.32
post 60 degree	13.53	15.38
after 3 weeks 60 degree	32.21	36.79

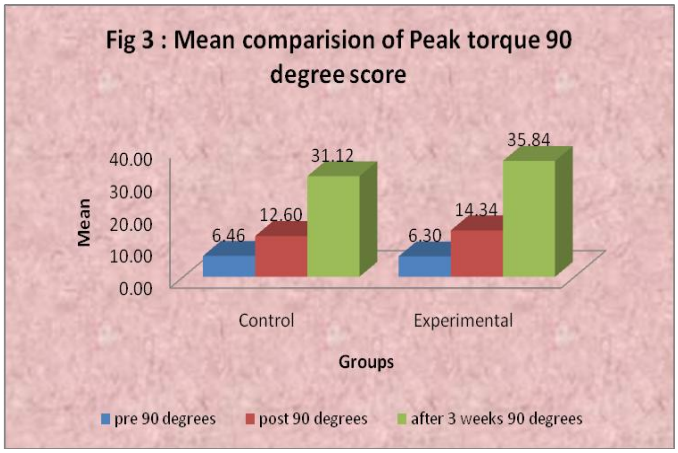
TABLE -4: SHOWING THE VALUES OF MEAN WITH STANDARD DEVIATION OF PEAK TORQUE 90 DEGREES IN TKR PATIENTS ON 3 DIFFERENT PHASES OF SURGERY.

Mean, S.D and t- Value : peak torque 90 degrees comparison

		N	Mean	Std. Deviation	t-value	p value
Control Peak torque 90 degrees	pre 90 degrees	20	6.46	1.19	11.419	0.050
	post 90 degrees	20	12.60	2.49		
	pre 90 degrees	20	6.46	1.19	15.862	0.050
	after 3 weeks 90 degrees	20	31.12	6.94		
	post 90 degrees	20	12.60	2.49	17.487	0.050
	after 3 weeks 90 degrees	20	31.12	6.94		
Experimental Peak torque 90 degrees	pre 90 degrees	20	6.30	0.84	15.400	0.050
	post 90 degrees	20	14.34	2.47		
	pre 90 degrees	20	6.30	0.84	21.417	0.050
	after 3 weeks 90 degrees	20	35.84	6.32		
	post 90 degrees	20	14.34	2.47	21.531	0.050
	after 3 weeks 90 degrees	20	35.84	6.32		

Statistical significant at 0.05 level of significance ($p<0.05$).

GRAPH:4 MEAN COMPARISON OF PEAK TORQUE DEGREE SCORE IN CONTROL AND EXPERIMENTAL GROUPS:



We observed that with regards to measures t-test for extensor lag of knee showed statistically significant improvement after 3weeks of treatment programme in experimental group than control group.

Comparison of peak torque 90degree score in control and experimental groups:

	Control	Experimental
pre 90 degrees	6.46	6.30
post 90 degrees	12.60	14.34
after 3 weeks 90 degrees	31.12	35.84

DISCUSSION

The statistics shows improvement in peak torque and decrease in Extensor lag and VAS score in both control and experimental groups. There is significant improvement in experimental group compared to the control group.

This study shows that there is a significant increase in range of motion (ROM) and strength following the application of both muscle energy technique and electrical stimulations with conventional therapy. These results suggest that the two treatments were effective.

The positive results with electrical stimulations might have occurred because of two reasons:

- One i.e., NMES is based on overload principle. According to this principle greater strength gains will occur when training done at higher contraction intensities than when training at lower contraction intensities.
- Second i.e., in NMES electrical current takes the pathway of least resistance, resulting in recruitment of large diameter fibers (TYPE-II) initially, followed by small diameter fibers (TYPE-I) which are of highly resistant to electrical current.

As the TYPE-II have been shown to decrease in size by ageing and these atrophied TYPE-II fibers get weakly activated by voluntary activation. Where TYPE-I fibers recruit first. Thus the recruitment of TYPE-II fibers with NMES is of more effective means to gain the motor and functional activity.

Various researchers have found that METS (or similar isometric stretching techniques), were effective in increasing joint range of motion (ROM) and strength, however, many of these studies only examined the immediate effect of the treatment intervention.

The increased active range of motion (ROM) and strength following METS may be due to several factors like neutral, viscoelastic and Thixotropic properties. The effectiveness of METS id attributed to the inhibitory Golgi tendon reflex. This reflex is believed to be activated during isometric contraction of muscles, which is claimed to produce a stretch on Golgi tendon organs and a reflex relaxation of the same muscles. Musculotendinous units function in a

viscoelastic manner and therefore have the properties of creep and stress relaxation. Creep is characterized by the lengthening of muscle tissue due to an applied fixed load. Stress relation is characterized by the decrease in force over time necessary to hold a tissue in particular length.

The effect of muscle energy technique (METS) could have been effected by the thixotropic is the property of a tissue to become more liquid after motion and returns to a stiffer, gel like state at rest. The thixotropic property of the muscle is thought to result from an increase or decrease in number of stable bonds between actin and myosin filaments when the muscle is at rest and activity respectively. With activity , the muscle becomes more fluid like because the stable bond are broken or prevented from forming. Based on thixotropic properties, the temporary increase in strength is considered to be maintained during periods of activity and to decrease during periods of inactivity.

CONCLUSION

This study concludes that individually both experimental and control groups were found to be effective in improving terminal knee extension, Range of motion (ROM) and quadriceps strength after 3weeks of exercise. However when both groups were compared, there was a significance of experimental group with greater mean than control group.

LIMITATIONS:

- Small sample size
- Study duration was short.
- Subjects could not be follow up after study
- Gender differences
- Duration of osteoarthritis.

RECOMMENDATIONS:-

- The further study is recommended to do with large sample size.
- Further follow up is recommended after 6weeks and 8weeks.
- Further study needed for different types of replacements.
- Further study needed for effects of METs on over weight and obese.

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