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Results of combined physiotherapy in patients with clinical sings of shoulder impingement syndrome : a randomized controlled trial

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Abstract

Shoulder pain is a very common disorder, affecting approximately 16% to 21% of the population. Moreover, nearly one-fifth of all disability payments for musculoskeletal disorders are for patients with shoulder disorders. The most frequent cause of shoulder pain is shoulder impingement syndrome, accounting for 44% to 60% of all complaints of shoulder pain during a physician office visit.

The aim of the study was to investigate the effects of combination of taping neuromuscular with individually adapted exercises and individually adapted exercises alone in patient with shoulder impingement syndrome.

A total of 60 patients aged between 18-75 years with diagnosis of shoulder impingement syndrome were involved in this comparative study. The patients were randomly allocated into two groups: first group(experimental group) subjected of 12 sessions of individually adapted exercises +neuromuscular taping and a second (control group) group subjected of 12 sessions of individually adapted exercises. The patients was assessed by SPADI index score before and after the treatment.

The results showed statistically significant improvement in SPADI index score in both the experimental and control groups. In our rehabilitation protocol of experimental group we preferred taping neuromuscular, which is indicated for the inflammatory response of soft tissue around the shoulder and the mean improvement was significantly greater in the experimental group than in the control group.

Shoulder impingement syndrome is a common disorder in which definitive treatment is still uncertain. The study shows that the patients with this disorder can be treated successfully with individually adapted exercises but the combination of taping with individually adapted exercises gives better outcomes.

Keywords: *neuromuscular taping, shoulder pain, exercises*

1. Introduction

Shoulder pain is a very common disorder, affecting approximately 16% to 21% of the population. Moreover, nearly one-fifth of all disability payments for musculoskeletal disorders are for patients with shoulder disorders. The most frequent cause of shoulder pain is shoulder impingement syndrome, accounting for 44% to 60% of all complaints of shoulder pain during a physician office visit (Urwin M et al 1999, Östör AJK et al 2005).

Shoulder impingement syndrome (SIS) has been defined as compression and mechanical abrasion of the rotator cuff structures as they pass beneath the coracoacromial arch during elevation of the arm (Neer et al 1983). SIS is characterized by pain and functional restrictions, mostly during overhead activities (Lewis et al 2005). Multiple theories have been proposed to explain the primary etiology of shoulder impingement, including anatomic abnormalities of the coracoacromial arch or humeral head, " tension overload," ischemia, or degeneration of the rotator cuff tendons; and shoulder kinematic abnormalities (Ludewig et al 2000). Inflammation in the suprahumeral space, inhibition of the rotator cuff muscles, damage to the rotator cuff tendons, and altered kinematics are believed to exacerbate the condition (Kamkar et al 1993). Kinematic changes have been thought to be present in patients with impingement syndrome and to result in narrowing of the supraspinatus muscle outlet or suprahumeral space. The vast majority of these cases are initially treated nonoperatively. Conservative treatment of patients with impingement symptoms commonly includes exercise programs intended to restore " normal" kinematics or muscle activity patterns. The clinical efficacy of several different treatment regimens have been studied. (Gerdesmeyer et al 2003, Green et al 2003, Johansson et al 2005, Walther et al 2004). Altered function of lower trapezius and serratus anterior has been found to influence the scapular movement and associate with subsequently poor shoulder function and chronic impingement problems(Kibler et al 2003, Cools et al 2002) and Ludewig and Cook 2000 observed inhibition of the serratus anterior and lower trapezius and over activation of the upper trapezius muscle in the subjects with shoulder impingement syndrome. Most of the current rehabilitation protocols mainly emphasize the idea of the restoration of the scapular control and the role of various muscles among the subacromial space (Lunden et al 2010, Escamilla et al 2009).

Although the neuromuscular taping (NMT) has been increasingly used in the rehabilitation protocols and prevention of sports injuries, there is no clear evidence regarding potential mechanisms underlying the beneficial effects of NMT. One of the aims of NMT techniques is to normalize the scapulohumeral rhythm by altering the scapular muscle activity and correcting abnormal scapular position. The activity of lower trapezius was found to be increased in the 60–30° arm lowering phase by NMT as compared with the sham application in baseball players with shoulder impingement syndrome(Hsu YH et al 2009). It has been proposed that the control of scapula and the shoulder could be provided by the constant proprioceptive feedback, alignment correction during dynamic movements with NMT. It has been shown that NMT promotes the proximal stability of the scapula allowing free humeral movements without pain (Host et al 1995). Kase described different types of taping methods like space correction or lymphatic correction which primarily aim to increase the subacromial space beside the control

of the muscles stabilizing the scapula (Kase et al 2003)

2. Purpose

The aim of the study was to investigate the effects of combination of taping neuromuscular with individually adapted exercises and individually adapted exercises alone in patient with shoulder impingement syndrome.

3. Method and samples

This is a comparative study. Adults with a diagnosis of shoulder impingement syndrome were referred from a rheumatologist shoulder clinic. A total of 60 patients aged 18-75 years were involved in the study. The patients were treated between January and December 2014 in "Fisiomed" centre of rehabilitation for outpatients. They were randomly allocated into two groups: the first group recieved neuromuscular taping + individually adapted exercises (NMT group) and the second group received only individually adapted exercises (IAE 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 SIS by trained physiotherapists with the following eligibility criteria (He´bert et al 2003b Hughes et al 2008).
Inclusion criteria:

1. Age between 18 and 75 years.
2. Pain before 150° of active shoulder elevation in any plane.
3. Positive Neer or Hawkins–Kennedy test indicating possible impingement signs.
4. Pain on resisted lateral abduction or Jobe test.

Exclusion criteria:

1. Intra-articular steroid injection.
2. Shoulder girdle fracture.
3. Glenohumeral dislocation/subluxation.
4. Acromioclavicular sprain.
5. Concomitant cervical symptoms consistent with radiculopathy.
6. History of a shoulder surgery within the previous 12 weeks, or shoulder pain which lasted more than 6 months.

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.

4. Study protocol

Neuromuscular taping group received a standardized application of a double cross fun taping 3 times a week at the end of IAE suggested by David Blow 2012. Both groups received a daily

individually adapted exercises program included dynamic shoulder exercises, isometric shoulder exercises, neck exercises and stretching exercises. The aim of the intervention was firstly to promote proper scapula kinematic during arm elevation against gravity and secondly, to strengthen the scapulohumeral and scapulothoracic muscles with an external resistance. The decision to introduce strengthening exercises with an external resistance only when proper shoulder control has been observed was taken to ensure a gradual loading of the muscle-tendon-bone units without any setback in the pain level. It resulted that during the intervention more emphasis was put on shoulder control. Exercises of increasing difficulty in terms of movement plane, ROM, number of repetitions, speed and resistance were performed.
Treatment was provided by experienced and trained physiotherapists with an international qualification for neuro muscular taping and manual therapy.

5. 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) (Mac Dermid 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.

6. 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 X^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).

7. Results

A total of 60 patients ((30 in NMT group and 30 in the IAE group) completed the treatment period of 4 weeks. The average age of the NMT group patients was 38,84±6,2 years and the average age of the IAE group was 33,45±6,45 years Table 1.
13 were women (42%), 18 were men (58%) in the NMT group , 14 were men (48%) and 15 were women (52%) in the SEP group Table 2
In the NMT group 10 patients had the left shoulder affected and 21 had the right. The IAE group had 9 patients with left shoulder affected and 18 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

	NMT *Group*	***IAE*** *Group*
	Age in yers	***Age in years***
Mean	33,84	33,45
St deviation	32	31
Median	27	25
Mode	6,22	6,43
Minimun	25	25
Maximun	45	45

Table 2. The gender distribution of subjects studied

Gender	***NMT*** *Group*		***IAE*** *Group*	
	N	*%*	*N*	*%*
Male	18	58	14	48
Female	13	42	15	52
Total	31	100	29	100

Table 3. Affected Shoulder of subjects studied

Affected Shoulder	NMT Group		IAE Group	
	N	%	N	%
Left	10	33	9	38
Right	21	67	18	62
Total	31	100	29	100

Pain VAS score

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

VAS (pain)	NMT	IAE	P value
	Group mean±SD*	Group mean±SD	
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

Table 5. Comparison of ROM between two groups

ROM	NMT	IAE	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

Table 6. Comparison of SPADI scores between two groups

SPADI	NMT	IAE	P value
	Group mean±SD*	Group mean±SD*	
SPADI sub-score for pain			
Baseline	36±17,2	35,67± 18,1	0,67
After 1W*	29,5 ±13,3	32,4±17,3	<0.01
After 4W*	24,38±18,1	24,92±17,8	0.14
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

Table 7. Patients satisfaction after treatment

ROM	NMT	IAE	P value
	Group	Group	
Worse	0	0	<0.001
Same	0	0	-
Slightly better	5	4	-
Better	26	25	-

8. Discussion

The purpose of this study was to compare the short-term efficacy of NMT+ individually adapted exercises compared with individually adapted exercises alone. 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 shoulder impingement syndrome 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 SIS. 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 IAE 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/impingement, 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 IAE 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 IAE 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 IAE groups improved the Disability scores. Results consistent with the results of a study in patients with various shoulder problems by NMT and IAE at the same time (Frazier et al., 2006 Smith et al 2009).

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

9. Conclusion

Shoulder impingement syndrome is a common disorder in which definitive treatment is still uncertain. The study shows that the patients with SIS 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 SIS. 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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