THE EFFECTS OF TAPING NEUROMUSCULAR COMPARE TO PHYSICAL THERAPIES MODALITIES IN PATIENTS WITH ADHESIVE CAPSULITIS OF THE SHOULDER

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Abstract

Adhesive capsulitis is a common painful condition characterized by severe loss of mobility and shoulder pain. Patients with this disease have a painful restriction of both active and passive mobility and an overall loss of shoulder movement in all planes. This experimental design study investigated the effect of combination of taping neuromuscular and stretching exercises program compared to ultrasounds and stretching exercises program. A total of 40 patients aged between 40 and 60 years were involved in the study. Patients were divided in two groups: first group subjected of neuromuscular taping +stretching exercises program for 4 weeks (experimental group 20 patients) and a second group subjected of a daily program of physical therapy + stretching exercises (control group 20 patients). They were evaluated using visual analogue scales for pain, goniometric measure for passive and active range of motion, SPADI index for shoulder function and patient satisfaction. Analysis showed statistically significant improvement in both the experimental and control groups. In addition, the mean improvement in VAS was significantly greater after first week in the experimental group than in the control group. The study showed that the combination of taping with stretching exercises program leads to better outcomes in rehabilitation of patients with frozen shoulder especially when an immediate effect is needed.

Keywords: Adhesive exercises, taping neuromuscular, ultrasound, laser, stretching exercises.

Introduction:

Adhesive capsulitis is a condition that affects the shoulder joint and is characterized by an important pain and significant loss of active and passive mobility of the shoulder. Adhesive capsulitis has an incidence of 3–5% in the general population and up to 20% in those with diabetes (Miller et al., 1996). This condition occurs mainly in people aged between 40-60 years, with a higher incidence in women. (Urwin M, Symmons 1998). It is due to an inflammatory process resulting in the formation of adhesions between the capsule, anatomical neck of the humerus and the inferior capsular recess(Codman et al., 1934;Neviaser et al., 1945). Although the exact pathophysiologic cause of this pathology remains elusive, there are two types identified in the literature, idiopathic and secondary adhesive capsulitis. Idiopathic or "primary" adhesive capsulitis occurs spontaneously without a specific precipitating event. Primary adhesive capsulitis results from a chronic inflammatory response to fibroblastic proliferation, which may actually be an abnormal

response from the immune system. Secondary adhesive capsulitis occurs after a shoulder injury or surgery, or may be associated with another condition such as diabetes, rotator cuff injury, cerebrovascular accident or cardiovascular disease, which may prolong recovery and limit outcomes. The onset of this condition is usually gradual and idiopathic, patients experience the following stages of the condition; a freezing or painful stage, followed by stiffness, frozen or transitional phase, and finally a thaw- ing phase, characterized by increased ROM (Leung MS et al., 2008;Manske RC et al., 2008). Treatments advocated for adhesive capsulitis include rehabilitation as the initial conservative measure, anti-inflammatory drugs, intra- articular corticosteroids, capsular distension injections, and surgical interventions in refractory cases (Oglivie-Harris & Myerthall, 1997). Various treatments (Carette et al., 2003;Philadelphia Panel, 2001;Harris JD, et al., 2011), including stretching, mobilization and manipulation techniques, have been advocated for restoration of a pain-free state and normal use of the upper extremity. The rehabilitative interventions performed depend on the institution. There is as yet no definitive agreement on the most effective form of treatment. The optimal use of physical therapies and the frequency and timing of session criteria have not yet been established (Green S, et al., 2003). Neuromuscular taping is a relatively new technique used in rehabilitation programs of adhesive capsulitis. Although it has been commonly used in orthopedic and sports settings, it is increasingly becoming an adjunct treatment option for the other musculoskeletal impairments.

Materials and methods

Purpose

This experimental design study investigates the effect of combination of taping neuromuscular and stretching exercises program (SEP)compared with physical therapies and SEP in patients with adhesive capsulitis.

Method and samples

This is a comparative study. Adults with a diagnosis of adhesive capsulitis were referred from a rheumatologist shoulder clinic. A total of 40 patients aged 40-60 years were involved in the study. The patients were treated between March and September 2014 in"Fisiomed"centre of rehabilitation for outpatients. They were randomly allocated into two groups: the first group recieved neuromuscular taping + SEP (NMT group) and the second group received physical therapies + SEP (PHT group).The randomization was done in blind using sealed envelopes in which were written the names of the patients. They were screened for the clinical presentation of adhesive capsulitis by trained physiotherapists with the following eligibility criteria:

Inclusion criteria:

1. Age between 40 and 60 years
2. Significant pain and loss of active and passive mobility of the shoulder
3. An absence of radiological evidence of glenohumeral joint arthritis;
4. Symptoms present for at least 3 months
5. Men and woman who were willing of to participate in the study(Cyriax,1993; Griggs et al., 2000).

Exclusion criteria:

1. Secondary adhesive capsulitis
2. Local corticosteroid injection to the affected shoulder within the last 3 months
3. Pregnancy

4. History of metastatic cancer or diagnosis of cancer within 12 months
5. Unstable angina
6. Prior shoulder surgery

Ethical approval was granted by the relevant ethics committee, and written informed consent was obtained from each participant after they were fully informed of the plan and goals of treatment. An explicit explation was given about each individual`s freedom to refuse to participate in the study or to withdraw it at any point, without suffering any ill effects whatsoever.

Study protocol

Neuromuscular taping group received a standardized aplication of a double cross fun taping 3 times a week at the end of SEP suggested by(Blow et al. 2012). A daily program of physical therapy modalities (intermittent ultrasound of 1 MHz and 1 W/cm^2 for 5 min and high power laser for 10 min) were used in PHT group for 4 weeks. Both groups received a daily stretching exercises program included abduction in the scapular plane, flexion with the patient in the supine position, and rotations during abduction (the degree of abduction was increased according to the patient's progress and tolerance level). Each stretch was maintained for 30 s, with 15 s rest between stretches. Treatment was provided by experienced and trained physiotherapists with an international qualification for neuro muscular taping, physical and manual therapy.

Outcome measure

Primary outcome measures were Visual Analogue Scale for pain(VAS) (Costant et al., 1987;Clarck P, et al., 2003), standard goniometric ROM examination, Shoulder Pain and Disability Index (SPADI) (MacDermid J et al 2006). An improvement of 2 points or more on Visual Analogue Scale (VAS) was defined as a clinically important difference. A minimum change of 30% in range of motion was considered as a clinically important improvement, an improvement of 11 points in the total SPADI score(Williams JW, et al 1995) were considered as minimum clinically important changes. As secondary outcome measures we used the Patients' Satisfaction with Treatment (PST). A minimum change of 30% was considered as a clinically important improvement (Farrar JT et al 2001).The patients were assessed before the treatment (initial evaluation) and after first and forth weeks for the VAS, ROM, SPADI score. The PST was assessed only before and after the four week of treatment.

Statistical analysis

The two-tailed paired T-test was used to find the treatment effect (increase in ROM and reduction in the pain and SPADI scores) and to compare the outcomes between the two groups. The Pearson χ^2-test was used to find the significance of study parameters on a categorial scale between the two groups. A value of $P < 0,5$ was considered significant. SPSS 15 software was used for statistical calculation (Bailey, 1997).

Results

A total of 40 patients ((20 in NMT group and 20 in the PHT group) completed the treatment period of 4 weeks. The average age of the NMT group patients was 52 years±8 (range 44-60) and the average age of the PHT group was 51±6 years (range 43-60) Table 1.

13 were women (65%), 7 were men (35%) in the NMT group **,** 8 were men (40%) and 12 were women (60%) in the PHT group Table 2

In the NMT group 7 patients had the left shoulder affected and 13 had the right. The PT group had 8 patients with left shoulder affected and 12 with the right. In both groups the

majority of the patients had affected the right shoulder Table 3. The two groups were similar in terms of age, sex, involved shoulder.

Table 1. *Age distribution of subjects studied*

Age in years	***NMT*** *Group*		***PT*** *Group*	
	N	*%*	*N*	*%*
40-45	5	25	4	20
46-50	4	20	6	30
51-55	7	35	5	25
56-60	4	20	5	25
Total	20	100	20	100
Mean±SD	52±8		51±6	

Table 2. *The gender distribution of subjects studied*

Gender	***NMT*** *Group*		***PT*** *Group*	
	N	*%*	*N*	*%*
Male	7	35	8	40
Female	13	65	12	60
Total	20	100	20	100

Table 3. *Affected Shoulder of subjects studied*

Affected Shoulder	***NMT*** *Group*		***PT*** *Group*	
	N	*%*	*N*	*%*
Left	7	35	8	40
Right	13	65	12	60
Total	20	100	20	100

Pain VAS score

VAS scores decreased significantly in both treatment groups as compared with the baseline levels. The pain scores of the neuromuscular taping group were significantly lower (p values=0.001) at the first week examination as compared with the physical therapy group. However, there was no significant difference in the same parameters between two groups at the second week (p value=0,21) (Table 4).

Table 4. *Comparison of VAS (pain) between two groups*

VAS (pain)	***NMT*** *Group mean±SD*	***PT*** *Group mean±SD*	***P value***
Baseline	6,1±1,4	6,5±1,5	0.42
After 1W	3.4±1,8	4,9±1,3	0.001
After 4W	2.9±1,5	3±1,2	0.21

SD -*standard deviation*, 1W-*first week*, 4W-*forth week*

Range of motion

In both groups, ROM in flexion, abduction, and external rotation improved significantly after treatment ($p = 0.001$). Patients in NMT group had significantly higher forward elevation and abduction after treatment after first week of treatment($p < 0.01$). There was not much difference between the NMT group and PT group after four week of treatment(p=0,15,p=108, p=0.178) and there was not much difference between the NMT

group and PT group after first and four week of treatment for the external rotation (p=0.109 p=0,22) (Table 5).

Table 5. *Comparison of ROM between two groups*

ROM	***NMT***	***PT***	***P value***
	Group mean±SD	*Group mean±SD*	
Abduction			
Baseline	79±13	78±15	0,173
After 1W	92±13,4	84±12	< **0.01**
After 4W	129±16	128,7±15	0.15
Forword elevation			
Baseline	97±14	98±13	0,67
After 1W	106±13	101±12	< **0.01**
After 4W	138±13	137,9±13	0.108
External rotation			
Baseline	25±18	26±16	0.178
After 1W	29±14,1	28±15,2	0.09
After 4W	31,6±17	31±14	0.22

SD -*standard deviation*, 1W-*first week*, 4W-*forth week*

SPADI disability score

Both groups improved significantly after 4 weeks in total SPADI score and its sub-score. Patients in NMT group had lower disability scores after first week of treatment(p<**0.01**) there was not much difference between the NMT group and PT group after four week of treatment(p=0.16, p=0.58, p=0.71) (Table 6).

Table 6. *Comparison of SPADI scores between two groups*

SPADI	***NMT***	***PT***	***P value***
	Group mean±SD	*Group mean±SD*	
SPADI sub-score for pain			
Baseline	36±17,2	35,67± 18,1	0,69
After 1W	29,5 ±13,3	32,4±17,3	<**0.01**
After 4W	24,38±18,1	24,92±17,8	0.16
SPADI sub-score for function			
Baseline	57,68±11,4	56,84±16,2	0,23
After 1W	46,1±14,8	51±12,3	<**0.01**
After 4W	31,67±13,5	32,32±17,3	0.058
SPADI total score			
Baseline	94±17.6	92.51±17,3	0,17
After 1W	75,6±13,5	83,52±12,7	<**0.01**
After 4W	52,95±16,7	53,14±18,1	0,071

SD -*standard deviation*, 1W-*first week*, 4W-*forth week*

Patients satisfaction after treatment

In both groups patients reported better results afer treatment (p=0.001) (Table 7).

Table 7. *Patients satisfaction after treatment*

ROM	***NMT***	***PT***	***P value***
	Group	*Group*	
Worse	0	0	**<0.001**
Same	0	0	-
Slightly better	4	5	-
Better	16	15	-

Discussion

The purpose of this study was to compare the short-term efficacy of NMT+ SEP compared with PT and SEP. In our rehabilitation protocol of experimental group we preferred taping neuromuscular, which is indicated in the inflammatory response of soft tissue around the shoulder. Most of the patients with frozen shoulder had night pain, and some manual therapy techniques could be painful. The taping neuromuscular was aimed to decrease the pain and inflammatory response.

It was demonstrated that both strategies are effective in reducing pain and restoring ROM and shoulder function in patients with adhesive capsulitis. We identified a significant improvement of the outcomes after first week of treatment in the NMT group. There was no significant difference after fourth week of the treatment.

The pain scores of the NMT group were significantly lower (p values=0.001) at the first week examination as compared with the PH group (Table4). We think that the sudden effects may have been potentially due to NMT, which reduces mechanical irritation of the involved soft tissue structures and reorients the shoulder movements through an arc of improved glenohumeral motion. Taping provides immediate sensorimotor feedback, and patients often report symptom relief, improved comfort level, or stability of the involved joint. These results are consistent with those found by a study among 42 subjects with rotator cuff tendonitis/impingemen, where was observed that NMT provides an immediate effect on pain and the active ROM, however, without any improvements in disability scores (Thelen et al., 2008). Also, another study claimed that the effects of taping may be due to the sensorimotor and proprioceptive feedback mechanisms (Simoneau G et al., 1997).

The range of motion (Table 5) in flexion, abduction, and external rotation improved significantly after treatment in both groups ($p = 0.001$). Patients in NMT group had significantly higher forward elevation and abduction after treatment after first week of treatment($(p < 0.01)$. There was not much difference between the NMT group and PT group after four weeks of treatment. We think that these findings are also emphasizing the role of muscle imbalance which should be implemented to the NMT as well as the exercises stretching program

NMT can improve the following musculoskeletal conditions: strengthen weakened muscles, control joint instability, assist the postural alignment, and relax the over- used muscles.

In our study we combined NMT and PT with stretching exercise programe. A study conducted by Griggs et al., (2000) has demonstrated that the vast majority of patients who have idiopathic adhesive capsulitis can improve successfully ROM with a specific 4-direction shoulder stretching programme. Also,various authors have previously reported improvements in range of motion by using NMT (Frazier S et al., 2006; Jaraczewska E, et al., 2006; Murray H, et al., 2001; Osterhues DJ et al., 2004; Yoshida A et al., 2007(Selkowitz DM,et al 2007,;Smith M, et al., 2009).

SPADI index score (Table 6) improved significantly after 4 weeks in both groups. Patients in NMT group had lower disability scores after first week of treatment in total

SPADI score and its sub-score ($p<0.01$).

Increase of ROM and pain reduction after implementation of our protocols for NMT and PT groups improved the Disability scores. Results consistent with the results of a study in patients with various shoulder problems by NMT and PT at the same time (Frazier et al., 2006).

Patients satisfaction (Table 7): all the patients were satisfied after treatment because we did not include multiple techniques and NMT provides immediate sensorimotor feedback, and patients often reported symptom relief, improved comfort level, and stability of the involved joint. We think that the immediate effect of NMT may be considered as a very important advantage as compared with the local physical therapy modalities. This is also a favorable result which may increase the performance during exercise that is an indispensible step of the treatment process.

Another important practical difference of two treatment options is the duration and frequency of the application. Local modalities are usually performed daily for 2–4 weeks as we preferred in our study. However, NMT is performed three times within the same period and showed similar effectiveness (Smith M, et al., 2009).

Therefore, we may conclude that NMT may be preferred as an alternative treatment option when an immediate effect by shorter application durations is needed.

Conclusion

Adhesive capsulitis is a common disorder in which definitive treatment is still uncertain. The study shows that the patients with frozen shoulder can be treated successfully with physiotherapy but the combination of neuromuscular taping with stretching exercises program leads to better outcomes in rehabilitation of patients with frozen shoulder. Despite the small sample that was used study provides an efficient protocol to help the physiotherapists for rehabilitation of patients with frozen shoulder. Future studies also need to involve large numbers of patients, and measure both short-term and long-term outcomes. More research is also needed to establish a standard protocol of treatment for frozen shoulder, and to develop valid and reliable outcome measures for these conditions.

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