

Comparison of the early response to two methods of rehabilitation in adhesive capsulitis

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Summary

Principle: A randomised, comparative prospective clinical trial was planned to compare the early response to different rehabilitation methods for adhesive capsulitis taking into consideration the clinical efficacy and the cost effectiveness of the methods.

Methods: Forty patients with adhesive capsulitis were randomised into two treatment groups. The first group (CYR) received the Cyriax approach of deep friction massage and mobilisation exercises three times weekly. The second group (PT) had daily physical therapy including hot pack and short wave diathermy application. Both groups concluded their treatments with stretching exercises and were also instructed to a daily home exercise program. The primary end point of the study was to reach 80% of the normal passive range of motion (ROM) of the shoulder in all planes within a period of two weeks. Secondary end points

were the overall ROM and pain response (spontaneous pain, night pain and pain with motion) to each treatment.

Results: 19 patients in the CYR group (95%) and 13 patients in the PT group (65%) reached sufficient ROM at the end of the second week ($p < 0.05$). The improvement in shoulder flexion, inner and outer rotation values and the decrease in pain with motion were significantly better in the CYR group after the first week of treatment.

Conclusion: The Cyriax method of rehabilitation provides a faster and better response than the conventional physical therapy methods in the early phase of treatment in adhesive capsulitis. The method is non-invasive, effective and requires fewer hospital visits for a sufficient early response.

Key words: adhesive capsulitis; frozen shoulder; treatment; physical therapy; Cyriax

Introduction

Adhesive capsulitis (frozen shoulder) is an insidious painful condition with gradual restriction of all planes of movement in the shoulder. It is the main cause of shoulder pain and dysfunction in middle aged and elderly populations [1, 2]. It can be due to idiopathic or post-traumatic causes but the term adhesive capsulitis should be reserved for the idiopathic type of shoulder stiffness. Factors associated with adhesive capsulitis include female gender, age older than 40 years, trauma, immobilisation, diabetes, thyroid disease, stroke, myocardial infarction, the presence of autoimmune diseases, cervical spine disorders and reflex sympathetic dystrophy syndrome [1-3]. Idiopathic (primary) adhesive capsulitis is characterised by fibrosis of the capsule resulting with progressive, painful loss of active and passive shoulder motion. Reeves [4] has described three stages of the disease: Stage I is mainly characterised by pain usually lasting 2-9 months. In Stage II (frozen stage); pain

gradually subsides but stiffness is marked lasting 4-12 months. In Stage III (thawing phase); pain resolves and improvement in range of motion (ROM) appears.

While many treatments have been employed in the management of shoulder disorders, few have been proven to be effective in randomised controlled trials. Nonsteroidal anti-inflammatory drugs, local anaesthetic and corticosteroid injections into the glenohumeral joint, calcitonin and antidepressants, distension arthrography, closed manipulation, physical therapy modalities and stretching exercises can be listed among the most common non-surgical approaches to treatment in adhesive capsulitis [5-14]. Physical therapy is often the first line of management for shoulder pain, yet to date its efficacy has not been established [11]. Although education regarding frozen shoulder and simple home stretching exercises have been shown to improve self-assessed shoulder function and

health status in patients with adhesive capsulitis [14], lack of sufficient data from randomised controlled trials comparing different rehabilitation techniques is remarkable. A Cochrane review of randomised trials of interventions delivered by a physiotherapist in study populations suffering from a shoulder disorder, reveals no evidence of a benefit of physical therapy when used alone [15].

The self-limiting nature of adhesive capsulitis complicates the discussion of the efficacy of any treatment method in the long term. Bulgen et al. [5] have stated that there is little advantage of any of their treatment regimens over no treatment within 8 months despite the beneficial effect of corticosteroid injections in the short-term. Recently, Carette et al. [16] published a placebo-controlled trial in which they discuss the transient benefit of corticosteroid injection with or without physiotherapy within the first 3 months. Their treatment groups were similar to the placebo group with respect to all outcome measures by the end of 12 months.

Recently published literature has researched the efficacy of rehabilitation programs applied for as long as 12–16 weeks in adhesive capsulitis [8, 10, 17]. In fact the majority of the improvement is

reached within the first few weeks of the treatment after which the rate of progress decreases. In the long term, the outcome is similar with benign neglect or placebo [5, 16]. Therefore it seems reasonable to use a hospital-based treatment program aimed at a rapid recovery rate with a minimum number of visits to the hospital after which a follow-up period with a home exercise program can be prescribed. This, in our opinion, would diminish the negative effects of a hospital-based rehabilitation procedure on patients' daily life and their subsequent compliance.

We aimed this study at comparing the initial effects of a treatment method for adhesive capsulitis described by Cyriax [18] consisting of deep friction massage and manipulation with the commonly used physical therapy approach of superficial and deep heating using hot packs and short wave diathermy. Our main concern was to take into consideration the beneficial effect of one technique over the other in terms of the speed of the clinical efficacy in the initial phase. The requirement of fewer hospital visits necessary for the Cyriax technique would reflect an additional health care advantage for the treatment of adhesive capsulitis.

Patients and methods

The study was conducted at the outpatient clinic of the Department of Physical Medicine and Rehabilitation, Medical Faculty of Cukurova University, Adana, Turkey. The local ethics committee approved the study protocol and written informed consent was received from all patients enrolled in the study.

Patients

The study population consisted of 40 patients between 40–85 years of age. The criteria for inclusion in the study were (1) shoulder pain of minimum 2 months duration with no major shoulder trauma, (2) marked loss of active and passive shoulder motion, (3) pain with motion with a minimum visual analogue scale (VAS) score of 30 mm, (4) normal findings on anteroposterior and axillary lateral radiographs of the glenohumeral joint (5) absence of polyarthritis or neurological diseases or cervical neuropathy and (6) absence of medical conditions such as cardiac disease, infections, coagulation disorders. Patients who had adhesive capsulitis secondary to shoulder dislocation, fractures, reflex sympathetic dystrophy and rotator cuff tears were excluded from the study group. All patients were assessed by an experienced physiatrist by history and physical examination. The patients were questioned about their age, sex, history of any systemic and metabolic diseases, previous treatments and duration of pain. The measurement of spontaneous pain, night pain and pain with motion was conducted by means of a 100 mm VAS.

Documenting the initial ROM, especially of passive motion, is critical in determining the efficacy of the treatment plan in adhesive capsulitis [2]. The study was planned to compare the efficacy of the two methods over a short period of time in which it would be hard to compare functional improvement. Therefore, passive ROM of the shoulder was measured in all planes with a long-arm go-

niometer while the patients were lying supine. Shoulder flexion was assessed in the sagittal plane with the arm at the side and the hand pronated, while shoulder abduction was measured in the frontal plane with the arm at the side and the shoulder externally rotated to obtain maximum abduction. Shoulder inner and outer rotation were measured in the transverse plane while the arm was abducted to 90 degrees, the elbow flexed to 90 degrees, the hand pronated and the forearm perpendicular to floor [19].

Serum samples were obtained to evaluate complete blood count and routine biochemical analysis to exclude secondary factors. Chest and shoulder x-rays were evaluated by the same physician.

60 patients with a diagnosis of adhesive capsulitis were invited for randomisation. 14 of the patients did not meet the inclusion criteria, 3 refused to participate because of transport problems and 1 refused to participate in the trial for personal reasons. 42 patients were randomised for enrolment in the study. The patients were numbered sequentially and allocated to two groups (the Cyriax group and the physical therapy group). One patient in the CYR group were excluded from the study due to poor compliance and one from the PT group discontinued the intervention due to attacks of unstable hypertension in the first week.

Intervention

Following a one-week washout period, the patients were invited to the therapy sessions. The pre-treatment evaluation of shoulder pain and ROM was carried out by a blinded observer at the beginning of the study. The CYR group received the Cyriax approach to therapy with hourly sessions in the hospital three times a week (Monday, Wednesday, Friday). The treatment program consisted of deep friction massage and manipulation performed by the same experienced physical therapist. The PT group was

invited to the hospital every day excluding weekends and received a one-hour physical therapy session consisting of a conventional technique of physical therapy modalities. Hot packs wrapped in towelling were placed on the target shoulder for 20 minutes for superficial heating followed by short wave diathermy (SWD) applied for 20 minutes for deep heating while the patients were lying supine. Continuous SWD with 220 V/50 Hz power source and 27.12 MHz oscillation frequency was applied to the therapy region (Short wave Diathermy KSF Model equipment ITO, Tokyo-Japan). Active stretching and pendulum exercises were performed by the two groups after each session. All patients in the study group were also instructed in a standardised home exercise program consisting of passive ROM and pendulum exercises to be performed every day. Concomitant use of NSAIDs or analgesics was not permitted throughout the study.

The physical examination procedures were repeated by the same blinded observer at the end of the first and the second week. Passive ROM was measured after each treatment session. Treatments were stopped when the patients reached at least 80% of the normal ROM of the shoulder. Normal ROM was accepted as abduction = 180°, flexion = 180°, inner rotation = 70° and outer rotation = 90° [19]. Patients who reached 150° flexion and abduction and 55° inner and 70° outer rotation were considered to have reached a sufficient initial response and were removed from active treatment and continued with home exercises only.

Study endpoints

The primary outcome measure of the study was the recovery rate (number of patients who reached 80% of

normal ROM of the shoulder) at the end of the second week in the two different treatment programs.

The secondary end points of the study were: the degree of improvement in ROM and decrease in pain scores between the groups at the end of the first and the second week of treatment.

Statistical analysis

A study power of 80% was planned to permit detection of a 40% increase in the number of patients treated successfully in the Cyriax group at a significance level of 5%. Thus 40 patients were randomly allocated into two different treatment groups consisting of 20 patients in each arm. A 50% reduction in the number of treatment sessions in the CYR group with regard to the PT group was also predicted in order to reach the predefined recovery of ROM in this study.

Normality of variables was checked by histograms and one sample t tests. Parametric tests were applied for the normally distributed data and non parametric tests were applied for not normally distributed data. Comparisons were made between the rates of predefined recovery within two weeks. Pre-treatment and post-treatment ROM and pain values were compared within each group with a paired t test or Wilcoxon signed rank test. Comparisons of the improvement in ROM and decrease in pain scores were made by student t-test or Mann Whitney-U test between the two therapy groups. The recovery ratios between the two groups after the first and second weeks were analysed by chi-square or Fisher's Exact test. SPSS for Windows 10.0 package program was used for statistical analysis. A p value below 0.05 was considered to be significant.

Results

Forty patients with a mean age of 56.0 ± 8.6 (43–82) years and diagnosed as having adhesive capsulitis were enrolled in the study. Twelve of the patients were male and 28 were female. Mean age, duration of symptoms, ratio of sex and Stages according to Reeves were similar in the two treatment groups (table 1). Comparison of the initial pain scores and passive ROM values between the two treatment groups revealed no statistical significance ($p > 0.05$) (table 2). Both groups were identical as regards demographic data as well as pain and ROM values at the outset of the study (table 2).

11 patients (55%) in the CYR group and 6 patients (30%) in the PT group reached sufficient ROM after the first week but the difference in the frequencies did not reach statistical significance.

At the end of the second week, 19/20 of the CYR group (95%) and 13/20 of the PT group (65%) reached sufficient ROM and the differences in the recovery rates were statistically significant with a markedly greater efficiency of the Cyriax therapy ($p < 0.05$) (fig. 1). One patient in the CYR group and seven patients in the PT group could not reach sufficient ROM after two weeks of active treatment.

Reduced pain scores and improved ROM values were obtained in both groups at the end of the first week ($p < 0.05$). Improvement in shoulder flexion, inner and outer rotation values and the decrease in pain with motion were, however, significantly better in the CYR group. Other parameters did not show any significant difference. Amongst the group of patients who continued the treatment

Table 1
Demographics of the two groups of patients according to age, sex, duration of symptoms and the stages according to Reeves.

	Cyriax	Physiotherapy	p
Age (years)*	53.6 ± 6.9 (43–70)	58.4 ± 9.7 (44–82)	0.1
Duration of symptoms (months)*	7.6 ± 3.9 (2–12)	5.6 ± 3.9 (2–12)	0.1
Sex: F/M (n)	15/5	13/7	0.4
Stages (Reeves) (n)	I (6/20) II (14/20)	I (8/20) II (12/20)	0.5 0.5

* Mean ± SD (min–max)

Table 2

Pain and passive ROM values at the beginning and after the first and second weeks of therapy.

	Initial		1st week		2nd week	
	CYR	PT	CYR	PT	CYR	PT
VASs	30.6 ± 22.9	37.1 ± 24.0	16.8 ± 18.1	26.8 ± 18.5	15.2 ± 18.5	21.2 ± 17.9
VASn	60.9 ± 28.3	62.0 ± 19.7	37.1 ± 27.2	43.6 ± 22.9	39.1 ± 28.1	42.0 ± 25.6
VASm	68.9 ± 22.4	74.1 ± 13.2	45.1 ± 25.6	64.2 ± 12.9	50.4 ± 24.5	62.5 ± 12.6
Flexion	128.6 ± 18.6	125.8 ± 24.9	154.8 ± 15.5*	140.3 ± 20.6	155.5 ± 14.2	146.4 ± 22.7
Abduction	114.8 ± 22.3	116.0 ± 25.6	150.3 ± 28.4	143.8 ± 28.6	157.7 ± 21.6	145.3 ± 28.5
Inner rot.	48.2 ± 11.9	42.7 ± 13.7	67.7 ± 6.9*	55.0 ± 17.2	66.7 ± 10.0*	56.1 ± 14.7
Outer rot.	40.8 ± 11.7	36.3 ± 16.5	67.0 ± 17.2*	50.3 ± 26.1	74.4 ± 14.2*	52.8 ± 24.3

VAS (mm), Range of motion (degrees)

VASs: Spontaneous pain

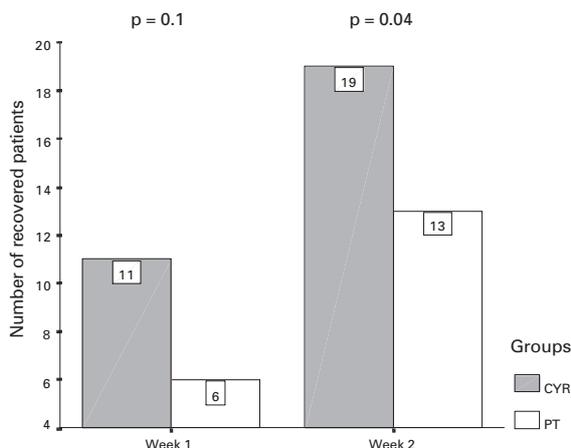
VASn: Night pain

VASm: Pain with motion

* differences between two treatment groups reaching statistical significance ($p < 0.05$)

Figure 1

The efficacy of the two different therapies over time.



throughout the second week (9 in the CYR group and 14 in the PT group), the improvements in inner and outer rotations were better in the CYR group ($p < 0.05$) (table 2).

As a result of the beneficial protocol of the Cyriax method, the mean number of therapy sessions for patients to reach sufficient recovery were 3.0 ± 1.5 (min-max: 2–6) in the CYR group whereas the mean was 8.2 ± 2.3 (min-max: 4–10) in the PT group ($p < 0.001$).

Discussion

Despite interest in the disease, the aetiology and treatment of shoulder stiffness remain controversial. Goals of treatment are to decrease pain, increase motion, and improve function. Although literature data lacks a consensus on the non-operative approach for the treatment of adhesive capsulitis, it is still the primary intervention. When this fails, operative treatment with either manipulation under anaesthesia alone or in combination with arthroscopic capsular release may be reasonable options and appear to produce satisfactory results in most cases [2, 9, 11].

The efficacy of the treatments for shoulder symptoms have rarely been evaluated in randomised comparative studies so far. Based on the limited quantity of high grade evidence, it has so far been concluded that the treatment procedures have no superiority over each other in the long term, but differences may exist in the early phases of the treatment [5, 10, 16]. Bulgen et al. [5] compared three non-surgical treatment regimes, intra-articular steroids, mobilisations or ice therapy and have shown that there is little long-term advantage in any of the treatment regimens over benign neglect, but that steroid injections may benefit pain and ROM in the early stages of the condition.

Arslan and Celiker [10] have compared the efficacy of local corticosteroid injection and physical therapy and observed that local steroid injection therapy was as effective as physical therapy after 12 weeks in their adhesive capsulitis patients. A recent placebo-controlled trial by Carette et al. [16] demonstrated the efficacy of single intra-articular corticosteroid injection administered under fluoroscopy combined with a simple home exercise program in improving shoulder pain and disability in adhesive capsulitis. The addition of supervised physiotherapy provided faster improvement in shoulder ROM whereas when used alone, supervised physiotherapy was found to be of limited efficacy. However, the beneficial effects in all treatment groups had disappeared within one year reaching a level comparable to the placebo group in their study. The authors concluded that the health care advantage between the groups might be transient and all groups might be identical in the long-term.

Few studies in the literature stress the clinical efficacy of different treatment methods in the very short-term. Halverson and Maas [20] performed hydroplasty on 21 shoulders of 16 patients over a 4-year period. Ninety-four percent (17/18) of the

procedures improved patients' measured mobility immediately after the procedure and fifty-three percent (10/19) produced immediate, short term, and sustained improvement in comfort and function. Kivimaki et al. [13] searched the efficacy of manipulation under anaesthesia with or without steroid injection. The comparisons of the shoulder mobility and pain were made right after the manipulation. The addition of intraarticular corticosteroids did not produce an additional treatment effect. Laroche et al. [12] have searched the efficacy of shoulder joint distension during arthrography and stated that joint distension followed by intraarticular corticosteroid injection and physical therapy significantly improved symptoms within the first five days and these gains were sustained after one month.

The use of shoulder manipulation in the treatment of adhesive capsulitis remains controversial. Opponents cite the risk of dislocation, fracture, nerve palsy, and rotator cuff tearing as limiting the usefulness of manipulation. In their retrospective study of 38 shoulder manipulations in 32 patients followed for an average time of 58 months, Reichmister et al. [21] have found that 97% of patients had relief of pain and recovery of near complete range of motion with no evidence of biceps tendon rupture, rotator cuff insufficiency, fractures, dislocations or nerve palsies. The literature data supports the fact that manipulative methods acquire a rapid response in the treatment [13, 21, 22]. Placzek et al. [22] reported on 31 patients who underwent brachial plexus block followed by manipulation and found that the ROM increased and pain decreased on their early follow-up (2-8 weeks). Our results confirm the efficacy of a manipulative technique described by Cyriax in the early phase of the treatment in adhesive capsulitis.

Alvado et al. [23] have attempted to perform a meta-analysis of randomised clinical trials to determine the efficacy of physical treatments in adhesive capsulitis of the shoulder. Only 16 articles could be selected because of the heterogeneity of the criteria assessing the functional results and of the poor methodological value of most of the articles. It seemed impossible to come to any conclusion about the superiority of one method over the other. This meta-analysis demonstrated the need of a consensus about the criteria of assessment and

the time of evaluation before assessing the therapeutic value of any intervention.

Conventional physical therapy measures require instruments along with a therapist and the patients are strictly advised to attend their daily outpatient therapy in the hospital. However the treatment protocol might occasionally be interrupted due to problems of time and transportation. The Cyriax method requires fewer hospital visits, enabling the patients to proceed in their daily and professional activities. No special equipment is needed for the method but only an experienced health professional competent in the technique. The manipulation used during the Cyriax approach is mild and does not require anaesthesia. It provides a health-care advantage during the active treatment period and this is of major importance for both the patient and the overloaded physical therapy clinics of referral hospitals.

The limitation to our study may be that we do not have the long-term follow up data for our treatment groups. Based on the literature data reflecting no differences between any treatment in the long term, the study was planned to search for the speed of recovery of two methods in the early phase. Any healthcare advantage, even though transient, is appreciated in the initial phases of the treatment program. A faster program with fewer hospital visits not only enables the patients to proceed with most of their daily activities but also decreases the costs of the treatment. Randomised controlled studies of large study populations are needed to clearly define a standardised treatment algorithm in patients with different stages of frozen shoulder.

Acknowledgements: we gratefully acknowledge the contribution of Aynur Guney (PT), and Gulsah Seydaoglu, MD, PhD to this study.

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