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Effectiveness of Ultrasound Therapy in Combination with Manual Therapy and Shoulder Exercises for Sub Acromial Impingement Syndrome

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I. INTRODUCTION

01.1 Background

The shoulder joint has the greatest range of motion of any joint in the body. Because of this mobility the shoulder is more likely to be injured or cause problems. They include sprains, strains, dislocations, separations, tendinitis, bursitis, torn rotator cuffs, frozen shoulder, fractures and arthritis. Among these conditions sub acromial impingement syndrome is the most disabling condition of the shoulder. (Hermoso, F.E, 2009).

Sub acromial impingement syndrome (SIS) is a painful impingement of the supraspinatus tendon and sub acromial bursa between the head of the humerus and coracoacromial arch, which is a frequent cause of shoulder pain (Aktas I et al 2007). It is characterized by severe pain in the anteroposterior and lateral shoulder extending to the deltoid and biceps area. It is caused by overuse or repetitive micro trauma sustained in the overhead position (Williamson MP et al 1994). It is currently believed that stiffness and thickening of the coracoacromial ligament (Hypvonen, P 2003), lesions to the long head of the biceps, sub acromial bursitis and partial or full thickness tears of the rotator cuff (Calis HT et al 2011) and abnormal scapular kinematics(Hebert LG et al 2002) are the different aetiologies for SIS

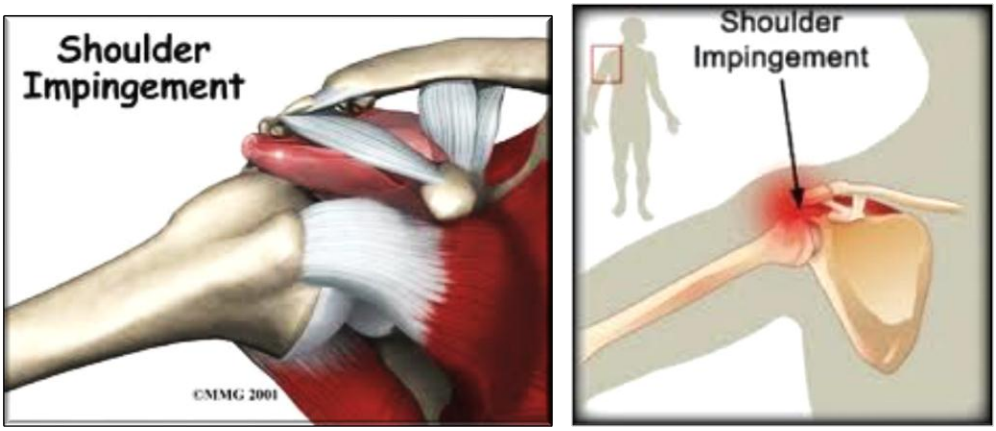


Figure 1 Sub acromial Impingement Syndrome

Physiotherapy is often the first choice of treatment for SIS. Between 10 to 30% of all shoulder patients seen in primary care are referred to physiotherapy after initial presentation, Physiotherapy is widely used in the management of SIS which includes various treatment methods such as shoulder exercises, manual therapy, and electrotherapy. Physiotherapy has been found to be effective in reducing pain and disability in patients with shoulder impingement (Michener, L.A et al 2004).

Ultrasound is a commonly used electrotherapeutic modality for impingement as well as other forms of tendinitis and muscle injury. Therapeutic ultrasound is a modality commonly used by physiotherapist. Ultrasound therapy works by driving alternating compression and rarefaction of sound waves with a frequency of more than 20,000 cycles per seconds. Therapeutic ultrasound may have two types of benefits, namely thermal effects and non-thermal effects. Thermal effects aid in pain relief whereas non-thermal effects enhance cell-repair effects of the inflammatory response (H.D., et al 2004). Reduction in pain and induce tissue repair helps in regaining the reduce range of motion due to SIS.

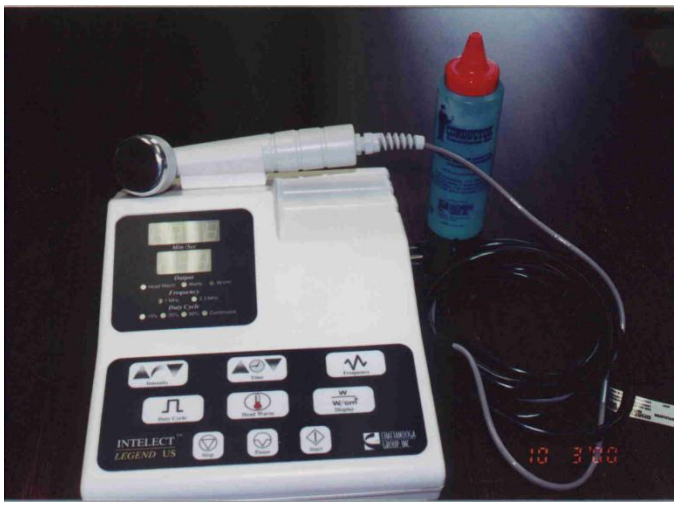
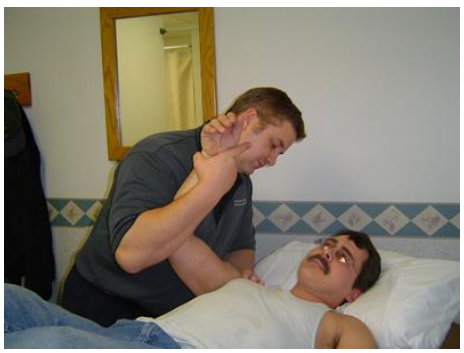


Figure 2 Therapeutic Ultrasound apparatus

When recovering from a shoulder injury physiotherapy exercises are an integral part in regaining the range of motion, muscle elasticity, and strength. Therapeutic exercises can be defined as the use of active or assisted exercises aimed at improving the range of motion, strength or dynamic neuromuscular control of joint motion, whereas manual therapy can be defined as the use of manually and/or mechanically applied movement techniques to improve joint motion (Somty.R.2002). Both therapeutic exercises and manual therapy are commonly used as part of physiotherapy programs aimed at improving shoulder kinematics. Therapeutic exercise focusing on strengthening the rotator cuff and scapula stabilizing musculature has been shown to be effective in treating shoulder impingement symptoms (Bang MD et al 2000)

Manual or manipulative therapy encompasses the treatment of health ailments of various etiologies through "hands-on", physical intervention. Various manual therapy techniques have proved to be effective for SIS. Stretching reduces capsular tightness (D'Hespeel C.G., 2004) and a few studies have evaluated the effectiveness of incorporating glenohumeral joint mobilizations for SIS (Bang MD et al 2000).



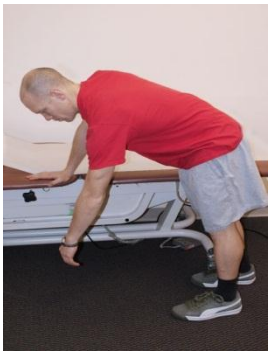


Figure 3 Manual therapy and shoulder exercises

01.2 Problem Justification

The shoulder is the most movable joint in the body. However, it is an unstable joint because of the range of motion allowed. This instability increases the likelihood of joint injury.

The most common cause of shoulder pain in the older population is soft tissue injuries. These include frozen shoulder, sub acromial impingement, rotator cuff tendinopathy or rupture, arthritic conditions, degeneration and, or destruction of the joint and referred pain from cervical radiculopathy. (Hermoso, F.E, 2009)

Shoulder instability and acromioclavicular joint disorders tend to affect younger people, particularly men who play certain sports that involve repetitive shoulder movements, such as overarm bowling or throwing and contact sports, such as rugby.

Among the different diagnoses covered by the concept of shoulder pain, the most common is sub acromial impingement syndrome which is increasingly more common in athletes whose sports involve repetitive overhead motions as well as in the older population.

This condition is used in our study as majority of sub acromial impingement may be successfully managed with conservative treatment. (Arcuni SE2000). Specific supervised exercises obtain improvements in the range of movement and muscular function by restoring the shoulder's mobility and stability. Physiotherapeutic options include several electrotherapy techniques. Among them Ultrasound (US) Therapy is more popular.

Although adequate literature provides evidence to prove the effectiveness of various therapeutic exercises and manual therapy techniques **(**Lori A. et al 2004), the effectiveness of US therapy in the treatment of SIS is still under debate. According to some studies ultrasound therapy added to conservative treatment of SIS do not provide an additional benefit to the patients, (Celik D et al 2009, Valma, J et al 2001) and some other studies also reveal that the effectiveness of US in the treatment of SIS is limited. (Santamato A et al 2009).

In spite of the limited evidence to prove the effectiveness of US in the treatment of SIS it is a widely used electrotherapeutic modality to treat patients with soft tissue injuries including SIS. Based on this our study was designed to assess whether US therapy helps in rehabilitation of SIS in the acute and sub-acute stages.

The patients were referred only from Kurunegala and Peradeniya teaching hospitals due to the limited accessibility. Occurrence of SIS does not differ according to the age and sex of the patients and it was equally distributed in the age group from 18-55. The age of selected patients was ranged from 18 to 55 according to the limited availability of the patients with pure impingement and the equal distribution of this condition in this range.

01.3 Objectives

01.3.1 General objectives

- To assess the effectiveness of ultrasound therapy when added to manual therapy and shoulder exercises in the rehabilitation of patients with sub acromial impingement syndrome.

01.3.2 Specific objectives

- To assess the effectiveness of the ultrasound with manual therapy and shoulder exercises.
- To assess the effectiveness of manual therapy and shoulder exercises in treating sub acromial impingement syndrome

01.4 Hypothesis

01.4.1 Null hypothesis (H_0)

Ultrasound therapy is not beneficial when combined with manual therapy and exercises in the physiotherapy management of patients with SIS to reduce pain, increase range of motion and to reduce shoulder disability

01.4.2 Alternative hypothesis (H_1)

Ultrasound therapy is beneficial when combined with manual therapy and exercises in the physiotherapy management of patients with SIS to reduce pain, increase range of motion and to reduce shoulder disability.

II. REVIEW OF LITERATURE

What is subacromial impingement?

Brotzman (2003) reported that impingement is a chronic inflammatory process produced as the Rotator Cuff muscles (Supraspinatus, Infraspinatus, Teres minor and Subscapularis) and the Subdeltoid bursa pinched against the coracoacromial ligament and the anterior acromian when the arm is raised above 80 degrees. The supraspinatus, infraspinatus portion of the rotator cuff is the most common area of the impingement. This syndrome is commonly seen in throwing sports, in racquet sports, and in swimmers, but can be present in anyone who uses the arm repetitively in a position over 90 degrees of elevation. (Brotzman SB et al 2003)

02.2 Sub acromial impingement syndrome – most frequent reason of the painful shoulder syndrome.

Painful shoulder syndrome is a frequent cause of visit to a physician. The development of knowledge about the anatomy and biomechanics of the shoulder allows, based on detailed examination, to precise localization of the shoulder dysfunction. Sub acromial impingement syndrome is the most common cause of pain as well as of limited motion of the shoulder region. Misdiagnosis and mistreatment can lead to serious damage of the structures placed in the sub acromial space including the rotator cuff, which along with the deltoid are responsible for movements of the upper limb in the shoulder joint. If not taken seriously, the problem can cause irreversible damages which will result in pain and limitations of upper limb movements. (Szyluk, K., et al 2008)

02.3Are ultrasound, laser and exercise superior to each other in the treatment of sub acromial impingement syndrome? A randomized clinical trial

Calis HT et al, (2011) conducted a study to define and compare the efficacy of ultrasound, laser and exercise in the treatment of SIS. This was a randomized controlled trial with-pre and post-treatment evaluations. This study was performed on 52 patients with SIS who were out patients referred to the physical medicine and rehabilitation unit. The patients were put randomly into three groups. According to this study result they concluded that ultrasound and the laser treatments were not superior to each other in the treatment of SIS.

02.4Efficacy of standardized manual therapy and home exercise programme for chronic rotator cuff disease: randomized placebo controlled trial

Bennell K, et al (2010) investigated the efficacy of a program of manual therapy and exercise treatment compared with placebo treatment delivered by physiotherapists for the people with chronic rotator cuff disease. Participants were randomized and single blinded, placebo controlled trial. A standardized programme of a manual therapy and home exercise did not confer additional immediate benefits for pain and function compared with a realistic placebo treatment that controlled for therapists' contact in middle aged to older adults with chronic rotator cuff disease.

02.5 Adding ultrasound in the management of soft tissue disorders of the shoulder: a randomized placebo-controlled trial.

A study group (Kurtaiş et al 2004) from Ankara in Turkey conducted a randomized placebo controlled trial in2004, to assess the effectiveness of ultrasound over a placebo intervention when added to other physical therapy interventions and exercise in the management of shoulder disorders. This study included Forty patients who were diagnosed by ultrasonography or magnetic resonance imaging to have a periarticular soft tissue disorder of the shoulder and were randomly assigned to either a group that received true US

(n=20; mean time since onset of pain=8.7 months, SD=8.8, range=1-36) or a group that received sham US (n=20; mean time since onset of pain=8.1 months, SD=10.8, range=1-42). Besides true or sham US (10 minutes), superficial heat (10 minutes), electrical stimulation (15 minutes), and an exercise program (15-30 minutes) were administered to both groups 5 days each week for 3 weeks. After the intervention subjects showed within-group improvements in reduction of pain, range of motion, Shoulder Disability Questionnaire scores, and Health Assessment Questionnaire scores with the intervention, but the differences did not reach significance when compared between the groups. Finally they concluded that the results suggested that true US, compared with sham US, bring no further benefit when applied in addition to other physical therapy interventions in the management of soft tissue disorders of the shoulder.

02.6 A systematic review of manipulative therapy for the treatment of shoulder pain.

Pribisevic M, (2010) conducted a systematic review to discuss the evidence for manipulative methods of management of shoulder pain and chiropractic management techniques used within the literature. A literature search of MEDLINE,CINAHL,MANTIS, the Cochrane Musculoskeletal Group trials register and the Cochrane Controlled Trials Register was conducted. Search terms included chiropractic or manipulative therapy and shoulder pain, impingement, rotator cuff, shoulder instability, shoulder joint, treatment or rehabilitation exercises. Publications were included if they contained shoulder pain or contained a specific clinical diagnosis of a shoulder pain syndrome in the title; a detailed description of the treatment intervention which was typical of the profession; treatment performed by a registered practitioner and outcome measures were included in the studies. Exclusion criteria included the diagnosis of adhesive capsulitis or referred/pathological pain. The articles were reviewed and clinical trials ranked on the Physiotherapy Evidence Database scale. From a total of 913 retrieved publications, 22 case reports, 4 case series and 4 randomized, controlled trials met the inclusion and exclusion criteria for this review. The literature contains 2 articles of reasonably sound methodology. The evidence for chiropractic management of shoulder pain is limited to low level evidence in the form of case reports and case series and 1 small controlled trial. There is a need for more well-designed, trials investigating multi-modal chiropractic management for shoulder pain. (Pribisevic M, 2010)

02.7 The value of intermittent ultrasound treatment in sub acromial impingement syndrome.

Celik D et al (2009) conducted this study with thirty-six patients (29 females, 7 males; mean age 51 years; range 40 to 69 years) with type II SIS who were randomized to two groups to receive intermittent ultrasound (group 1, n=20) and placebo ultrasound (group 2, n=16) for three weeks (15 sessions). All the patients received the same standard physical therapy and rehabilitation modalities besides ultrasound treatment. Evaluations were made before and three and six weeks after treatment. Functional results were assessed by the Constant score, pain was assessed by a visual analog scale, and range of motion was measured. Within-group comparisons showed significant improvements in both groups three and six weeks after treatment According to the findings the study group concluded that intermittent ultrasound added to conservative treatment of SIS do not provide an additional benefit to the patients (Celik D et al 2009).

02.8 A prospective double blind placebo-controlled randomized trial of ultrasound in the physiotherapy treatment of shoulder pain.

A prospective double blind placebo controlled randomized trial to compare the effectiveness of manual therapy and ultrasound with manual therapy and placebo ultrasound in the treatment of new episodes of unilateral shoulder pain referred for physiotherapy was carried out by a study group from the University of Bermingham in UK in the year 2007. In a multicenter, double blind, placebo-controlled randomized trial, participants were recruited with a clinical diagnosis of unilateral shoulder pain from nine primary care physiotherapy departments in Birmingham, UK. Recruitment took place from January 1999 to September 2001. Participants were 18

years old and above. Participants all received advice and home exercises and were randomized to additionally receive manual therapy plus US or manual therapy plus placebo US. The primary outcome measure was the Shoulder Disability Questionnaire (SDQ-UK). Outcomes were assessed at baseline, 2 weeks, 6 weeks and 6 months. Analysis was by intention to treat. A total of 221 participants (mean age 56 years) were recruited. 113 participants were randomized to US and 108 to placebo US. There was 76% follow up at 6 weeks and 71% at 6 months. The mean (95% CI) reduction in SDQ scores at 6 weeks was 17 points (13-26) for US and 13 points (9-17) for placebo US (P = 0.06). There were no statistically significant differences at the 5% level in mean changes between groups at any of the time points. The results suggested that true US, compared with sham US, and brings no further benefit when applied in addition to other physical therapy interventions in the management of soft tissue disorders of the shoulder.

III. METHODOLOGY

This chapter presents the research design, variables, study population and study area, selection criteria, measurements, materials and apparatus and procedure.

03.1 Research design

This randomized control study was done to investigate the effectiveness of ultrasound therapy in patients with clinical signs and symptoms of sub acromial impingement syndrome. Selected participants were divided into an intervention group and a control group.

03.2 Variables

The following variables were used in the study. They can be categorized into two groups.

03.2.1 Independent variables

- Manual therapy and shoulder exercises
- Manual therapy, shoulder exercises and ultrasound therapy

03.2.2 Dependant variables

- Shoulder pain
- Shoulder ROM
- Shoulder disability

03.3 Study population and study area

The study participants were referred by the orthopedic surgeons, physicians, and rheumatologists from the teaching hospital, Peradeniya and from the teaching hospital, Kurunegalla. Referred participants were thoroughly assessed with a standard physical examination by the investigators and the participants eligible with the selection criteria were confirmed for the study. This research study was carried out at the Department of Physical Medicine (DPM), Teaching hospital, Kurunegalle and at the DPM, Faculty of Allied Health Sciences, University of Peradeniya, Peradeniya.

03.4 Selection Criteria

The participants who were referred for the study were included and excluded from the study according to the following criteria

03.4.1 Inclusion criteria

- Age between 18 and 55 year.
- Main complaints in the glenohumeral joint region or the proximal arm.
- Documented X-ray (XR)/ ultrasound (US) and/or evidence of sub acromial impingement through physical examination.
- Presence of two of the following signs indicating SIS: Neer impingement test, Hawkins-Kennedy impingement test, painful arc with active abduction or flexion.
- Pain with two of the following resistance tests: external rotation, internal rotation, abduction, or flexion.
- Shoulder disability: greater than or equal to 20/100 (0 = no disability).
- Potentially available for the next two months.
- Able to understand written and spoken English, Tamil, or Sinhala.
- Pain at rest and/or with free movement and/or with movement against resistance with a score on the visual analogue scale of (1-8)/10.

03.4.2 Exclusion criteria

- Primary scapulothorasic dysfunction due to paresis.
- Diagnosed instability or previous history of dislocation.
- Adhesive capsulitis (frozen shoulder).
- More than 1/3 restriction of elevation compared to the unaffected side.
- Substantial shoulder weakness or loss of active shoulder function.
- Shoulder surgery in the last 12 months on the involved side.
- Involvement with sensory and muscular deficit.
- Radiological findings of tumor lesions, avascular necrosis, glenoid development defects, acromial bone, severe degenerative signs affecting inter-articular space and fractures
- Ischemic cardiopathy in subacute phase
- Cognitive deficit, psychiatric alterations or behavioral disorders that might compromise the patient's collaboration
- Unsuitable for electrotherapy: pregnancy, epilepsy, pacemaker, osteosynthesis, undergoing treatment with Sintrom

After a complete description of the study was provided, written informed consent was obtained from all subjects or their relatives. The participants were instructed to abstain from the execution of painful activities of daily living involving the affected shoulder.

03.5 Sampling and sample size

All participants referred from the hospitals were screened for study eligibility. At the end of the evaluation, 30 patients who were affected by SIS (Neer stage I , 19 right shoulders and 11 left shoulders), had sub-acute pain, fulfilled the selection criteria, agreed to participate, and signed informed consent statements were enrolled in the study (16 women and 14 men; mean age = 40.22 years, SD =9.0, range=18-60).

These participants were divided into 2 groups by convenient sampling. The participant who was referred first and eligible for the study was assigned to the control group. And the second patient was referred to the intervention group. Thus participants were assigned to groups alternatively. A group of 15 participants were assigned to the control group and 15 participants to the intervention group.

Among the selected participants only 26 participants completed the study and were included in the analysis. One participant was excluded due to falling on the affected shoulder during the study period. One participant was unable to complete the study due to family problems. Other 2 participants quit due to unknown reasons.

13 participants from the control group completed the study that received manual therapy and performed shoulder exercises (8 women and 5 men; mean age = 37.62 years, SD =14.57, range=18-56). And 13 participants from the intervention group also completed the study that received US therapy in addition to manual therapy and shoulder exercises (6 women and 7 men; mean age =39.92 years, SD =16.6, range=18-60)

03.6 Interventions

The protocol for both the control and intervention groups involved the application of manual physical therapy and shoulder exercises for a total of 15 treatment sessions of 40 minutes, over a period of 3 consecutive weeks (5 days per week). At the beginning of the treatment all participants were given a brief explanation on anatomy and biomechanics of the shoulder complex and a short description of the etiology and pathology of SIS.

The treatments in the first week aimed at reducing the pain intensity and to prevent further damage and consisted of manual therapy techniques such as joint mobilization techniques and transverse friction massage and shoulder pendulum exercises.

Figure 0:4 Joint mobilization techniques

The second and third week aimed at restoring the functional level by increasing ROM, muscle strength and flexibility and consisted of ROM exercises with rope and pulley, L bar exercises, self-capsular stretching exercises, joint mobilization techniques and

strengthening exercises with weights, therapeutic bands, springs and push ups. The standard exercise protocol and manual therapy were given in order to restore muscular deficits in strength, mobility, and coordination of the rotator cuff and the shoulder girdle muscles to unload the subacromial space during active movements. And the participants were expected to return to their functional level without recurrence at the end of the treatment.

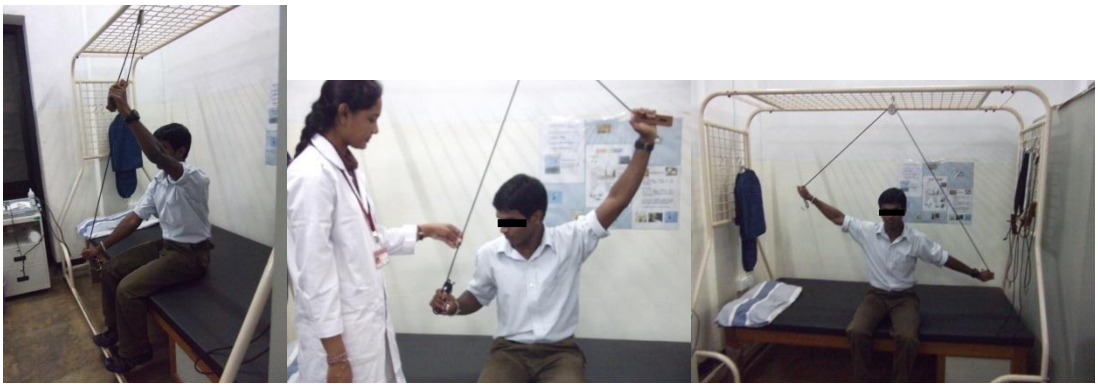


Figure 0:5 Abduction and flexion exercises with rope and pulley

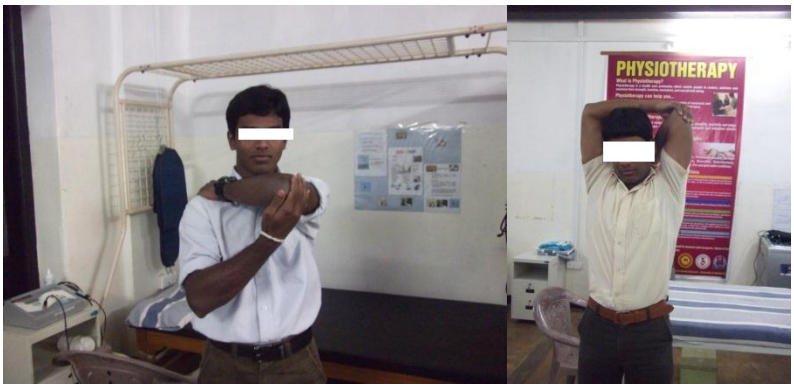


Figure 0:6 Shoulder capsular stretching exercises

Figure 0:7 Strengthening exercises with weights

Figure 0:8 Wall pushups

Participants in the intervention group received pulsed ultrasound for 5 minutes with a device that was operated at a frequency of 1 MHz, and an intensity of 1 W/cm^2, The treating physical therapist, using the technique of slow circular movements, applied the transducer head over the superior and anterior periarticular regions of the participant's glenohumeral joint and on the shoulder trigger points. The treatment was continued from the first treatment day over the 15 day treatment period.

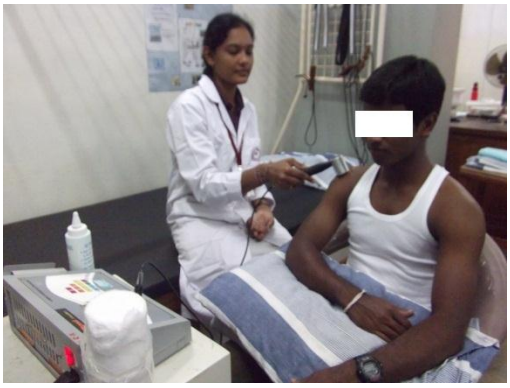


Figure 0:9 the participant being treated with Ultrasound therapy

The participants were treated by final year physiotherapy students with 3 years of clinical experience and supervised by the chief physiotherapist from the department of physiotherapy, teaching hospital Kurunegala and the head of the department, Department of Physiotherapy, University of Peradeniya

03.7 Data collection and Procedure

03.7.1 Methods of collection

Data were collected using a standard shoulder assessment form (Annexure 1). Participants were assessed by the group members at the baseline (before the first treatment session), at the end of first and second weeks and at the end of physical therapy (after the last treatment session).

03.7.2 Measurements

1. Shoulder pain intensity was measured using the visual analogue scale (scored on a 10 point visual analogue scale)

2. The shoulder disability was measured using the shoulder disability index.

3. Active painful joint ROM for shoulder flexion, extension, abduction, adduction and external and internal rotation were measured using a goniometer.

4. And at the end of the treatment, patient satisfaction with treatment was assessed using a brief questionnaire. (Annexure 2)

03.7.3 Materials and apparatus

- **Materials and apparatus**

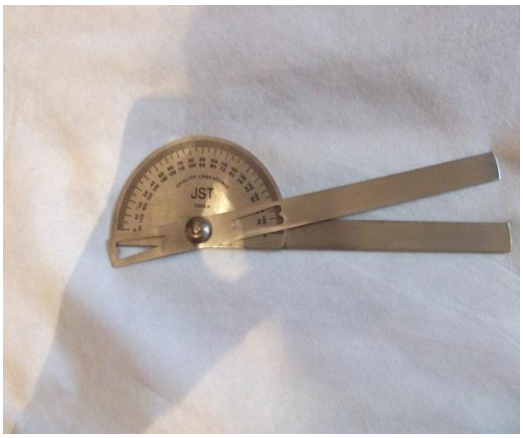


Figure 10 Universal Goniometer

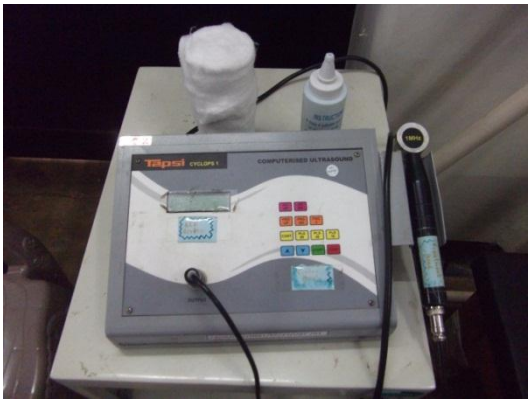


Figure 11 Ultrasound therapy apparatus

03.7.4 Procedure

1. All shoulder ROMs were measured using the universal goniometer. Shoulder flexion, abduction, and external rotation were measured in the supine position whereas shoulder extension and external rotation were measured in the prone position.

The axis of goniometer was placed at 2.5cm inferior to the lateral aspect of the acromion process for shoulder flexion and extension, at 1.3cm inferior and lateral to the coracoid process for abduction and at the olecranon process of the ulna for shoulder internal and external rotation.

Figure 0:12 Goniometric measurement of shoulder ROM

2. Shoulder pain intensity was measured in various activities involving the shoulder. The participants were asked to mark the pain intensity for each activity on separate visual analogue scales. The right end of the VAS was defined as "worst pain imaginable'', the left end as "no pain ". Each level was recorded in a table (Table). A score was then calculated out of 100 with higher scores reflecting higher pain levels.

3. Shoulder disability level was measured in various activities involving shoulder. The right end of the VAS was defined as "so difficult required help", the left end as "no difficulty".The level of difficulty in doing each activity is marked in the table. A score was then calculated out of 100 with higher scores reflecting higher disability levels.

03.8 Ethical clearance

Ethical clearance was obtained by requesting from the ethical review committee of the faculty of Allied Health Sciences, University of Peradeniya.

03.10 Data analysis

All analyses were performed with MINITAB statistical software (version14). Frequency distributions as well as means and standard deviations were used for descriptive purposes. At the baseline, differences in age was analysed using the two-sample Wilcoxon rank sum test. Differences between treatment groups in change scores at the baseline and at the end of each treatment sessions over a period of 3 consecutive weeks were analysed with the two-sample Wilcoxon rank sum test. Repeated measurements obtained before and after treatments within groups were also analysed with the two-sample Wilcoxon rank sum test. The Kruskal Wallis test was performed to estimate differences between age groups for each studied outcome. The alpha level for significance was set at 0.05.

IV. RESULTS

Distribution of age groups among control and intervention groups

The age of the participants of both the control and intervention groups ranged from 18-55. The above age group was categorized into 4 groups.

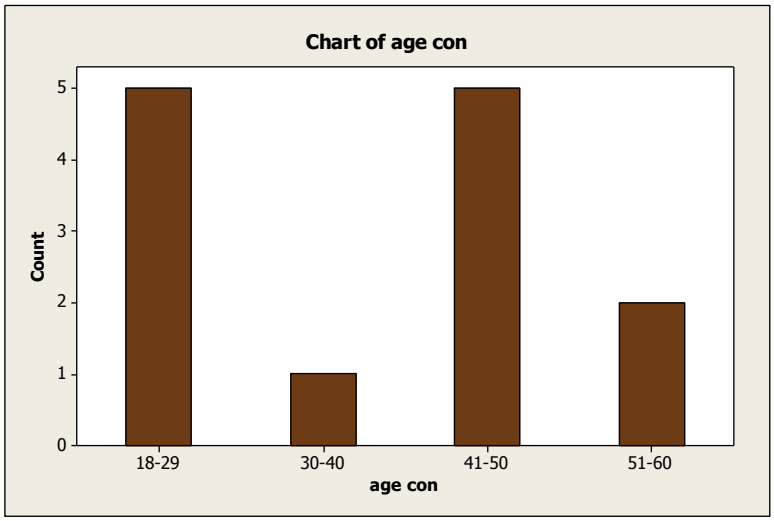


Figure 13 Histogram showing the distribution of age groups in the control group

The figure 12 shows the histogram of distribution of the age groups in the control group.

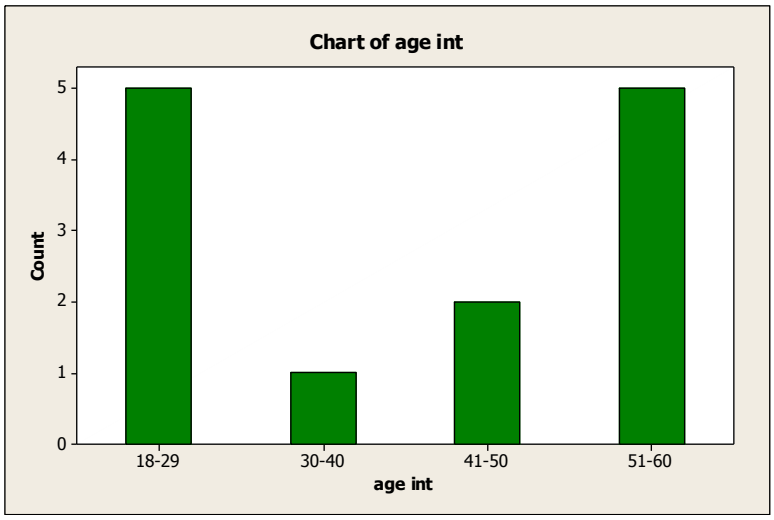


Figure 14 Histogram showing the distribution of age groups in the intervention group

The figure 13 is a histogram that shows the distribution of different age groups in the intervention group.

The 'Kruscal Wallis test' was used to compare the distribution of age in the control and intervention groups. According to the Wilcoxon signed rank test, there was no significant difference between distribution of age groups in the control group and the intervention group.

04.2 Distribution of male and female participants in control group and the distribution of male and female participants in intervention group

Both male and female participants were included in the study. The control groups had 5 male and 8 female participants. The intervention group had 7 male and 6 female participants. The figure 14 is the pie chart that shows the distribution of gender in both groups.

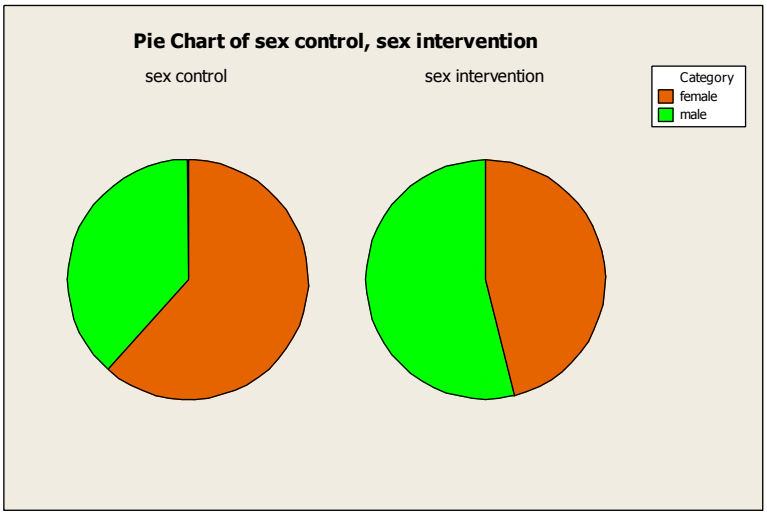


Figure 15 the pie chart showing the distribution of male and female participants in the control and the intervention group

04.3 Distribution of involved side (right/left) among selected participants in control group and the distribution of involved side among selected participants in intervention group

Some participants involved in the study had shoulder impingement on the right side. And some of them had involved the left side. All the participants were right handed.

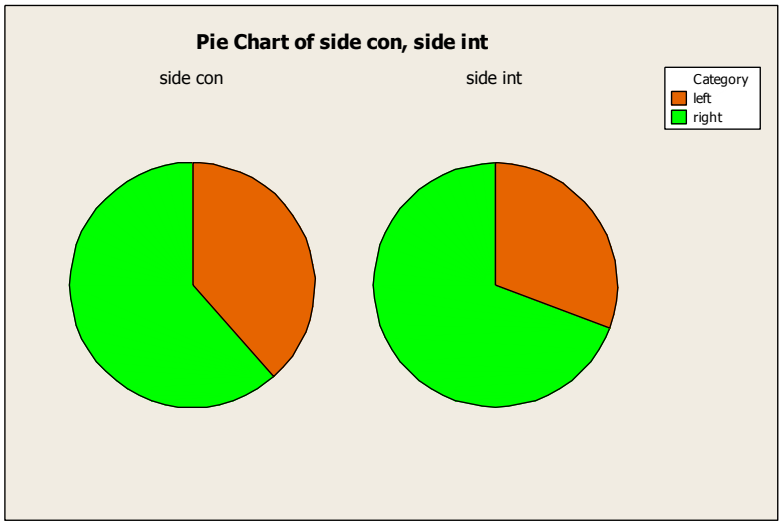


Figure 16 the pie chart showing the distribution of affected sides in the control and intervention groups

The above pie charts show the distribution of participants involved side of shoulder in the control and intervention group.

04.4 Normality tests for baseline measurements of pain, disability and ROM in control and intervention groups

The normality test was used to find out whether the baseline measurements for pain, shoulder disability and shoulder ROM were normally distributed. The results showed that none of the above baseline characteristics follow the normal distribution. Hence the 'Wilcoxon signed rank test' was used to compare for any difference between the control and intervention groups for baseline measurements.The Wilcoxon signed rank test hypotheses were H0: median = hypothesized median versus H1: median ≠ hypothesized median. The confidence level was set at 95.0.

04.5 The comparison for measurements between male and female participants at the baseline and the improvement

According to Wilcoxon Rank sum test;

Table 1 the comparison for measurements between male and female participants at the baseline and the improvement

Measurement			Control			Intervention		
			Male (M)	Female (M)	Difference	Male (M)	Female (M)	Difference
Visual Analogue Scale		Initial	44.4	57.625	NS	69.41	49.42	NS
		Pain reduction	49.25	29.32	NS	53.65	31.33	NS
Shoulder Disability Index		Initial	43.34	54.33	NS	56.26	38.73	NS
		Disability reduction	47.08	33.73	NS	38.66	21.08	NS
Range of motion	Abduction	Initial	120.6	167.00	NS	113.0	143.33	NS
		After treatment	10.2	49.37	NS	24.28	51.16	NS
	External rotation	Initial	40.0	44.0	NS	44.2	53.0	NS
		After treatment	27.0	23.87	NS	15.0	16.0	NS
	Internal rotation	Initial	61.75	59.8	NS	61.83	61.42	NS
		After treatment	14.4	21.37	NS	22.85	13.16	NS

***= p<0.05, ** = p<0.01, ***= p<0.001, NS= Not Significant M= mean value**

The measurements for pain, disability and shoulder ROM at the baseline and at the end of the treatment have been compared within the groups for any difference between female and male participants and for any difference in the improvement according to the gender. The table 10 shows that there is no significant difference in measurements either at the baseline or at the end of the treatment. Hence there has been no difference within the groups according to the gender.

04.6 Comparison between involved side of the shoulder for initial measurements and improvement in control and intervention groups

According to the Wilcoxon rank sum test;

Table 2 Comparison between involved side of the shoulder for initial measurements and improvement in control and intervention groups

			Control			Intervention		
			Right (M)	Left (M)	Difference	Right (M)	Left (M)	Difference
Visual Analogue Scale		Initial	61.62	38	NS	63.56	47.6	NS
		Pain reduction	48.57	30.5	NS	43.78	38	NS
Shoulder Disability Index		Initial	54.99	43.56	NS	52.33	34.45	NS
		Disability reduction	47.04	33.86	NS	32.87	25.46	NS
Range of motion	Abduction	Initial		114.17	NS	112.5	136	NS
		After treatment		53.4	NS	47.5	32.3	NS
	External rotation	Initial	36	35	NS	44.44	53.67	NS
		After treatment	25.85	36.25	NS	18.33	29.7	NS
	Internal rotation	Initial	54.5	63.75	NS	52.86	57	NS
		After treatment	24.8	15	NS	21.43	9	NS

***= p<0.05, ** = p<0.01, ***= p<0.001, NS= Not Significant, M=mean value**

The measurements for pain, disability and shoulder ROM at the baseline and at the end of the treatment have been compared within the groups for any difference for baseline measurements between the participants who had affected there right shoulder and who had affected there right shoulder and for any difference in the improvement according to involved side. The table 11 shows that there is no significant difference in measurements either at the baseline or at the end of the treatment. Hence there has been no difference within the groups according to the involved shoulder.

04.7 Comparison between different age groups for initial measurements and improvement in the control and intervention groups

According to the Kruskal Wallis test;

Table 3 Comparison between different age groups for initial measurements and improvement in the control group

			18-29 (M)	30-39 (M)	40-50 (M)	51-60 (M)	Difference
			55.	42	62.	26	NS
		Initial					
Visual Analogue Scale		After treatment	44.	24	52.	14.	NS
			51.	53	47.	47.	NS
		Initial					
Shoulder Disability Index		After treatment	44.	40	40.	41.	NS
			145	18	14	17	NS
		Initial					
	Abduction	After treatment	52.	0	53		NS
			48	30	36.	70	NS
Shoulder Range of motion	External rotation	Initial					
		After treatment	66.	80	63	75	NS
			63.	90	68.	50	NS
	Internal rotation	Initial					
		After treatment	16	0	10.	25	NS

***= p<0.05, ** = p<0.01, ***= p<0.001, NS= Not Significant**

Table 4 Comparison between different age groups for initial measurements and the improvement at the end of three weeks

		18-29 (M)	30-39 (M)	40-50 (M)	51-60 (M)	Difference
		50.	62	45	71	NS
	Initial					
Visual Analogue Scale	After treatment	29.	56	30	56	NS
		35.	65.	31	58	NS
	Initial					
Shoulder Disability Index	After treatment	20	52	19	40	NS
		141	160	125	110	NS

		Initial					
	Abduction	After treatment	21.	20	40	54	NS
			49.	70	45	44	NS
Shoulder Range of motion	External rotation	Initial					
		After treatment	15.	20	15	19	NS
			60.	90	60	62	NS
	Internal rotation	Initial					
		After treatment	27.	0	20	12	NS

***= p<0.05, ** = p<0.01, ***= p<0.001, NS= Not Significant**

The measurements for pain, disability and shoulder ROM at the baseline and at the end of the treatment have been compared within the groups for any difference between the age groups of participants and for any difference in the improvement according to the age group. The table 12 and 13 show that there is no significant difference in measurements either at the baseline or at the end of the treatment. Hence there has been no difference within the groups according to the age category. According to the tables 10, 11, 12 and 13 there has been no significant difference at the baseline or at the end of treatment according to the involved side, gender or age group. Hence the intergroup comparison is done regardless of the variations in gender, age group and or involved side.

04.8 Overall improvement within the control and intervention groups

Table 5 within groups' improvement

According to Wilcoxon rank sum test;

	Overall improvements	**N**	**N for test**	**Wilcoxon statistic**	**P Value**	**Estimated Median**
Control group	**Vas4- Vas1**	13	13	91.0	**0.002**	40.50
	Dis4 – Dis1	13	13	91.0	**0.002**	42.34
	Abd4 – Abd1	13	08	36.0	**0.014**	25.50
	Ext4 – Ext1	13	11	0.00	**0.004**	-25.00
	Int4 – Int1	13	09	45.0	**0.009**	11.0
Intervention group	**Vas4– Vas1**	13	13	91.0	**0.002**	41.90
	Dis4 – Dis1	13	13	91.0	**0.002**	30.60
	Abd4 – Abd1	13	11	66.0	**0.004**	35
	Ext4 – Ext1	13	11	66.0	**0.004**	15.00
	Int4 – Int1	13	09	45.0	**0.009**	15.00

The above table shows the test results obtained by using Wilcoxon rank sum test for overall improvement after three weeks of treatment in pain, disability, abduction, internal rotation and external rotation in both control and intervention groups. The difference between initial measurements and measurements taken at the end of three weeks treatment period has been calculated using the above test.

If the P value is less than 0.05 the null hypothesis is rejected at 5% of significant level that the two sample medians is not equal. The measurements obtained before and after the treatment were taken as the two samples for this test. The above table shows that the P values for improvements at the end of treatment is less than 0.05 and there is significant improvement at the end of three weeks of treatment in both intervention and control groups.

Table 6 within group comparison at the baseline and after three weeks

		Control group			Intervention group		
		Initial (M)	**After 3 weeks (M)**	**Difference**	**Initial (M)**	**After 3 weeks (M)**	**Difference**
Vas scale		52.53	10.95	**	58.65	16.66	**
Disability		50.10	08.13	**	46.82	16.23	**
ROM	Abduction	138.46	172.76	*	128.30	165	**
	Ex. Rotation	42.46	67.53	**	48.30	63.76	**
	Int. rotation	65.53	79.69	**	61.61	80.00	**

***= p<0.05, ** = p<0.01, ***= p<0.001, NS= Not Significant M= mean value**

The table above depicts the difference in the measurements for pain, shoulder ROM and shoulder disability at the baseline and after three weeks of treatment in both intervention and control groups. According to the table the P values obtained by applying the Wilcoxon rank sum test to the measurements taken before and after the treatment it is clearly evident that most of the P values have been less than 0.01 which proves the improvement with the treatment in both the control and intervention groups.

04.9 Comparison between the control and intervention groups for baseline measurements and measurements at the end of each week.

Table 7 intergroup comparison for pain

Weekly improvement	**N**	**N for test**	**Wilcoxon statistic**	**P Value**	**Estimated Median**
Initial	13	12	28.0	**0.410**	-7.00
Vas2 – Vas1	13	13	49.5	**0.807**	1.000
Vas3 – Vas2	13	13	56.0	**0.485**	2.500
Vas4 – Vas3	13	12	12.5	**0.041**	-4.500
Vas4 – Vas1	13	13	46	**1.000**	0.300

Vas2 – Vas1- The difference between the initial measurement and at the end of the treatment at the 1st week for pain.

Vas3 – Vas2- The difference between the measurement and at the end of the treatment at the 1st week and the second week for pain.

Vas4 – Vas3- The difference between the measurement and at the end of the treatment at the 2nd week and the 3rd week for pain.

Vas4 – Vas1- The difference between the initial measurement and at the end of the treatment at the 3st week for pain.

The table 2 shows the test results obtained by using Wilcoxon rank sum test for comparison of pain measured with VAS between control and intervention groups for baseline measurements and improvements in first, second, third weeks and overall improvement at the end of treatment.

Table 8 intergroup comparison for disability

Weekly improvement	N	N for test	Wilcoxon statistic	P Value	Estimated Median
Initial	13	13	54.0	**0.576**	2.470
Dis2 – Dis1	13	13	18.0	**0.059**	-7.000
DIs3 – dIs2	13	13	57.0	**0.442**	3.130
Dis4 – Dis3	13	13	45.0	**1.000**	-0.145
Dis4 – Dis1	13	13	64.0	**0.208**	10.40

Dis2 – Dis1- - The difference between the initial measurement and at the end of the treatment at the 1st week for shoulder disability.

DIs3 – dIs2- The difference between the measurement and at the end of the treatment at the 1st week and the second week for shoulder disability.

Dis4 – Dis3- The difference between the measurement and at the end of the treatment at the 2nd week and the 3rd week for shoulder disability.

Dis4 – Dis1- The difference between the initial measurement and at the end of the treatment at the 3st week for shoulder disability.

Table 3 shows the test results obtained by using Wilcoxon rank sum test for comparison of disability measured with shoulder disability index between control and intervention groups for baseline measurements and improvements in first, second, third weeks and overall improvement at the end of treatment

Table 9 Intergroup comparison for abduction ROM

Weekly improvement	N	N for test	Wilcoxon statistic	P Value	Estimated Median
Initial	13	11	43.0	**0.398**	10.00
Abd2 – Abd1	13	11	36.0	**0.824**	1.5
Abd3 – Abd2	13	10	26.0	**0.919**	-1.00
Abd4 – Abd3	13	10	40.0	**0.221**	5.00
Abd4 – Abd1	13	12	44.0	**0.724**	5.00

Abd2 – Abd1- The difference between the initial measurement and at the end of the treatment at the 1st week for shoulder abduction ROM.

Abd3 – Abd2 -The difference between the measurement and at the end of the treatment at the 1st week and the second week for shoulder abduction ROM.

Abd4 – Abd3 -The difference between the measurement and at the end of the treatment at the 2nd week and the 3rd week for shoulder abduction ROM.

Abd4 – Abd1- the difference between the initial measurement and at the end of the treatment at the 3st week for shoulder abduction ROM.

The above table shows the test results obtained by using Wilcoxon rank sum test for comparison of abduction ROM measured with the Universal Goniometer between control and intervention groups for baseline measurements and improvements in first, second, third weeks and overall improvement at the end of treatment.

Table 10 Intergroup comparison for external rotation

Weekly improvement	N	N for test	Wilcoxon statistic	P Value	Estimated Median
Initial	13	12	27.0	**0.367**	-8.00
Ex.ro2 Ex.ro1	13	11	35.0	**0.894**	0.00
Ex.ro3 Ex.ro2	13	11	39.0	**0.625**	2.00
Ex.ro4 Ex.ro3	13	11	52.0	**0.100**	6.00
Ex.ro4 Ex.ro1	13	11	48.5	**0.182**	11.5

Ex.ro 2 – Ex.ro 1- The difference between the initial measurement and at the end of the treatment at the 1st week for shoulder external rotation ROM.

Ex.ro 3 – Ex.ro 2 -The difference between the measurement and at the end of the treatment at the 1st week and the second week for shoulder external rotation ROM.

Ex.ro 4 – Ex.ro 3 -The difference between the measurement and at the end of the treatment at the 2nd week and the 3rd week for shoulder external rotation ROM.

Ex.ro 4 – Ex.ro 1- The difference between the initial measurement and at the end of the treatment at the 3st week for shoulder external rotation ROM.

The above table shows the test results obtained by using Wilcoxon rank sum test for comparison of external rotation ROM measured with the Universal Goniometer between control and intervention groups for baseline measurements and improvements in first, second, third weeks and overall improvement at the end of treatment.

Table 11 Intergroup comparison for internal rotation

Weekly improvement	N	N for test	Wilcoxon statistic	P Value	Estimated Median
Initial	13	10	33.0	**0.610**	9.00
In.ro2 –In.ro1	13	11	50.5	**0.131**	5.00
In.ro3 –In.ro2	13	11	50.5	**0.131**	5.00
In.ro4 –In.ro3	13	07	19.5	**0.398**	0.00
In.ro4 –In.ro1	13	8	15.5	**0.779**	0.00

In.ro 2 – In.ro 1- The difference between the initial measurement and at the end of the treatment at the 1st week for shoulder internal rotation ROM.

In.ro 3 – In.ro 2 -The difference between the measurement and at the end of the treatment at the 1st week and the second week for shoulder internal rotation ROM.

In.ro 4 – In.ro 3 -The difference between the measurement and at the end of the treatment at the 2nd week and the 3rd week for shoulder internal rotation ROM.

In.ro 4 – In.ro 1- The difference between the initial measurement and at the end of the treatment at the 3st week for shoulder internal rotation ROM.

The above table shows the test results obtained by using Wilcoxon rank sum test for comparison of internal rotation ROM measured with the Universal Goniometer between control and intervention groups for baseline measurements and improvements in first, second, third weeks and overall improvement at the end of treatment.

Table 12 Comparison between groups before treatments and after each week

			Control group (M)	Intervention group(M)	Differences
Vas scale		Initial	52.53	58.65	NS
		1st week	35.69	40.00	NS
		2nd week	18.64	30.22	NS
		3rd week	10.95	16.66	*
Disability		Initial	50.10	46.82	NS
		1st week	31.43	34.77	NS
		2nd week	16.40	24.93	NS
		3rd week	08.13	16.23	NS
ROM	Abduction	Initial	138.46	128.30	NS
		1st week	156.76	143.08	NS
		2nd week	167.23	157.07	NS
		3rd week	172.76	165.00	NS
	External rotation	Initial	42.46	48.30	NS
		1st week	51.23	56.38	NS
		2nd week	58.23	62.07	NS
		3rd week	67.53	63.76	NS
	Internal rotation	Initial	65.53	61.61	NS
		1st week	71.92	77.23	NS
		2nd week	75.07	78.38	NS
		3rd week	79.69	80.00	NS

***= p<0.05, ** = p<0.01, ***= p<0.001, NS= Not Significant M= mean value**

The table 8 shows the difference between the measurements in both control and intervention groups. There is no significant difference between the control and intervention groups in all the initial measurements at the baseline for pain, shoulder disability and shoulder ROM. And the comparison at the end of the first week of treatment has shown no significant difference between the groups. At the end of the second week of treatment there is no significant difference between the groups. The pain reduction in the 3rd week has shown significant difference between groups. But all the other measurements for shoulder disability, and ROM have not shown any significant difference between the groups. According to the above table the control group which received manual therapy and shoulder

exercises alone and the groups which received ultrasound therapy in addition to them have shown no significant difference in the improvement with the treatment regarding pain, disability and ROM.

Table 13 Overall improvements in percentage

			Control group (M)	Improvement Percentage (%)	Intervention group (M)	Improvement Percentage (%)
VAS scale		I	52.53	**79.15%**	58.65	**71.59%**
		1	35.69		40.00	
		2	18.64		30.22	
		3	10.95		16.66	
Disability		I	50.10	**83.77%**	46.82	**65.33%**
		1	31.43		34.77	
		2	16.40		24.93	
		3	08.13		16.23	
ROM	Abduction	I	138.46	**24.77%**	128.30	**28.60%**
		1	156.76		143.08	
		2	167.23		157.07	
		3	172.76		165.00	
	External rotation	I	42.46	**59.04%**	48.30	**32.00%**
		1	51.23		56.38	
		2	58.23		62.07	
		3	67.53		63.76	
	Internal rotation	I	65.53	**21.60%**	61.61	**29.84%**
		1	71.92		77.23	
		2	75.07		78.38	
		3	79.69		80.00	

The above table shows the percentage for overall improvement in both control and intervention groups. The pain has been reduced by 79.15% in the control group whereas in the intervention group it has been reduced by 71.59%. The disability has been reduced by 83.77% in the control group whereas in the intervention group it has been reduced by 65.33%.

The Abduction has been improved by 24.77% in the control group whereas in the intervention group it has been improved by 28.60%. Internal rotation it has been improved by 59.04% in the control group and in the intervention group it has been improved by 32.00%. External rotation has been improved by 21.60% in the control group whereas in the intervention group it has been improved by 29.84%

V. DISCUSSION

The aim of this study was to identify whether ultrasound therapy has an additional effect when combined with manual therapy and shoulder exercises in the treatment of patients with SIS. This is a randomized control trial which has not been done before in Sri Lanka.

05.1 Major findings

The measurements in VAS, disability index and shoulder ROM shows significant improvement in both control and intervention groups at the end of three weeks treatment period. In the control group VAS for pain measurement has reduced from 52.54±23.24 to 10.95 ± 9.52, the disability index has reduced from 50.11±19.11 to 8.13 ± 7.03. And the ROM for abduction external rotation and internal rotation were increased from abduction 138.5 ±46.2 to 172.77 ±16.90, external rotation 45.38±19.73 to 67.54± 13.15, and internal rotation 42.46 ±21.88 to 79.69 ± 12.33

In the intervention group VAS for pain measurement has reduced from 58.65 ±20.56 to 16.66± 13.02, the disability index has reduced from 46.83±19.80 to 16.24 ± 13.26. And the ROM for abduction external rotation and internal rotation were increased from abduction 128.31 ±31.84 to 165.00 ±21.41, external rotation 48.31±17.72 to 80.00 ±14.72, and internal rotation 48.31±17.72 to 63.77± 13.40.

Between group comparisons for the improvement in patient condition regarding pain, disability and shoulder ROM for abduction, internal rotation and external rotation after the three weeks treatment or at the end of first or second week have shown no statistically significant difference between the groups.

The participants' age ranged from 18-55. The distribution of age among the control and intervention groups has no significant difference. And the comparison between difference for baseline measurements and overall improvement for pain, shoulder disability and shoulder ROM has not shown significant difference according to the different age groups involved in this study either in the control or intervention groups.

Most of the participants had been affected by their dominant shoulder. But some of them had been affected by their non-dominant shoulder. But according to the results comparison between baseline measurements and overall improvement has no significant difference in either group.

In this study both male and female participants were included. But comparison between female and male participants for baseline measurements and overall improvement has no significant difference in control or intervention groups.

Thus the result shows that there is no gender, side or age associated with improvement.

05.2 Interpretation of results

It has been found by previous studies that there is an equal effectiveness of physiotherapist-led exercises compared with surgery (Kromer, T.O., et al 2009). Other studies have concluded that manual therapy and exercise seem effective for shoulder impingement (Michener, L.A., et al 2004) Results of the study conducted by Roy, J.S., et al. (2007) suggested that a 4-week program including motor control and strengthening exercises reduces shoulder pain and improves function in persons with SIS.

In the present study both the control and intervention groups has significant improvement after three weeks of treatment. There is significant improvement in pain reduction, disability and shoulder ROM from baseline measurements to the first, second and third week after treatment in both the groups. The control group received manual therapy and shoulder exercises alone and these treatments have led to the significant improvement in the control group. These findings support the previous study results and emphasize the importance of manual therapy and shoulder exercises in the treatment of patients with SIS.

The effects of therapeutic ultrasound are still being disputed. To date, there is still very little evidence to explain how ultrasound causes a therapeutic effect in injured tissue. Nevertheless practitioners worldwide continue to use this treatment modality relying on personal experience rather than scientific evidence.

Therapeutic ultrasound may have two types of benefit: Thermal effects and non-thermal effects. Thermal effects aids in pain relief whereas non thermal effects enhance the cell-repair effects of the inflammatory response. (H. D., et al. 2004).Reduction in pain and induced tissue repair are believed to help in regaining the reduced ROM due to SIS.

According to the study conducted by Ceilik D et al (2009), intermittent ultrasound added to conservative treatment of SIS do not provide an additional benefit to the patients with SIS. There was little evidence that active therapeutic ultrasound is more effective than placebo ultrasound for treating people with pain or a range of musculoskeletal injuries or for promoting soft tissue healing according to some systematic reviews.

The present study also shows that there is no significant difference between the control group which received manual therapy and shoulder exercises and intervention group which received ultrasound therapy in addition. According to the present study results, ultrasound therapy does not have an additional effect when combined with shoulder exercises and manual therapy.

05.3 Significance of the study

Although various studies have been done in UK, Turkey and some other country (Pribicevic, M, et al 2010) and the values of individualized treatment according to the findings of patient's physical assessments (Kromer, T.O, et al 2010) the studies have not been done related to this in Sri Lanka.

The number of patients per physiotherapist is far more in Sri Lanka when compared with advanced countries. This has been a major factor which leads to the limited availability of time that a therapist can spend for a patient. The patients also tend to believe that these modalities are effective than exercises and pay less attention to exercises.

The present study aimed not only at proving that ultrasound therapy does not have an added effect when combined with shoulder exercises and manual therapy, but also at emphasizing the importance of manual therapy and shoulder exercises in relieving symptoms in patients with SIS without the use of any electrotherapeutic modality.

05.4 Strength of the study

The strength of this study is enhanced by its methods and design. Internationally accepted measuring tools and scales have been used to collect data. The shoulder pain and disability index used in this study has shown to be valid and highly responsive in assessing shoulder pain and function (MacDermid, J., et al 2006); it is therefore highly recommended for use in patients with SIS (Purdy, S., et al 2005).

Participants were enrolled according to inclusion and exclusion criteria. All the group members have been involved in the interventions, data collection and the measurements. Every group member treated a similar number of participants from both the groups. Treatments were given according to standard treatment protocols and ultrasound therapy was given according to standard parameters.

Special training regarding manual therapeutic techniques such as shoulder joint mobilization including anterior posterior and inferior glides of 1st and 2nd grades, deep friction massage, shoulder capsular stretching and strengthening exercises was provided by the staff of the Department of Physiotherapy, Faculty of Allied Health Sciences, to each member of the team to reduce potential errors in treatments and taking measurements. Treatments were done under the supervision and instructions of qualified physiotherapists.

All the data has been analyzed through the MINITAB which is recognized as an accurate statistical software package. Data analysis was done with the assistance from qualified and experienced statisticians and the Department of Statistics, of the Faculty of Science, University of Peradeniya

05.5 Limitations of the study

This study has been done in a limited time period. Therefore duration of treatment has been only 3 weeks and has led to a lack of follow up period.

Due to limited time and limited accessibility for the investigators to hospitals the sample size was limited to 30.

Among them only 26 participants completed the study and there were 4 drop outs because of distance to the faculty of Allied Health Sciences.

Some patients referred from the Teaching Hospital, Peradeniya refused to give consent to participate in the study due to distance to the faculty and hence, could not be included in the study.

05.6 Future directions

The present study has shown that ultrasound therapy has no additional effect when combined with other physiotherapy interventions for SIS. The previous studies and systematic reviews also concluded that US therapy has no added effect.

Further studies are needed to compare the effectiveness of various other electrotherapy modalities when combined with manual therapy and exercises in the treatment of musculoskeletal conditions to improve the knowledge of how and when to apply appropriate modalities, manual therapy, therapeutic exercises and other physical therapy interventions for various conditions.

Studies to assess the effectiveness of individual assessment based treatment for various conditions should be encouraged.

Although the analytic studies regarding physiotherapy are being done, only few clinical trials have been done which are related to physiotherapy, in Sri Lanka. Therefore more and more trials should be encouraged in the development of physiotherapy as a profession and to improve the knowledge and the quality of physiotherapists in Sri Lanka

VI. CONCLUSION

The results of this research show that the participants who received manual therapy and shoulder exercises alone as well as the group which received ultrasound therapy in addition to manual therapy and shoulder exercises had significant improvement at the end of three weeks of treatment and at the end of each week.

The study finally concludes that ultrasound therapy has no additional benefit when combined with manual therapy and shoulder exercises in the treatment of patients with SIS to reduce pain, disability and to improve ROM.

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ANNEXURE

01 Assessment form

01).Demographic data

- Name;
- Age;
- Sex;
- Occupation;
- Handedness; left t
- Chief complaint;

Shoulder pain yes

Numbness yes

Difficulties in overhead activities

Yes

02).History

History of present illness; DM H Arthritis

Other

History of past medicine; NSAIDs An s

Other

Personal history; Married Un l

Socio-economical history (Monthly income)

<Rs;10,000	
>Rs;10,000	

03). Investigations

-X-ray image……..

-Ultra sound scan…….....

-Other ……

03).On observation

Built; medium obese thin

Deformity; AC joint shoulder

Abnormal pattern of movement; yes no

Willingness to move; yes no

Swelling; yes no

Inflammation; yes no

Other……

……..

04).On palpation

Tenderness	present	not present
SC joint		
Clavicle		
AC joint		
Bicipital groove		
Supraspinatus insertion		
Upper trapezius		
Deltoid insertion		
Subacromial bursa		

05).Pain assessment

- Side left right
- -Site neck shoulder arm forearm
- -Onset sudden gradual
- -Is it constant? Yes No

Visual Analogue Scale:

0-No pain

10-The worst pain imaginable

Table 12 Visual Analogue Scale

State	0	1	2	3	4	5	6	7	8	9	10
At its worst?											
When lying on the involved side											
Reaching for something on a high shelf											
Touching the back of your neck											

Pushing with the involved arm											

Total pain score…. /50*100=……%

(If a patient does not answer all questions, divided by the total possible score. E.g. if one question missed by 40)

Disability scale:

How much difficulty the patient has?

0 -No difficulty

10-So difficult it requires help.

Table 13 Disability Scale

State	0	1	2	3	4	5	6	7	8	9	10
Washing your hair											
Washing your back											
Putting on an skirt or trouser											
Buttoning on a shirt											
Forward reaching for an object											
Placing an object on a high shelf											
Carrying a heavy object of 4.5 kilograms											
Removing something from your back pocket.											

Total disability score…./80*100=…..%

(If a patient does not answer all question divided by the total possible score, e.g. if one question missed divided by 70)

Source: Roach et al. (1991).Development of a shoulder pain and disability index

05).On examination

Special tests

	Positive	Negative
Neer test:	☐	☐
Hawkins-Kennedy test:	☐	☐
Drop arm test:	☐	☐
Empty can test:	☐	☐
Infraspinatus resistance test	☐	☐
Lift off test	☐	☐
Biceps load test	☐	☐

Motor assessment

Table14 Motor Assesment

	L					R				
	AROM		PROM			AROM		PROM		
	PF	PFr	PF	PFr		PF	PFr	PF	PFr	
Flexion										
Extension										
Abduction										
Adduction										
Internal rotation										
External rotation										

AROM-Active Range of Motion

L-Left

PROM-Passive Range of Motion

R-Right

PF- Painful ROM

PFr- Pain free ROM

Patient's satisfaction

-How do you feel about the pain you feel now compared with that you felt a week ago?

Feel the same ☐ ☐ ☐

-How do you feel about the ability to use your hand in day to day activities compared to that a week ago?

Feel the same ☐ ☐ ☐

-How do you feel about the ability to lift your arm over the head compared to that a week ago?

Feel the same ☐ ☐ ☐

02. Treatment protocol

Goals:

-Relieve pain.

-Maintain/increase flexibility (ROM).

- Improve and maintain muscle power

Range of motion exercises

-Pendulum exercise

- Flexion- Extension exercises 15 times
- Abduction- Adduction exercises 15 times
- Circumduction (clock wise & anti clock wise) each 15 times

-Active/active assisted/passive ROM

- Abduction with rope and pulley(figure 9) 15 repetitions
- L- Bar active assisted exercises(figure 10)
  - Abduction- Adduction with L- bar exercises 15 repititions
  - Flexion – Extension with L- bar exercises 15 repetitions
  - Internal rotation- External rotations L- bar exercises 15 repetitions
- Self-capsular stretching
  - Anterior self- capsular stretching 3 repetitions, ask the patient to holding each for 5 counts
  - Posterior self – capsular stretching 3 repetitions, ask the patient to holding each for 5 counts

Joint mobilization:

- Initially start with grade 1. Gradually progress into 2.
- Joint distraction and Inferior, anteroposterior and posteroanterior glides.(figure 14) 15 gliding for each sets ant 3 times therapist have to peform

Strengthening exercise

- Rotator cuff (figure 14) using springs and thera bands
- Biceps(figure 15)using springs
- Serratus anterior (wall pushups)(figure 16)

Modalities

(For intervention group only)

Ultrasound treatment (figure 17)

(Pulsed 1MHz ultrasound at 1 W/cm^2 for 5 minutes,) patient should be in relaxed sitting position

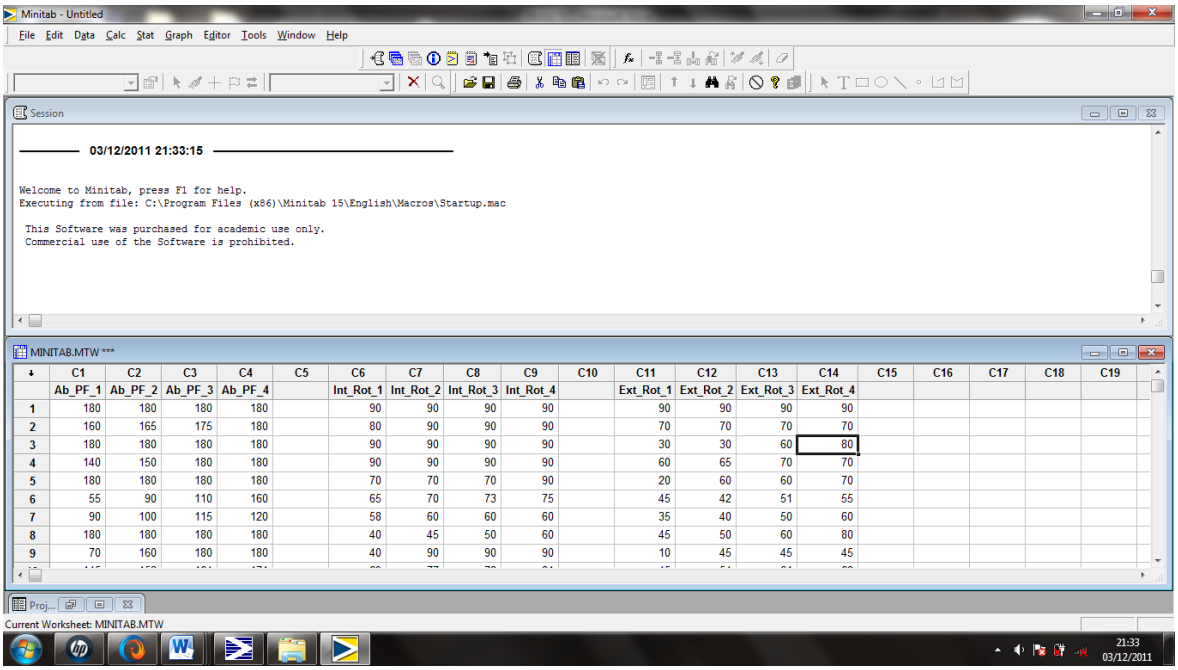
Patient education and activity modification

Educate the patient regarding activity, pathology, and avoidance of overhead activity, reaching and lifting activity

03. Study Participants details

	Name	Age	Address
1.	Mrs A.M Somawathie	50	Malvila, ThimbalaPanaliya, Polgahawella
2.	Mrs R.K.M Lalani	40	Piyasewana, Ethalawatthe.
3.	Mrs S.D Kusumawathie	53	Tharaptha, Hendigolla
4.	Mrs W.A Balawthie	58	Ambahera, Urumeeya
5.	Mr GaminiJayaratne	46	204, WijithaMawatha, Muruthalawa
6.	Mr S Navaneethan	28	Coolbrougdevision, Thalawakelle
7.	Mr W.D.Premaratne	56	Pallegama, Bandarakoswaththe
8.	Mr ThimiraGalappathtige	18	6/8, Revenue rd., Thennakumbura, Kandy
9.	Mrs ShiyalathaEkanayake	60	Homathagama, Ukumeeya, Kurunegala
10.	Mrs A.D.R Damayanthi	46	33/3, Santhasewana, Malkadawara, Kurunegala
11.	Mrs H.P. Somawathie	56	Waraliya, Panatharagama, Kurunegala
12.	Mrs G.D Hemawathie	59	Hongawathoraya, Kurunegalla
13.	Mrs M.G Manel	47	36, Heerrassagala, Pilimathalawa
14.	Mr W.A.G Wijesuriya	44	117/3, 1st lane, Arambawela, Pothuhera
15.	Mrs DasuniAnarasinghe	41	Ahelagolla, Bmanagala
16.	Mrs C.M Lalani	54	Bopalamulla, Dewalagama
17.	Mr N.K.G.Rajapakshe	39	Galpaya, Meethalawa, Gampola
18.	NimeshaGunasinghe	18	St Anthony's College, Katugasthota, Kandy
19.	Mr Inesh R.A.K	20	Galagedara , Kandy
20.	Lahiru	29	182, Mannikkawa, Hingula
21.	Mallika Jayawickrama	49	Bopathgama, Aratthikattuwa
22.	Chandima Abeykon	22	Ivo Jeninghs Hall, Peradeniya
23.	K.A.D.K Nawaratne	24	Panawalagama,Mhamulgama
24.	Ms.K.H. Jayasekara	18	143, Sirikulamwatthe, Mallawapitiya.

04. Data analysis using Minitab software



	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17	C18	C19
	Ab_PF_1	Ab_PF_2	Ab_PF_3	Ab_PF_4		Int_Rot_1	Int_Rot_2	Int_Rot_3	Int_Rot_4		Ext_Rot_1	Ext_Rot_2	Ext_Rot_3	Ext_Rot_4					
1	180	180	180	180		90	90	90	90		90	90	90	90					
2	160	165	175	180		80	90	90	90		70	70	70	70					
3	180	180	180	180		90	90	90	90		30	30	60	80					
4	140	150	180	180		90	90	90	90		60	65	70	70					
5	180	180	180	180		70	70	70	90		20	60	60	70					
6	55	90	110	160		65	70	73	75		45	42	51	55					
7	90	100	115	120		58	60	60	60		35	40	50	60					
8	180	180	180	180		40	45	50	60		45	50	60	80					
9	70	160	180	180		40	90	90	90		10	45	45	45					

05. Consent letter -English

Department of Physiotherapy,

Faculty of Allied Health Sciences,

University of Peradeniya

…..…../……./…….

Dear Mr/Mrs/Miss,

Obtaining the consent for treatment and collection of data

We are a group of final year students from the department of Physiotherapy, Faculty of Allied Health Sciences, University of Peradeniya, conducting a research to find out the effectiveness of Ultrasound therapy, which is a part of physiotherapy treatment for a disorder of the shoulder called "shoulder impingement syndrome"

We would appreciate your participation. During the research you will undergo a physical assessment for shoulder and receive physiotherapy treatment; this procedure will require you to expose the shoulder region. The treatment will continue for three weeks.

If you have no objection in participating in this research please confirm it below.

…….

(Signature)

I hereby give my consent and authority to**……**

(Name of the physiotherapy student), to perform the above mentioned procedure.

The nature of these procedures has been explained to me, and I understand what will be done.

Name; ……

Signature; …….. Date; ……..

---

06. Consent letter- Sinhala

fN!; Ñls;ail fomd¾;fïka;=j"

iu fi!LH úoHd mSGh"

fmardfoKs úYajúoHd,h"

fmardfoKsh'

"""$"""$2011

uy;auhdfKks$uy;añhKs$fukúhKs"

m%;sldr lsÍu iy o;a; /ia lsÍu i|yd wjir ,nd .ekSu'

wm Subacromial Impingement Syndrome (SIS) kñka ye¢kafjk frda.S ;;a;ajh i|yd Ndú;d lrk fN!; Ñls;ail m%;sldr j, wx.hlajk Ultrasound m%;sldr l%ufha M,odhS;djh ms<sn|j iólaIKhl kshef,k" fmardfoKs úYajúoHd,hSh iu fi!LH úoHd mSGfha fN!; Ñls;ail fomd¾;fïka;=fõ wjika jir YsIH lKavdhuls'

tai|yd wms Tnf.a iyNd.S;ajh w.h lr isákafkuq' iólaIKh ;=<§ Tn Wrysi i|yd jk ldhsl mÍlaIKhlg Ndckh flfrk w;r fN!; Ñls;ail m%;sldrhkao ,nd foa' fï l%shdj,sh i|yd Wrysia m%foaYh ksrdjrKh lsÍu Tfnka wfmalaId flf¾' fuu m%;sldr wLKavj i;s ;=kla mqrd ,nd foa'

fuu iólaIKh i|yd iyNd.S ùug Tfí úfrdaO;djhla fkdue;skï lreKdlr my;ska th ;yjqre lrkak'

''''''''''''''''''''''''''''''''

w;aik

uu fuhska '' ^fN!; Ñls;ail isiqjdf.a$ isiqúhf.a ku& yg by; i|yka l%shdj,sh isÿ lsÍug uf.a wjirh yd n,h ,nd foñ' fuu l%shdj,sfha iajNdjh ud yg meyeÈ,s lrk ,o w;r isÿ lrkq ,nk foh uu wjfndaO lr .;sñ'

ku''

w;aik'''''''''''''''''''''''''''''''''' Èkh ''''''''''''''''''''''''''''''''''''

07. Consent letter - Tamil

,ad;kUj;Jt Njhs;%l;Lr; rpfpr;ir Kiwf;Fk; jfty; Nrfhpj;jYf;Fkhd mDkjp ngwy;

Nguhjidg; gy;fiyf;fofj;jpy; ,ize;j Rfhjhu tpQ;Qhdf; fw;iffs; gPlj;jpy; ,ad; kUj;Jtj; Jiwapy; ,Wjpahz;by; fy;tp fw;Fk; khzth;fshfpa ehk;> ,Wjpahz;L Research Methodology vd;w ghlj;jpl;lj;jpw;F mikthf "Effectiveness of Ultrasound therapy in combination with manual therapy and shoulder exercises for subacromial impingement syndrome" vd;w jiyg;gpy; vkJ Ma;it Nkw;nfhs;s ,Uf;fpNwhk;. Njhs;%l;Lg; gpur;ridf;Fhpa fopnahyp rpfpr;ir njhlh;ghd ,e;j Ma;T njhlh;r;rpahf %d;W fpoikfs; eilngWk;.

,e;j rpfpr;ir Kiwf;F cq;fspd; njhlh;r;rpahd gq;fspg;ig toq;FkhW Nfl;Lf; nfhs;fpNwhk;.

…………………………..

ehd; Fwpg;gpl;l ,e;j khztUf;F rpfpr;ir mspg;gjw;F vdJ rk;kjj;ijAk; xj;Jiog;igAk; nfhLg;Ngd;.
vdf;F ,e;j rpfpr;ir Kiw njhlh;ghd KOikahd tpsf;fk; mspf;fg;gl;Ls;sJ.

ngah; : ……………………..

ifnahg;gk; : …………………………………… jpfjp : …………………