The efficacy of designed physical therapy program on frozen shoulder syndrome

Moussa A.Sharaf[1], Emad T. Ahmed[2], Amr A. Abdel-aziem[3]

Departments of : [1]Physical Therapy for Neurology and Neurosurgery; [2]Physical Therapy for Surgery and [3]Physical Therapy for Biomechanics. College of Applied Medical Science, Taif University, KSA.
moussasharaf@gmail.com

Abstract: Frozen shoulder is one of the most causes of shoulder pain that results in pain and limitation of range of motion which causes a serious limitation in function which need early and progressive physical therapy intervention. This study was conducted to evaluate the effectiveness of a designed physical therapy program on the treatment of frozen shoulder syndrome. One hundred patients who have frozen shoulder participated in this study. Their age ranged from 40–60. They were divided randomly into two equal groups; study group and control group. All patients were evaluated for intensity of pain, range of motion of shoulder flexion, shoulder abduction and shoulder external rotation and muscle testing for shoulder flexors, shoulder abductors and shoulder external rotators. The results of this study showed significant improvement in both groups in favour of study group. It can be concluded that, the combined effect of LASER, ultrasound, stretching and mobilization have more efficacy in the treatment of frozen shoulder.

[Moussa A. Sharaf, Emad T. Ahmed, Amr A. Abdel-aziem. **The efficacy of designed physical therapy program on frozen shoulder syndrome**. *J Am Sci* 2013;9(8):1-6]. (ISSN: 1545-1003). http://www.jofamericanscience.org. 1

Keywords: Frozen shoulder, Shoulder pain, Adhesive capsulitis, LASER.

1.Introduction

Frozen shoulder is a condition where the shoulder joint (glenohumeral joint) gradually becomes stiff, resulting in loss of movement. It may involve other restrictions in motion in the surrounding muscles and shoulder blade (scapula) movements.[1] It is an insidious condition that begin with pain, then gradual restriction of movement in the shoulder in all planes. Frozen shoulder is the main cause of shoulder pain and dysfunction in the middle age and elderly population.[2] It is a commonly encountered clinical complaint. It is encountered by clinicians, Rheumatologists, Orthopaedic surgeons and physical therapists. Defining 'frozen shoulder' is not straightforward.[3] It has been used incorrectly as a general diagnosis for shoulder pain and stiffness. The definition, aetiology, pathophysiology and treatment of this condition are subjects of debate.[4]

The non-dominant arm is more likely to be involved, although about 12% of people are affected bilaterally.[5] Frozen shoulder syndrome is common affecting 2-5% of the general population, whilst in diabetics the incidence is between 10-20%.[6] Other factors such as depression, immunologic factors, posture and occupation have been implicated in the aetiology.[7]

The natural history of this condition is well documented.[4] Frozen shoulder passes through the three phases of freezing, frozen and thawing. The freezing (painful) phase lasts between 2.5 and 8 months. This phase is a reactive phase. Night pain is a common feature of this phase. This is followed by the frozen (stiff) phase, which lasts between 4 and 12 months. There may still be night pain but this usually diminishes as gleno-humeral mobility decreases. Stretching may be effective in this phase. Spontaneous recovery of mobility (thawing) follows over the next 4 to 12 months although full recovery is commonly protracted. After the thawing phase, an objective restriction of mobility may often persist for several years.[8]

The most commonly affected movements are external rotation and abduction of the glenohumeral joint. Patients commonly complain of sharp pain reaching for the back pocket, combing the hair, or doing up the bra.[9] The arm does not swing when walking. At rest the arm is often held in adduction and internal rotation, and the scapula of the affected side is usually elevated, laterally rotated and abducted. Depending on the longevity of symptoms, the body may develop a compensatory mechanical adaptation. [8] Frozen shoulder is a challenging condition for both the physical therapist and patient.[10]

The definitive treatment for frozen shoulder remains unclear even though multiple interventions have been studied including oral medications,[11] corticosteroid injections,[12] exercise,[12-14] joint mobilization,[15-17] acupuncture,[18] manipulation,[19-21] nerve blocks[22] and surgery.[23-25] Unfortunately, varied inclusion criteria, different treatment protocols, and various outcome assessments render study comparison difficult. Management of this disorder focuses on restoring joint movement and reducing shoulder pain, involving medications, physical therapy, and/or surgical intervention. Treatment may continue for months, there is no strong evidence to

favor any particular approach.[26] Medications frequently used include NSAIDs; corticosteroids are used in some cases either through local injection or systemically. Physiotherapy may include massage therapy and daily extensive stretching.[1]

Patients may have more than a dozen physical therapy sessions during this time including ultrasound, mobilization and exercise regimens. Transcutaneous electrical nerve stimulation (TENS) are commonly used to alleviate pain.[27] Ultrasound (US) is used as a therapeutic modality for many conditions and for soft tissue disorders. US can exert effects on the cells and tissues via thermal and nonthermal mechanisms.[28,29] Nonthermal effects are claimed to promote healing, although this has not been proven with in vivo studies.[29]

The aim of the current study was to evaluate the effectiveness of a designed physical therapy program on the treatment of frozen shoulder syndrome.

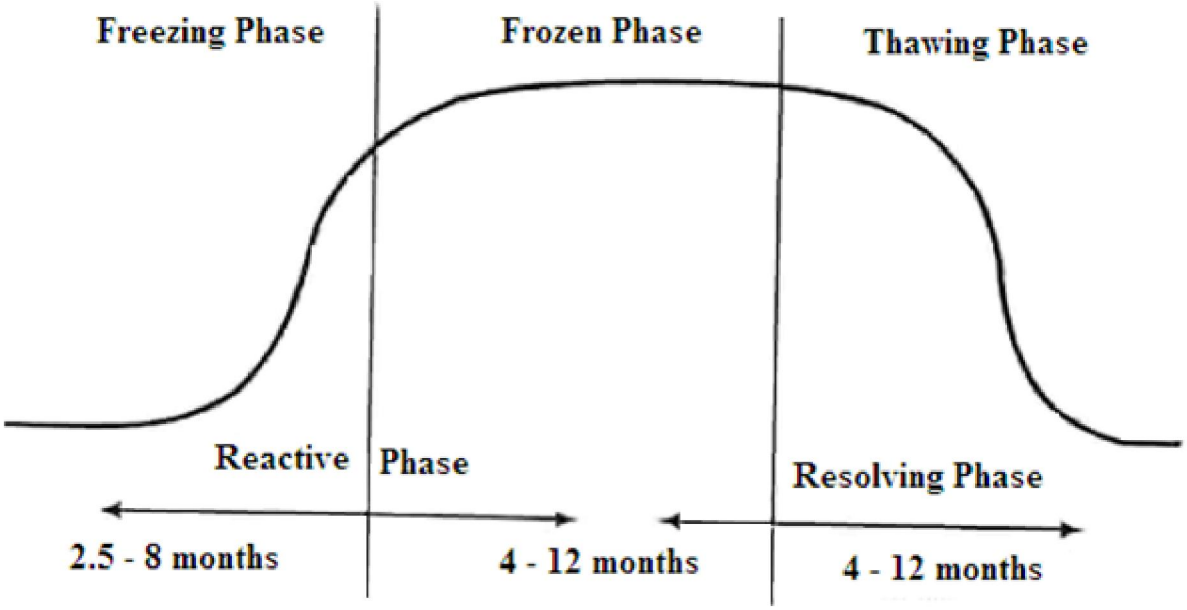

Fig. 1: Phases of frozen shoulder

2. Subjects, Materials and Methods

Subject selection:

This study was carried out on 100 patient who are complaining from frozen shoulder. They were selected from a general governmental hospital. An experimental study of a new designed physical therapy program performed on 100 patients with frozen shoulder. All patients fulfilled the inclusion criteria:

Inclusion criteria:

- Their age ranged from 40 – 60 years old.
- History of shoulder pain and stiffness of the shoulder for more than one month.
- Flexion < 120°, abduction < 100° and external rotation < 40°.

Exclusion criteria:

Patients were excluded if they:

- had previous surgery in the shoulder joint.
- had rotator cuff tear.
- history of recent severe trauma.
- had disorders in the cervical spine and neurological pathologies.

Patients were randomly divided into 2 equal groups; study group (Group A) and control group (Group B).

Procedures:

A. Assessment procedures:

Full history taking and full examination for those patients were conducted before participation in this study to ensure that those patient fulfilled the inclusion criteria.

Full examination should include:

- Assessment of pain by using visual analogue scale. Patients were asked to fill in a linear 10cm visual analogue pain scale.
- Range of motion (ROM) of all movements of the shoulder joint including, shoulder flexion, shoulder abduction and shoulder external rotation. This was conducted by using goniometer. Flexion and abduction of the shoulder joint were measured from sitting position, while external rotation of the shoulder joint was measured from prone lying position.[30]
- Assessment of active and passive ROM were conducted. Passive motions were assessed from

supine lying position to appreciate the quality of the resistance to motion at the end of passive movement (end feel).
- Manual muscle testing of the muscles around the shoulder joint including shoulder flexors, shoulder abductors and shoulder external rotators.[31]
- Assessment procedures repeated three times; before treatment (pre-treatment), after 2 months and at the end of the treatment (post-treatment).
- A full examination for the upper-quarter of the body was performed before participation in the study to rule out pathology of the cervical spine and other neurological pathologies.

B. Treatment procedures:

The study group (Group A) received a designed physical therapy program in the form of:

- TENS to decrease pain.
- Laser to decrease pain and alter pathology that occurs in case of frozen shoulder.
- Ultrasound therapy to improve the extensibility of soft tissues around the shoulder.
- Stretching of the tight structures.
- Strengthening exercises: strengthening exercises conducted for all muscles around the shoulder specially shoulder flexors, shoulder abductors and shoulder external rotators as follows:

Closed-chain isometric strengthening.
- Open-chain strengthening with Therabands.
- Light isotonic dumbbell exercises.
* Mobilization exercises for the shoulder joint and the scapula-costal articulation.

The control group (Group B) received the traditional physical therapy program which consists of just mobilization and TENS application.

The treatment continued for four months for control group and study group.

Data analysis

Statistical analyses were performed using the software package SPSS for Windows, version 16. A repeated measures analysis of variance was performed to examine the change in each outcome measure among the study groups and across treatment sessions. The analysis of variance was followed by Tukey's post hoc multiple comparisons. The level of significance (alpha) was set at 0.05 and the least significant difference test was used to adjust the inflation of alpha due to multiple comparisons.

3. Results

This study was conducted to evaluate the efficacy of a designed physical therapy program on the treatment of frozen shoulder syndrome. This study was carried out on 100 patients who were divided randomly into two equal groups; study group (n=50) and control group (n=50). The results of this study showed the following:

1- Concerning general characteristics of subjects:

The results showed no significant differences between both groups as shown in table 1.

Table 1: General characteristic of the patients

Variable	Group A(n=50)	Group B (n=50)	t-value	P-value
Age (year)	50.76 ±5.15	49.74±5.43	0.964	0.544
Weight (Kg)	75.5±4.36	74.7±4.65	0.865	0.758
Height (cm.)	176.4±5.72	175.42±5.74	0.89	0.87
Duration of illness (month)	4.04±1.27	3.94±1.3	0.388	0.889

2- Concerning assessment of pain by using visual analogue scale (VAS):

The results showed significant decrease in intensity of pain in both group in favour of the study group (group A) at pre-treatment, after two months and at post-treatment as shown in table 2. Independent t-test proved that there was no significant difference between the two groups for pain level at pre-treatment (p= 0.359). On the other hand, the pain level of study group was significantly lower than that of control group at after 2 months (p= 0.02) and at post-treatment (p= 0.001).

Table 2: Comparison between both groups at pre-treatment, after 2 months and post-treatment mean values of pain intensity according to VAS:

Variable	Pre-treatment	After 2 months	Post-treatment	F-value	P-value
Group A	5.24±1.60	3.70±1.37	2.48±1.15	18.43	0.000
Group B	5.54±1.66	4.34±1.33	3.30±1.30	15.968	0.000

3- Concerning measurement of ROM of the shoulder joint:

The results showed significant improvement in ROM of shoulder flexion, shoulder abduction and shoulder external rotation in both group at pre-treatment, after 2 months and at post-treatment in favour of the study group as shown in table 3. Regarding shoulder flexion, independent t-test proved that there was no significant difference between the two groups at pre-treatment mean values of shoulder flexion ROM (p= 0.433) while, the mean values of shoulder flexion was significantly higher in study group at after 2 months (p= 0.033) and at post-treatment (p= 0.006).

As well, the analysis of the results of shoulder abduction showed that, there was no significant difference between the two groups at pre-treatment (p= 0.751) while, the value of study group was significantly higher at after 2 months (p= 0.005) and at post-treatment (p= 0.000). For shoulder external rotation; independent t-test proved that there was no significant difference between the two groups for pre-treatment mean values (p= 0.530). On the other hand, the mean values of study group was significantly higher at after 2 months (p= 0.015) and at post-treatment (p= 0.001).

Table 3: Comparison between both groups at pre-treatment, after 2 months and post-treatment mean values of ROM of shoulder flexion, shoulder abduction and shoulder external rotation:

Variable		Pre-treatment	After 2 months	Post-treatment	F-value	P-value
Shoulder flexion	Group A	118.56±17.40	129.22±20.03	137.48±19.29	560.638	0.000
	Group B	115.48±16.27	121.7±14.22	128.16±13.56	134.81	0.000
Shoulder abduction	Group A	75.32±15.89	97.60±18.67	117.48±17.30	505.279	0.000
	Group B	76.58±16.10	88.04±14.02	94.26±12.68	207.746	0.000
Shoulder external rotation	Group A	22.36±11.81	35.56±12.44	40.62±12.34	338.654	0.000
	Group B	25.82±12.62	29.64±11.44	32.82±10.92	289.542	0.000

4- Concerning manual muscle testing:

The results showed significant improvement in the muscle power of shoulder flexors, shoulder abductors, and shoulder external rotators in both group at pre-treatment, after 2 months and at post-treatment in favour of the study group as shown in table 4.

Table 4: Comparison between both groups at pre-treatment, after 2 months and post-treatment mean values of muscle power of shoulder flexors, shoulder abductors and shoulder external rotators:

Variable		Pre-treatment	After 2 months	Post-treatment	F-value	P-value
Shoulder flexors	Group A	2.96±0.832	3.48±0.707	4.2±0.756	32.984	0.000
	Group B	3.08±0.804	3.32±0.741	4±0.756	19.337	0.000
Shoulder abductors	Group A	2.58±0.575	3.22±0.582	3.88±0.521	67.455	0.000
	Group B	2.6±0.571	3±0.495	3.48±0.505	35.249	0.000
Shoulder external rotators	Group A	2.56±0.705	3.2±0.639	3.88±0.659	48.821	0.000
	Group B	2.66±0.658	2.94±0.586	3.5±0.505	26.604	0.000

4.Discussion

This study was conducted to evaluate the effectiveness of a designed physical therapy program on the treatment of frozen shoulder syndrome. The main findings of this study revealed significant differences among pre-treatment, after 2 months and post-treatment as regarding to intensity of pain, shoulder flexion, shoulder abduction, shoulder

external rotation, muscle power of shoulder flexors, shoulder abductors and shoulder external rotators in both groups (in favour of the study group).

Concerning the significant improvement in the control group, this appears to be attributable to the effect of traditional physical therapy treatment.

It can be justified as follows TENS alleviated pain in patient in the control group, as it blocks pain through both peripheral and central mechanisms.[32] This opinion is supported by the opinions of **Indeck & Printy,[33] Kaada,[34]** who concluded that TENS is often used to treat pain in variety of acute and chronic musculoskeletal conditions.

The use of TENS alleviated pain in addition to the added effect of mobilization were suggested to be the cause for pain relief and increasing ROM[15,16] and give a chance for patients to move the shoulder joint in all directions and so increased muscle power of shoulder flexors, shoulder abductors and shoulder external rotators. This findings are supported by the findings of **Dewan & Sharma.[35]** This is in consistent with the opinion of **Rizk et al,[36]** who found that TENS has been shown to significantly increase range of motion more than heat combined with exercise and manipulation.

Concerning the study group, there was a significant improvement more than that in the control group it can be explained by the added effect of LASER can explain the better results of pain relieve for the study group. This opinion is in agreement with the opinion of **Stergioulas,[37]** who stated that, low-power laser therapy is more effective for treatment of patients with adhesive capsulitis. This is also, supported by the opinion of **Trelles et al,[38]** who found that LASER therapy elicited the following types of effects: biostimulatory, analgesic, anti-exudative, antihaemorrhagic, anti-inflammatory, anti-neuralgic, anti-oedematous, anti-spasmotic and vasodilatory.

Additionally, the use of ultrasound and stretching were suggested to decrease pain and inflammation and increased ROM through improving microcirculation and increase of collagen and tendon extensibility. This is supported by the opinion of **Mao et al,[2] Basford,[39]** and **Leung & Cheing.[40]**

As well, the significant improvement in the study group more than that in the control group might be explained by the added effect of mobilization[15,16] and exercises. This is supported by the opinion of **Jewell et al,.[41]** They suggested that joint mobilization and exercise were the most effective interventions.

Conclusion and Recommendations

The combined effect of LASER, ultrasound, stretching and mobilization have more efficacy in the treatment of frozen shoulder as they can relieve pain, improve range of motion and improve functional activities.

References

1. Ewald, A. Adhesive capsulitis: A review. American family physician. 83 (4): 417–422, 2011.
2. Mao C-Y, Jaw W-C, Cheng H-c. Frozen shoulder: correlation between the response to physical therapy and follow-up shoulder arthrography. Arch Phys Med Rehabil. 78: 857-859, 1997.
3. Baslund B: Frozen shoulder current concepts. Scandinavian J Rheumatology 19: 321-325, 1990.
4. Grubbs N: Frozen shoulder syndrome – a review of literature. JOSPT. 18: 479-487, 1993.
5. Wadsworth CT: Frozen shoulder Phys Ther. 66:1878-1883, 1986
6. Pal B, Anderson J, Dick WC, Griffiths ID: Limitation of joint mobility and shoulder capsulitis in insulin and Non-insulin dependent diabetes mellitus. Br J Rheumatol. 25: 147-151, 1986.
7. Murnaghan JP: Frozen shoulder. In: Rockwood CA, Matsen FA (Eds.) The shoulder. Philadelphia: W B Saunders Co., pp. 837-862, 1990.
8. Reeves B. The natural history of the frozen shoulder. Scandinavian Jour Rheumatol. 4: 193-196, 1975.
9. Kesler RM: The shoulder. In: Kesler RM, Hertling D (Eds.), Management of Common Musculo-Skeletal Disorders. Philadelphia: Harper and Row, pp. 274-310, 1983.
10. Page P, Labbe A. Adhesive capsulitis: use the evidence to integrate your interventions. N Am J Sports Phys Ther. 2010 December; 5(4): 266–273
11. Binder AI, Hazleman BL, Parr G, Roberts S. A controlled study of oral prednisolone in frozen shoulder. Br J Rheumatol. 25: 288-292, 1986.
12. Carette S, Moffet H, Tardif J. Intraarticular corticosteroids, supervised physiotherapy, or a combination of the two in the treatment of adhesive capsulitis of the shoulder: a placebocontrolled trial. Arthritis Rheum. 48: 829-838, 2003.
13. Griggs SM, Ahn A, Green A. Idiopathic adhesive capsulitis. A prospective functional outcome study of nonoperative treatment. J Bone Joint Surg Am. 82-A:1398-1407, 2000.
14. Arslan S, Celiker R. Comparison of the efficacy of local corticosteroid injection and physical therapy for the treatment of adhesive capsulitis. Rheumatol Int. 21: 20-23, 2001.
15. Vermeulen HM, Obermann WR, Burger BJ, Kok GJ, Rozing PM, van Den Ende CH. End-range mobilization techniques in adhesive capsulitis of the shoulder joint: A multiple-subject case report. Phys Ther. 80: 1204-1213, 2000.
16. Vermeulen HM, Rozing PM, Obermann WR, le Cessie S, Vliet Vlieland TP. Comparison of high-grade and low-grade mobilization techniques in the management of adhesive capsulitis of the shoulder:

randomized controlled trial. Phys Ther. 86: 355-368, 2006.
17. Johnson AJ, Godges JJ, Zimmerman GJ, Ounanian LL. The effect of anterior versus posterior glide joint mobilization on external rotation range of motion in patients with shoulder adhesive capsulitis. J Orthop Sports Phys Ther. 37: 88-99, 2007.
18. Tukmachi ES. Frozen shoulder: A comparison of western and traditional chinese approaches and a clinical study of its acupuncture treatment. Acupuncture Med. 17: 9-22, 1999.
19. Hill JJ, Bogumill H. Manipulation in the treatment of frozen shoulder. Orthopedics. 11: 1255-1260, 1988.
20. Roubal PJ, Dobritt D, Placzek JD. Glenohumeral gliding manipulation following interscalene brachial plexus block in patients with adhesive capsulitis. J Orthop Sports Phys Ther. 24: 66-77, 1996.
21. Dodenhoff RM, Levy O, Wilson A, Copeland SA. Manipulation under anesthesia for primary frozen shoulder: effect on early recovery and return to activity. J Shoulder Elbow Surg. 9: 23-26, 2000.
22. Dahan TH, Fortin L, Pelletier M, Petit M, Vadeboncoeur R, Suissa S. Double blind randomized clinical trial examining the efficacy of bupivacaine suprascapular nerve blocks in frozen shoulder. J Rheumatol. 27: 1464-1469, 2000.
23. Andersen NH, Sojbjerg JO, Johannsen HV, Sneppen O. Frozen shoulder: arthroscopy and manipulation under general anesthesia and early passive motion. J Shoulder Elbow Surg. 7: 218-222, 1998.
24. Gerber C, Espinosa N, Perren TG. Arthroscopic treatment of shoulder stiffness. Clin Orthop Relat Res. 459: 119-128, 2001.
25. Berghs BM, Sole-Molins X, Bunker TD. Arthroscopic release of adhesive capsulitis. J Shoulder Elbow Surg. 13: 180-185, 2004.
26. Kelley MJ, Mcclure PW, Leggin BG. Frozen Shoulder: Evidence and a Proposed Model Guiding Rehabilitation J Orthop Sports Phys Ther. 39:135-148, 2009.
27. Winters J, Sobel J, Groenier K, Arendzen H, Jong B: Comparison of Physiotherapy, Manipulation and Corticosteroid injection for treating shoulder complaints in general practice: Randomised, single blind study. BMJ. 1997: 314: 1320-1325, 1997.
28. Young S. Ultrasound therapy. In: Kitchen S, Bazin S, eds. Electrotherapy: Evidence-Based Practice. China: Churchill Livingstone, pp. 211–230, 2002.
29. Baker KG, Robertson VJ, Duck FA. A review of therapeutic ultrasound: biophysical effects. Phys Ther. 81: 1351–1358, 2001.
30. Norkin, C.C., White, D.J. Measurement of Joint Motion: A Guide to Goniometry, 2nd Edition. Davis, Philadelphia, 1995.
31. Hislop HJ, Montgomery J. Daniels and Worthingham's: muscle testing, techniques of manual examination, 6th ed. Philadelphia: W.B. Saunders Company, 1995.
32. Sluka KA. The Neurobiology of pain and foundations for electrical stimulation. In: Robinson AJ, Snyder-Mackler L, editors. Clinical Electrophysiology. Lippincott Williams & Wilkins; Philadelphia, pp. 107–149, 2008.
33. Indeck W, Printy A: Skin application of electrical impulses for relief of pain. Minn Med 17:305-309, 1975.
34. Kaada B: Treatment of peritendinitis calcarea of the shoulder by transcutaneous nerve stimulation. Acupunct Electrother Res 9:115-125,1984
35. Dewan A., Sharma R. Effectiveness of transcutaneous electrical nerve stimulation and interferential electrotherapy in adhesive capsulitis. Pb Journal of Orthopaedics 12: 64-71, 2011.
36. Rizk TE, Christopher RP, Pinals RS, Higgins AC, Frix R. Adhesive capsulitis (frozen shoulder): a new approach to its management. Arch Phys Med Rehabil. 64:29-33, 1983.
37. Stergioulas A. Low-power laser treatment in patients with frozen shoulder: preliminary results. Photomed Laser Surg. 26: 99–105, 2008.
38. Trelles M.A, Mayayo E., Miro L. The action of low reactive Level Laser Therapy (LLLT) on mast cells: a possible relief mechanism examined. Laser Therapy. 1, 27 -30, 1989.
39. Basford JR. Therapeutic physical agents. In: DeLisa JA, editor. Physical medicine and rehabilitation. Principles and practice. Philadelphia: Lippincott Williams & Wilkins, p. 251-70, 2005.
40. Leung M. S., Cheing G. L. Effects of deep and superficial heating in the management of frozen shoulder. J Rehabil Med. 40:145–150, 2008.
41. Jewell D. V., Riddle D. L., Thacker L. R. Interventions associated with an increased or decreased likelihood of pain reduction and improved function in patients with adhesive capsulitis: a retrospective cohort study. Phys Ther. 89: 419–429, 2009.