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Effectiveness of proprioceptive neuromuscular facilitation and muscle energy technique on unilateral Peri: Arthritis shoulder

Dr. Vaishali Kale[1], Dr. Keerthi Rao[2], Dr. Neha Naik[3]

[1] MPT, Dr. APJ Abdul Kalam College of Physiotherapy, Pravara Institute of Medical Science (Deemed to be University), Loni, Ahmednagar, Maharashtra, India

[2] MPT, HOD, department of orthopedic physiotherapy, Dr. APJ Abdul Kalam College of Physiotherapy, Pravara Institute Of Medical Science(Deemed to be University), Loni, Ahmednagar, Maharashtra, India

[3] MPT, Assistance Professor, Department of Orthopedic Physiotherapy, Dr. APJ Abdul Kalam College of Physiotherapy, Pravara Institute of Medical Science (Deemed to be University), Loni, Ahmednagar, Maharashtra, India

Abstract

Background: Shoulder pain is common and important musculoskeletal problem. It is reported that peri- arthritis shoulder is mostly commonly seen in 2-5% of general population, 19% with type 2 diabetes and hyperthyroidism diseases. Peri – arthritis shoulder is most commonly seen women than male between the ages of 40-65 years. Among manual therapy, Proprioceptive Neuromuscular Facilitation (PNF), Muscle Energy Techniques (MET) in peri – arthritis shoulder has been well studied. Comparing effect of PNF and MET is probably under studied; hence this study aims to find out the effectiveness of PNF and MET on Unilateral peri- Arthritis Shoulder.

Objective: To study the effectiveness of Proprioceptive Neuromuscular Facilitation and Muscle Energy Technique on range of motion and Shoulder Pain and Disability Index (SPADI) in participants with Unilateral peri- Arthritis Shoulder.

Methodology: A total of 40 participants with peri – arthritis shoulder meeting the inclusion and exclusion criteria were allocated into two groups to receive four week treatment of PNF and MET. Pre and post intervention scores were measured.

Results: Post intervention scores of PNF and MET in terms of ROM and SPADI showed significant improvement (p=0.001).In group A(PNF) post intervention mean value of shoulder flexion was 118.8 ± 22.73, shoulder extension 48.10 ± 9.49, shoulder abduction 114.60 ± 21.8, shoulder internal rotation 64.35 ± 9.46, shoulder external rotation 68.85 ± 14.83 and SPADI 33.91 ± 8.89% and in group B(MET) shoulder flexion was 90.55 ± 24.11, shoulder extension36.95 ± 9.79, shoulder abduction 92.55 ± 27.06, shoulder internal rotation56.50 ± 9.05, shoulder external rotation54.95 ± 14.61 and SPADI 13 ± 9.06%. But on comparison between two groups, it was observed that there was group A (PNF) showed statistically significant than group B (MET).

Conclusion: The prospective comparative study concluded that PNF is effective in increasing ROM and reducing percentage of SPADI than MET in participants with unilateral peri-arthritis shoulder.

Keywords: peri-arthritis shoulder, proprioceptive neuromuscular facilitation, muscle energy technique group, shoulder pain and disability index

Introduction

Shoulder joint is a synovial ball and socket type of joint. It has a highest degree of freedom as well as it is most mobile joint in the body. Structurally it is a weak joint because the glenoid cavity is too small and shallow to hold the head of humerus in place. This arrangement permits greater mobility. Stability of joint is provided by muscles, coraco-acromial arch, musculo-tendinous cuff and glenoid labrum [1].

Shoulder pain is common and important musculoskeletal problem. The most common causes of shoulder pain and disability in primary care are rotator cuff disorders, glenohumeral disorders and diseases, referred neck pain, traumatic disorder and acromioclavicular joint disorders [2]. Peri – arthritis shoulder is characterized by painful and limited active and passive range of motion. Peri- arthritis shoulder also called as adhesive capsulitis, frozen shoulder, stiff and painful shoulder, scapula humeral peri-arthritis, tendinitis of short rotators and adherent subacromial bursitis [3]. It is reported that peri- arthritis of shoulder is most commonly seen in 2-5% of general population, 19% with type 2 diabetes and hyperthyroidism diseases [4, 5]. Peri – arthritis of shoulder is most commonly seen between the ages of 40 and 65 years.[6] Women are more commonly affected than male because sexual hormones are responsible for adhesive capsulitis. Lower level of testosterone could influence the epidemiology of adhesive capsulitis [7, 8, 9].

There are four stages of peri-arthritis shoulder. Stage I (Synovium stage), Stage II (Freezing stage), Stage III (Frozen stage) and Stage IV (Thawing stage).In peri- arthritis shoulder pain is located over the antero-lateral aspect of the joint and radiates to the anterior aspect of the upper arm. Tenderness is generalized about the humeral head and over the bicipital groove. Active and passive motions are limited in all directions; pain gets aggravated at the end of motion [10]. The goal of treatment of peri – arthritis shoulder is to restore pain and to achieve complete range of motion. It can be treated with conservatively and operatively. The Proprioceptive Neuromuscular Facilitation treatment method is an important treatment to increase the flexibility, stability and muscle strength [11] Proprioceptive Neuromuscular

Facilitation stretch is a technique commonly used in clinical environments to enhance both active and passive range of motion with the ultimate goal to optimize motor performance and rehabilitation [12, 13].

Muscle Energy Technique is a form of osteopathic manipulative diagnosis and treatment in which the patient's muscles are actively used on request, from a precisely controlled position, in a specific direction, against a distinctly executed physician counterforce. Muscle Energy Techniques are used in treatment of somatic dysfunction especially decreased range of motion, muscular hyper tonicity and pain. Muscle Energy Techniques are form of soft-tissue, joint manipulations or mobilizations, derived from osteopathic medicine, employed in the treatment of musculoskeletal dysfunction [14].

There are number of reports on effects of Muscle Energy Technique on peri arthritis shoulder and effects of Proprioceptive Neuromuscular Facilitation and conventional physiotherapy on peri – arthritis shoulder. However, to the best of knowledge, the comparison of effectiveness of Muscle Energy Technique and Proprioceptive Neuromuscular Facilitation technique in peri – arthritis shoulder patients have not been much studied. With background of consideration, the present study has been planned find out the effectiveness of Muscle Energy Technique (MET) and Proprioceptive Neuromuscular Facilitation (PNF) intervention among subjects with peri- arthritis shoulder.

Method

The study conducted was a prospective comparative study. 40 participants were included in the study according to the inclusion and exclusion criteria. They were explained about the study and the intervention. The participants were briefed about the nature of study, the duration of intervention and the intervention being used in the language best understood by the participant. An informed written consent form, previously approved by the Institutional Ethical Committee (Dr. A. P. J. Abdul Kalam College of Physiotherapy, Loni) was then obtained from the participants. The demographic data and a detailed assessment were collected. Participants were subsequently allocated into two groups based on the method of simple randomized sampling. Intervention was given for 5days for 4 weeks Range of Motion and SPADI (Shoulder Pain and Disability Index) questioner was taken pre and post intervention then results were tabulated.

Procedure

The two groups were treated as follows: Group A (PNF) and Group B (MET). The intervention was given for the duration of 5 days per week for 4 weeks and session was for 20 min per session.

Group A: Group A was treated with Proprioceptive Neuromuscular Facilitation of D1 flexion, D1 extension, D2 flexion and D2 extension [15].

PNF for Shoulder D1 Flexion

Participants were positioned in supine. Therapist placed middle and index finger of hand in palm of participants hand and other hand on volar surface of distal forearm of elbow. Therapist apply quick stretch to wrist and finger and instruct participants to squeeze finger, turn palm, pull arm up and across your face against resistance applied by therapist. Therapist complete pattern with arm across the face in shoulder flexion, adduction, external rotation, partial elbow flexion, forearm supination and wrist and finger flexion. This procedure was for 10 repetitions per set, 3 sets per session.

PNF for Shoulder D1 Extension

Participants were positioned in supine. Therapist placed hand over dorsal surface of participants hand and finger with therapist hand using lumbrical grip and other hand on extensor surface of arm just proximal to elbow. Then therapists applied quick stretch to wrist and finger extensor and instruct participants to open hand then push arm down and out. Therapist completes the pattern in shoulder extension, elbow extension, abduction, internal rotation, elbow extension, forearm pronation, wrist and finger extension. This procedure was for 10 repetitions per set, 3 sets per session.

PNF for Shoulder D2 Flexion

Participants were positioned in supine. Therapist placed one hand on dorsum of hand using lumbrical grip and other hand over dorsum surface of forearm close to elbow. Therapist applies quick stretch to wrist and finger extensors and instructs participants to open hand and turn it to your face; lift your arm up and out and point thumb out. Therapist completes the pattern in shoulder flexion, abduction, external rotation, elbow extension, forearm supination, wrist and finger extension. (The arm should be 8-10 inch from ear, thumb shoulder be pointing to floor.)

PNF for Shoulder D2 Extension

Participants were positioned in Supine. Therapist placed index and middle finger of hand in palm of participants and other hand on volar surface of forearm or distal humerus. Therapist applies quick stretch to wrist and finger and instructs the participant to squeeze therapist finger and pull down across your chest. Therapist complete the pattern in shoulder extension, adduction, internal rotation, elbow extension, forearm pronation, wrist and finger flexion. (The forearm should cross the umbilical).

Group B: Group B was treated with Muscle Energy Technique for flexion, extension, abduction, medial rotation and lateral rotation of shoulder [16].

MET for Shoulder Flexors

Participants were positioned supine on treatment table with shoulder and elbow flexed. Therapist placed one hand under scapula and other hand over distal part of humerus. The participants were instructed to extend shoulder against approximately 25% of force applied by therapist. This force was maintained for 5-10 second. Then participant were allow to relax and new movement barrier was engaged. After 5-10 second of contraction and complete relaxation of efforts, therapist gently checks the increase range of motion. This procedure was repeated for 3 times.

MET for Shoulder Extensors

Participants were positioned side lying at the side of table with involved shoulder up. Therapist placed hand over posterior aspect of humeral head and other hand on the distal humerus to extend the shoulder and take up the tissue tension to restrictive barrier of shoulder extension. The participants were instructed to flex shoulder against approximately 25% force applied by therapist. This force was maintained for 5-

10 second. Then participant were allow to relax and new movement barrier was engaged. After 5-10 second of contraction and complete relaxation of efforts, therapist gently checks the increase range of motion. This procedure was repeated for 3 times.

MET for Shoulder Abductors

Participants were position in side lying at the edge of the table with involved shoulder up. Therapist stands perpendicular to participant and placed participants hands in abduction (arm needs to neutral). Therapist placed one hand around the proximal humerus with finger tips at superior portion of the humerus. Participants were instructed to adduct shoulder against approximately 25% force applied by therapist. This force was maintained for 5- 10 second. Then participant were allow to relax and new movement barrier was engaged. After 5-10 second of contraction and complete relaxation of efforts, therapist gently checks the increase range of motion. This procedure was repeated for 3 times.

MET for Shoulder Lateral Rotators

Participants were position in supine at the side of table shoulder 90 degree abduction and elbow 90 degree flexion. Therapist placed one hand on clavicle and other hand over forearm. Therapist move the arm into lateral rotation until 1st barrier of motion was reached. Participants were instructed to perform medial rotation against approximately 25% force applied by therapist. This force was maintained for 5- 10 second. Then participant were allow to relax and new movement barrier was engaged. After 5-10 second of contraction and complete relaxation of efforts, therapist gently checks the increase range of motion. This procedure was repeated for 3 times.

MET for Shoulder Medial Rotators

Therapist stood on the affected side of the participant. Participants were position Supine at the side of table shoulder 90 degree abduction and elbow 90 degree flexion. Therapist placed one hand on the top of shoulder and other over forearm. Therapist move the arm into medial rotation until 1st barrier of motion was reached. Participants were instructed to perform lateral rotation against approximately 25% force applied by therapist. This force was maintained for 5- 10 second. Then participant were allow to relax and new movement barrier was engaged. After 5-10 second of contraction and complete relaxation of efforts, therapist gently checks the increase range of motion. This procedure was repeated for 3 times.

Data analysis

The results were analyzed on basis of data obtained pre and post intervention using Shoulder Pain and Disability Index (SPADI) and goniometer to check the shoulder range of motion. Data was analyzed using SYSTAT version 12. Descriptive statistics for all outcome measures were expressed as mean, standard deviations and test of significance such as paired "t" test used for comparing the data within each group and unpaired "t" test for comparing the data between the groups.

Table 1: Comparison of mean values of all parameters in from Pre to Post treatment in Group A-PNF (n=20)

Parameters (In Degree)	Pre treatment	Post treatment	Student's Paired 't' test value	'p' value	Result / Significance
	Mean ± SD	Mean ± SD			
Flexion	73.10 ± 6.81	118.8 ± 22.73	13.83	p=0.001	Significant
Extension	26.25 ± 6.81	48.10 ± 9.49	11.98	p=0.001	Significant
Abduction	67.75 ± 26.08	114.60 ± 21.68	8.77	p=0.001	Significant
Internal Rotation	44.25 ± 9.94	64.35 ± 9.46	9.26	p=0.001	Significant
External Rotation	42.70 ± 15.88	68.85 ± 14.83	7.61	p=0.001	Significant
SPADI	78.4 ± 8.31%	33.91 ± 8.89%	23.12	p=0.001	Significant

Table 2: Comparison of mean values of all parameters in from Pre to Post treatment in Group B -MET (n=20)

Parameters	Pre treatment	Post treatment	Student's Paired 't' test value	'p' value	Result / Significance
	Mean ± SD	Mean ± SD			
Flexion ^{0}	74.80±24.06	90.55±24.11	2.92	p=0.001	Significant
Extension	26.15±8.53	36.95±9.79	5.27	p=0.001	Significant
Abduction	72.95±26.92	92.55±27.06	3.24	p=0.001	Significant
Internal Rotation	45.75±9.41	56.50±9.05	5.21	p=0.001	Significant
External Rotation	43.00±14.49	54.95±14.61	3.67	p=0.001	Significant
SPADI	73.33%±12.01%	46.13%±9.06%	11.54	p=0.001	Significant

Table 3: Comparison of mean values of all parameters at Post treatment in Group A - PNF and in Group B - MET (n=20)

Parameters (In Degree)	Group A	Group B	Student's Unpaired 't' test value	'p' value	Result / Significance
	Mean ± SD	Mean ± SD			
Flexion	118.8 ± 22.73	90.55 ± 24.11	2.26	p=0.097	Significant
Extension	48.10 ± 9.49	36.95 ± 9.79	1.99	p=0.084	Significant
Abduction	114.60 ± 21.68	92.55 ± 27.06	2.12	p=0.081	Significant
Internal Rotation	64.35 ± 9.46	56.50 ± 9.05	2.03	p=0.091	Significant
External Rotation	68.85 ± 14.83	54.95 ± 14.61	2.09	p=0.094	Significant
SPADI	33.91 ± 8.89%	46.13 ± 9.06%	2.98	p=0.001	Significant

Table 4: Comparison of Percentage increased/decreased in mean values of all parameters from Pre-treatment to Post treatment in Group A - PNF and in Group B - MET (n=20) Each

Parameters	Percentage increase/decrease from Pre-treatment to Post treatment	
	Group A	Group B
Flexion	62.51% ⬆	23.78% ⬆
Extension	83.24% ⬆	23.18% ⬆
Abduction	69.15% ⬆	19.24% ⬆
Internal Rotation	45. 42% ⬆	12.20% ⬆
External Rotation	61.24% ⬆	20.19% ⬆
SPADI	-56.74% ⬆	-36.03% ⬆

Result

The results of present study showed significant difference in Range of Motion and percentage of Shoulder Pain and Disability Index (SPADI) after 4 weeks of treatment between the groups (Proprioceptive Neuromuscular Facilitation and Muscle Energy Technique) in participants with unilateral peri – arthritis shoulder.

Discussion

The results of study showed that both Proprioceptive Neuromuscular Facilitation (PNF) and Muscle Energy Technique (MET) are effective in improving the shoulder range of motion in participants with unilateral peri- arthritis shoulder. Then after data analysis results of present study showed that PNF technique is more effective in improvement of range of motion and reduction in percentage of SPADI than MET in participants with unilateral peri – arthritis shoulder.

PNF is aimed at relaxing tense muscles and restricted joints to make quick gains in ROM [17]. PNF technique includes patterns of movements that are rotational, multi-axial and multidirectional which provides proper neuromuscular function. These movements are used to decrease pain, increase the range of motion and improve the function. PNF activates agonist and antagonist which provide the greatest potential for muscle tendon as it lengthens the Golgi tendon organ which stimulates relaxing antagonist muscles [18, 19].

In MET, the reduction in pain is due to joint movement and isometric muscle contraction that will stimulate joint and muscle proprioceptors. This may produce pain relief according to the Gate-control theory, where mechanoreceptor afferents carried by large diameter axons inhibit nociceptors afferents at the dorsal horn of the spinal cord. MET stimulates joint proprioceptors via the production of joint movement or the stretching of a joint capsule, may be capable of reducing pain by inhibiting the smaller diameter nociceptive neuronal input at the spinal cord level. MET is not so effective in improving shoulder ROM and function in adhesive capsulitis because post isometric relaxation appears to reach mainly the muscular parts of the treated motion segment and less to the other parts such as affiliated joint capsule, ligaments and fascia [20]. MET mainly works on reducing spasm or tightness of muscle by first resetting the muscle spindle and inhibiting the muscles by activating the Golgi tendon. Proposed mechanism by which passive manual stretches facilitates the collagen and regain of muscle length. This would then allow for increased joint ROM. The possible explanation of the increase in ROM relies on the effect of autogenic inhibition. The effect of MET for increase in range of motion can be explained on the basis of physiological mechanisms behind the changes in muscle extensibility- reflex relaxation, viscoelastic changes and changes to stretch changes. Combination of contractions and stretches is more effective because the forces could produce increased viscoelastic change. The effect of PNF to increase in ROM, PNF is a technique involving combinations of alternating contraction and stretches. Whose goal is facilitation of agonist muscle thereby increase the recruitment of additional motor neurons or increase the excitability of the motor neurons [21, 22].

Parveen kumar *et al.* (2015) stated that PNF exercise are more effective in improving in flexibility. The findings indicate that it is possible to significantly increase range of motion in people with chronic low back pain by use of a 4-week intensive PNF exercise program. PNF exercises take advantage of the body's inhibitory reflexes to improve muscle relaxation. This muscle relaxation allows a greater stretch magnitude during stretch training, which should result in superior gains in flexibility. In the present study also PNF groups shows more improvement than MET group [23].

Comparison between the two groups revealed that there were faster improvement in the group A than group B which proved Proprioceptive Neuromuscular Facilitation is effective than Muscle Energy Technique. Based on the results of this both study, the Muscle Energy Technique and Proprioceptive Neuromuscular Facilitation are effective methods to increase shoulder range of motion and for reduction of SPADI score in participants with unilateral peri-arthritis shoulder. PNF stretching is more effective than the MET in increasing range of motion and decreasing percentage of SPADI score.

Conclusion

On the basis of present study, it can be concluded that PNF is effective in increasing range of motion and reducing percentage of SPADI score than MET group in participants with unilateral peri –arthritis shoulder.

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Implications to practice

The use of various electrotherapeutic modalities and mobilization techniques can relieve the peri – arthritis shoulder but the rehabilitation is incomplete without focusing the treatment to the shoulder muscles (which are a recognized cause of shoulder pain). To treat peri – arthritis shoulder various conventional physiotherapeutic treatments are used but the use of Proprioceptive Neuromuscular Facilitation and Muscle Energy Technique is rare. Now days, when everybody wants quick relief from pain, Proprioceptive Neuromuscular Facilitation and Muscle Energy Technique can be considered as an effective, safe and simple option to reduce the pain, to improve range of motion and to reduce functional disability. Hence, Proprioceptive Neuromuscular Facilitation and Muscle Energy Technique must be used in clinical practice to reduce pain, to increase the ROM and to reduce functional disability.

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