

# COMPARISON BETWEEN TENS AND MET FOR REDUCTION IN PAIN AND INCREASE IN RANGE OF HIP INTERNAL ROTATION IN POST- OPERATIVE EXTRA CAPSULAR NECK OF FEMUR FRACTURE PATIENTS

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## ABSTRACT

**Background:** The occurrence of ECNF fractures is increasing in the ageing population. Post-operatively, these patients present with pain and loss of internal rotation range which further complicates the rehabilitation and affects their quality of life. TENS and MET are widely used clinically in pain management and movement enhancement in such cases.

**Methodology:** Single-blinded randomized active controlled parallel group trial. **Setting:** In-patient department of an Orthopedics super-specialty hospital in Pune, India. **Participants:** Patients with ECNF fracture between age group 50-80 operated by proximal femoral nail A or A2 (Anti-rotation).

Patients were pre-assessed for pain and range of motion and were randomly divided into TENS and MET groups. Intervention was given for 2 sessions/ day for 2 days in both the groups after which the post assessment was done. Dependent and independent 't' test was used for the range assessment for intra and inter-group analysis while Wilcoxon test and Mann Whitney test was used for the pain analysis respectively with alpha  $\geq 0.05$  at 95%CI.

**Results:** The TENS group showed reduction in Pain by 3.61 (p=0.00) and increase in IR ROM by 12.88 degrees (p=0.00, 95%CI 10.93-14.84). Similarly, the MET group also showed reduction in Pain by 3.61 (p=0.00) and increase in IR ROM by 15.22 degrees (p=0.00, 95%CI 12.22-18.21). Inter-group analysis showed an insignificant difference for pain (0, p=1.00) and for ROM (2.34 degrees, p=0.140)

**Conclusion:** Both, TENS and MET, are equally effective in pain reduction and hip internal rotation range enhancement in post operative patients of ECNF fracture.

**KEY WORDS:** Muscle Energy Technique, Internal Rotation, Pain, Transcutaneous Electrical Nerve Stimulation.

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## INTRODUCTION

Proximal femoral fractures or neck of femur fractures are divided into intra-capsular or extra-capsular fractures. Extra-capsular femoral neck fracture which is further divided into basal, pre- trochanteric, trochanteric and sub-trochanteric fractures. It is been stated that the trochanteric fractures comprise of 40%-50% of the proximal femoral fractures and that an increasing trend is been seen of the occurrence of these fractures in ageing population. This leads to increasing hospital stay and reducing the mobility of the patient deteriorating the overall functional status of the patient [1]. Prime complaint of the patient after surgery is pain. Due to pain the compliance of the patient towards physical therapy session during hospital stay decreases and thus reducing the patient's prognosis towards becoming mobile independently [1]. Post-operatively the patients tends to position their hip in external rotation which leads to reduction in range of internal rotation eventually due to post surgical pain and thus shortening or spasm of external rotators due to the posture of the operated limb.

Transcutaneous electrical nerve stimulation (TENS) is an inexpensive, non-pharmacological intervention used in the treatment of acute and chronic pain conditions. Nowadays more and more methods of pain relief having negative side effects are welcomed by patients. Non invasive electrical stimulation has also proved to be effective in reduction of pain in post-operative patients in orthopedics [1]. In this study use of high frequency TENS was done as it is more tolerable in acute pain [2]. TENS primarily alters pain perception through the stimulation of A-beta (sensory stimulation) nerve fibers, which in turn may inhibit the transmission of a nociceptive stimulus mediated by A-delta and C-fibers [3]. The motive of giving TENS in addition to the ongoing analgesic treatment was that after reduction in pain of the patient after its application functional ability of the patient would increase to activate the internal rotators and greater co-operation towards physical therapy sessions [1-3].

Muscle energy techniques are a class of soft tissue osteopathic (originally) manipulation

methods that incorporate precisely directed and controlled, patient initiated, isometric and/or isotonic contractions, designed to improve musculoskeletal function and reduce pain(Lean Chaitow) [4,5]. In his book 'Muscle Energy Techniques' Lean Chaitow says that MET is a technique in which patient initiates the contractions himself according to his capability with a very less as much less as 20% counterforce by the therapist against that contraction [4-6]. So this method proves to be safe in recent acute trauma/conditions as well without any damage. This techniques has its analgesic effects with probable mechanisms such as; Neurologically induced hyperalgesia, Improved drainage of inflammatory substances, The release of endorphins and/or endocannabinoids, A hydraulic effect involving connective tissue structures that temporarily allows increased freedom of movement following stretching or isometric contractions [5,6]. Keeping in view the effects of MET we treated the other group of patients with MET to reduce their pain and increase their range and thus making them mobile and functionally independent as soon as possible [5,6].

Due to this growing need to start rehabilitation and to tackle these prime problems of pain and restriction of range our aim was to compare between TENS and MET and to see which techniques yields better results in a short span of inpatient department treatment.

## METHODOLOGY

This study is a single-blinded randomized active controlled trial with a sample size of 60 patients (30 per group). After the approval of ethical committee, Institutional Review Board the study was commenced. The inclusion criteria were patients who were post-operative day 2 stabilized with PFNA or PFNA2 between the age group of 50-80 having pain between 3-6 on a 10 point Visual Analogue Scale with restricted range of internal rotation of hip. The patients who were excluded from the study either did not meet the inclusion criteria or belonged to the following exclusion criteria which were patients with sensory disturbances, patients with reduced comprehension and patients with pathological fractures. The duration of the intervention was 2 days (4 sessions, 2 each day). Random

computer generated allocation of patients consenting for participation and tools used were TENS machine, VAS scale, Gel, micropore, electrodes, Goniometer.

**Procedure:** The patients were divided into two groups; one group was given MET i.e. Post-isometric relaxation of external rotators of hip and the other group was given TENS. One each group included 30 patients. The sampling was done by computer generated randomized table. Range of internal rotation of hip was taken in the standard position that is bed side sitting with the VAS score before the first session and after the last session of the respective treatment in both the groups.

**Fig. 1:** Application of MET for internal rotation of hip.



**Fig. 2:** Application of 4 electrode TENS at the following vertebral levels: L2, L3, L5, S1



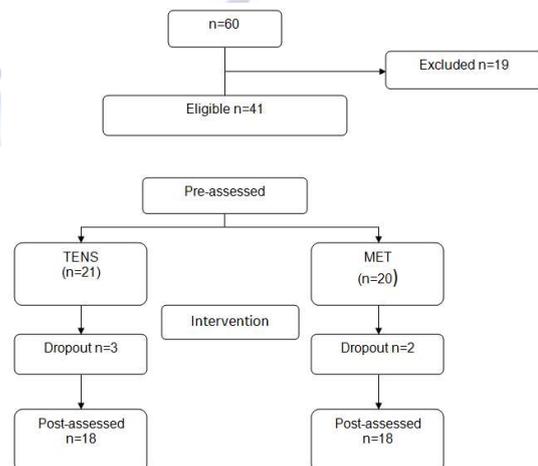
**Application of MET (post isometric relaxation of external rotators):** The patient was in supine lying position with hip and knee in neutral position. One hand of the therapist was placed laterally to the knee of the operated limb and the other was placed laterally to the ankle. The limb was taken in internal rotation in limited range very gradually until the 1st barrier of motion was reached. The patient was then

instructed to perform a 5 second isometric contraction of external rotators in direction of external rotation of approximately 20% of maximum effort compared to normal side against the opposing force provide by the therapist's hand. Following the contraction the limb was internally rotated passively by the therapist and a new movement barrier was reached. This process was repeated for 3 repetitions thus increasing the range of internal rotation.

**Application of TENS:** 4 channel TENS unit was applied to the patient. The electrodes were placed at the corresponding dermatomal level of the area of surgery where the pain was present. The levels corresponding to the most commonly presented areas of the pain were L2, L3, L5, and S1. TENS was applied for 30 minutes for 2 days, twice each day. The parameters for TENS application were frequency is 150 Hz, rectangular waveform, pulse duration 300ms in either supine or side lying position as per patient's comfort.

The effect size was calculated as 1 with 2 tail normal distribution at  $\alpha$  0.05 and power  $(1-\beta)$  0.95 (95%). Hence the sample size comes to 60. 30 each group.

**Consort flowchart:**



(n - sample size)

**Outcome measures:** Visual Analog Scale, Goniometric measurement of range.

When the data collection was done the data was analyzed statistically by the following tests:

Intra group analysis for range of motion	Paired T test
Intra group analysis for pain	Wilcoxon signed rank test
Inter group analysis for range of motion	Independent sample test
Inter group analysis for pain	Mann Whitney U test

**Table 1:** Demographic details for the subjects.

	TENS	MET
Subjects	21	20
Females:	7:14	11:09
Males		
Age	67.72 ± 19.54	63.83 ± 15.37

**Table 2:** Changes in pain and ROM in the TENS group.

Outcome measure	Pre Mean ± SD	Post Mean ± SD	Difference	p Value	95% Confidence Interval of the	
					Lower	Upper
Internal Rotation ROM	21.5 ± 8.66	34.38 ± 7.38	12.88 ± 3.93	0.00*	10.93	14.84
VAS	5.66 ± 1.18	2.05 ± 0.93	3.61 ± 0.97	0.00*		

\* Statistically significant as  $p < 0.05$

**Table 3:** Changes in pain and ROM in the MET group.

Outcome measure	Pre Mean ± SD	Post Mean ± SD	Difference	p Value	95% Confidence Interval of the Difference	
					Lower	Upper
Internal Rotation ROM	24.05 ± 5.77	39.27 ± 4.49	15.22 ± 6.02	0.00*	12.22	18.21
VAS	5.44 ± 1.04	1.83 ± 0.85	3.61 ± 1.14	0.00*		

\*Statistically significant as  $p < 0.05$

**Table 4:** Comparison between both the groups for variations in ROM.

p value non-significant as  $p > 0.05$

Groups	Mean ± SD	95% Confidence Interval of the		p Value
		Lower	Upper	
TENS	12.88 ± 3.93	1.11	5.78	0.14
MET	15.22 ± 6.02			

**Table 5:** Comparison between both the groups for variations in VAS.

Groups	Mean ± SD	p Value
TENS	3.61 ± 0.97	1
MET	3.61 ± 1.14	

p value non-significant as  $p > 0.05$

In this study we found that MET and TENS can help to reduce pain and thereby increasing the patient's ability to internally rotate the hip.

In the intra group analysis for range of motion T test was used for both the groups for which the 2-tailed p value was 0.00 which proves that the change is significant.

Similarly for pain in both the groups Wilcoxon signed rank test was used for which the 2-tailed p value was 0.00 which was significant for both the groups.

But when an inter group analysis was done between TENS and MET the p value for ROM was 0.140 and for pain was 1.00 and the tests used were Independent sample test and Mann

Whitney U test respectively which proved that it is not significant.

## DISCUSSION

TENS was used in this study with a view to block the post surgical pain which had the mechanism of producing analgesia by the pain blockade mechanism produced by the high frequency TENS in which the large diameter afferent fibre are activated thus blocking the pain transmission through the spinal cord. Thus high frequency TENS produces analgesia by activating endogenous inhibitory mechanisms which involves opioid GABA and muscarinic receptors. High frequency TENS also reduces central neuron sensitization and release of the excitatory neuro transmitters glutamate and substance P [2].

As we found in this study that the pain reduction and increase in range of motion due to the TENS application was significant so the possible way for these results could be, due to the pain reduction by the above mechanism there must

be decrease in spasm thus leading to increase in range of internal rotation of hip.

The other technique which was used in this study was MET. The result received that is pain reduction and increase in range of motion were significant which might be due to the following mechanism of the MET in which the isometric contraction of the muscle acts upon it's elastic component in which the sarcomere shortens and lengthening of the fascial and the tendinous structures takes place. The repeated contraction and relaxation of the muscles lead to release in spasm of the muscles but the overall length of the muscle does not change (Lederman 1997,2005). The release in spasm in turn has it's analgesic effect also by either of the following mechanism such as improved drainage of inflammatory substances (Havas et al 1997), the release of endorphins (McPartland 2008) [4,5].

This reduction in pain and spasm thus helped to improve the range of internal rotation if hip. Both these above methods form the vicious cycle of reduction in pain and spasm producing significant results in this study. Hence the difference between the mean values of ROM and VAS when both groups were compared were not significantly different probably because the above mechanisms are interlinked. Hence the results were that the intra group analysis was significant but the inter group analysis was not significant that is the p value was more than 0.05 for both ROM and pain.

To aid faster recovery and to increase the functionality of the patient these 2 methods were compared as these are easy for the patients to understand and also for the therapist to include in the treatment program to inculcate during the hospital stay of the patient.

As both the above methods are proven effective the therapist can choose any of the method depending upon the patient's condition and availability if the infrastructure.

MET can be given in less amount of time as compared to TENS so this method can be easily inculcated in post surgical physiotherapy protocol in the inpatient department (IPD).

Depending upon the activation of contraction of the muscles by the patients post operatively TENS can be beneficial if the isometric contrac-

tion is very difficult by the patient as TENS is easily tolerable by the patient.

To see more generalized effect of the above two methods the study should be carried out in more sample size. Long term follow up of the patients can be taken to evaluate the recovery of these patients with the addition of these methods to the regular treatment protocol.

## CONCLUSION

In this study it can be concluded that both, TENS and MET, are equally effective in pain reduction and hip internal rotation range enhancement in post operative patients of ECNF fracture.

## ABBREVIATIONS

**TENS-** Transcutaneous Electrical Nerve Stimulation

**MET-** Muscle Energy Technique

**ROM-** Range of motion

**VAS-** Visual Analogue Scale

**PFNA/PFNA2-** Proximal Femoral Nail Antirotation

**IR-** Internal Rotation

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**Conflicts of interest: None**

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