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A COMPARATIVE STUDY BETWEEN THE EFFICACY OF HIGH GRADE MOBILIZATION WITH ACTIVE EXERCISES VERSUS CAPSULAR STRETCHING WITH ACTIVE EXERCISES ON PATIENTS WITH ADHESIVE CAPSULITIS

H. B. Shivakumar¹, Chanappa T. S², R. Balasaravanan³, Swathi K. R⁴

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ABSTRACT: BACKGROUND: Adhesive capsulitis of shoulder is characterized by insidious and progressive pain and loss of active and passive mobility of glenohumeral joint. In many physical therapy programs for subjects with adhesive capsulitis of shoulder mobilization techniques are an important part of the intervention. The purpose of this study is to compare the efficacy of high grade mobilization with active exercise versus capsular stretching with active exercise in patients with adhesive capsulitis. **AIMS:** To compare the efficacy of high grade mobilization with active exercise versus capsular stretching with active exercise in patients with adhesive capsulitis. **METHODS AND MATERIALS:** It is a comparative experimental study dividing in to two groups. 60 subjects aged between 40-60 years 30 in each group. Group A: (n=30):- Treated with high grade mobilization with active exercise Group B: (n=30):- Treated with capsular stretching with active exercise. Analysis was based on VAS scores, ROM (Active) and Shoulder Pain and Disability Index (SPADI). Treatment was given for 5 days a week for 3 weeks. The following outcome measures were measured at baseline (pre) and (post) 3th week follow up. VAS Score, ROM of shoulder and Shoulder pain and disability index (SPADI) The baseline measurements were compared to data at the end of 3rd week. **RESULTS:** The VAS, ROM and SPADI percentage across baseline (pre) and 3rd week (post) follow up showed a significant improvement statistically in their mean scores within Group A and Group B ($P < 0.001$). Statistically significant greater changes in score were found in High grade mobilization with active exercise (Group A) for VAS, ROM and SPADI as compared to Capsular Stretching with active exercise (Group B). **CONCLUSION:** The results indicate that High grade mobilization with active exercise (Group A) and Capsular stretching with active exercise (Group B) are significantly effective in improving VAS, ROM and SPADI. However High grade mobilization with active exercise (Group A) appears to be more effective in improving glenohumeral joint mobility and reducing VAS and disability as compared to Capsular Stretching with active exercise (Group B).

KEYWORDS: Adhesive capsulitis, High grade mobilization, capsular stretching, range of motion.

INTRODUCTION: Adhesive capsulitis is an insidious and progressive pain with decreased active and passive mobility of the glenohumeral joint involving scapulohumeral pain.¹ In general, a global loss of active and passive motion is present; the loss of external rotation with the arm at the patient's side is a hallmark of this condition.²

The annual incidences of adhesive capsulitis are 3-5% in the general population and up to 20% in people with diabetes. It most commonly affects women aged between 40 and 60 years. Frozen

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shoulder often presents bilaterally and commonly affects the contralateral side years after onset of symptoms in the first shoulder but it does not affect the same shoulder twice.^{3,4}

Neviaser identified 4 stages of this condition, which have been correlated with clinical examination.

1ST STAGE: It is the painful phase, which is characterized by a gradual onset of symptoms. Symptoms persist for less than 3 months and consist of an aching pain referred to the deltoid insertion and inability to sleep on the affected side. Patients may report a mild limitation of ROM which invariably resolves with the administration of local anesthetic.

2ND STAGE: It is also called the “freezing stage”. Symptoms continue since 3 to 9 months and are characterized by nocturnal pain moreover when the patients lying on the affected side, furthermore a significant loss of both active and passive ROM is referred.

3RD STAGE: It is called the “frozen stage”, symptoms persists since 9 to 14 months. The shoulder stiffness is predominant and pain may still be present at the end of motion or at night.

4TH STAGE: It is the “thawing stage”; it is characterized by minimal pain and a gradual improvement of ROM due to capsular remodeling. This stage occurs between 15 and 24 months.⁵

The Clinical findings, course and prognosis of this condition are well known. As the patient progresses from the freezing to frozen stage, the pain becomes more severe, and the restriction in elevation and rotation increases.¹

Onset of the condition is usually gradual rather than acute. Patients will often describe an insidious onset of vague, dull pain at the deltoid insertion, over the anterior capsule and posterior capsule with deep palpation, a pain pattern that may be due to innervations of the joint capsule by the axillary nerve. Night pain is a very common feature, and sleeping on the affected shoulder is usually symptomatic. In those with longstanding disease, increased compensatory scapulothoracic motion can create additional pain around the medial scapula.¹

A considerable proportion of patients with adhesive capsulitis are treated with nonsteroidal anti-inflammatory drugs, intra-articular corticosteroid injections, and physical therapy. In persistent cases, more aggressive interventions, such as hydro dilatation, arthroscopic release, or manipulation under anesthesia, have been used.

With respect to physical therapy, a variety of interventions are used; these include heat or ice applications, ultrasound, interferential therapy, transcutaneous electrical nerve stimulation, active and passive range-of motion (ROM) exercises, proprioceptive neuromuscular facilitation (PNF) techniques, and mobilization techniques.

From a recent systematic review of the effectiveness of physical therapy interventions for shoulder pain, Green et al concluded that there is no evidence that physical therapy without concurrent interventions, such as corticosteroid injections, is of benefit for adhesive capsulitis. The authors of this review stressed the need for trials of physical therapy interventions for specific clinical conditions associated with shoulder pain.⁶

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In many physical therapy programs, mobilization techniques are an important part of the intervention. Mobilization techniques can be performed as physiologic movements or accessory movements. Physiologic movements at the glenohumeral joint are movements of the humerus in the cardinal planes (eg, flexion, extension, abduction, adduction, external rotation, and internal rotation).

Accessory movements are movements that are passively induced by a therapist and consist of rolling, gliding (or sliding), spinning, and distraction within the joint.⁷ The intensity of the mobilization techniques with rhythmic oscillatory movements usually is categorized according to the 5-grade classification system of Maitland. Mobilization techniques were applied with intensities according to Maitland grades III and IV. Grade III: Large amplitude reaching the limited Range of motion Grade IV: Small amplitude at the end of the limited Range of motion.^{8,9}

Joint mobilization techniques are assumed to induce various beneficial effects. The neurophysiologic effect is based on the stimulation of peripheral mechanoreceptors and the inhibition of nociceptors. The biomechanical effect manifests itself when forces are directed toward resistance but within the limits of a subject's tolerance.

The mechanical changes may include breaking up of adhesions, realigning collagen, or increasing fiber glide when specific movements stress the specific parts of the capsular tissue. Furthermore, mobilization techniques are supposed to increase or maintain joint mobility by inducing rheologic changes in synovial fluid, enhanced exchange between synovial fluid and cartilage matrix, and increased synovial fluid turnover.⁶

Stretching is a general term used to describe any therapeutic maneuver designed to increase mobility of soft tissues and subsequently improve range of motion by elongating structures that have shortened and have become hypo mobile over time.^{10,11} The lower the intensity, the longer the time the patient will tolerate stretching and soft tissues can be held in a lengthened position.

The higher the intensity, the less frequently the stretching intervention can be applied to allow time for tissue healing In hypo mobile patients manual stretching and self-stretching is found to be effective Stretching takes soft tissues structures beyond their available length to increase range of motion. Self-stretching enables a patient or increase range of motion gained as the result of direct intervention by the therapist.^{10,9}

Active exercises within the pain free range of motion stimulate mechanoreceptors and decreases pain. Exercises within pain free range also move the synovial fluid, thus decrease Inflammation and decrease pain. It maintains physiological elasticity and contractility of the muscles. It provides sensory feedback from the contracting muscles. It also provides a stimulus for bone and Joint tissue integrity.^{10,12}

Ultrasound is a deep heating agent commonly used in rehabilitation. Deep heating agents are capable of causing increased temperatures in tissues up to 3 to 5cm deep. It provides increased extensibility of collagen fibers, decreased joint stiffness, decreased muscle spasm, modulation of pain and increased blood flow.^{13,14}

AIMS AND OBJECTIVES:

- To assess the effectiveness of high grade mobilization and active exercises with ultrasound on adhesive capsulitis
- To assess the effectiveness of capsular stretching and active exercise with ultrasound on adhesive capsulitis

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- To compare the effectiveness of high grade mobilization and active exercises with ultrasound and capsular stretching and active exercise with ultrasound on relieving the pain
- To compare the effectiveness of high grade mobilization and active exercise and capsular stretching and active exercise with ultrasound on improving the range of motion (ROM).
- To compare the effectiveness of high grade mobilization and active exercises with ultrasound and capsular stretching and active exercise with ultrasound in the improvement of shoulder disability

METHODOLOGY:**SOURCE OF DATA:**

1. Out Patient Department of Orthopedics, Kempegowda Institute of Medical Science Hospital and Research Center, Bangalore
2. Out Patient Department of Physiotherapy, Kempegowda Institute of Physiotherapy, Bangalore.

METHODS OF COLLECTION OF DATA:

Study Design: Comparative study design

Sample size: 60 subjects

Sample method: Random Sampling Method

Study duration: 1 year

INCLUSION CRITERIA:

1. Patients aged between 40 to 60 years.
2. Patients diagnosed with adhesive capsulitis of shoulder by a certified medical practitioner.
3. Having a painful stiff shoulder for at least 3 months or more.
4. Patient with diabetes.

EXCLUSION CRITERIA:

a) Intrinsic problems of the shoulder such as:

1. Tear of rotator cuff
2. Biceps tendonitis
3. Calcific tendonitis
4. History of any trauma, fracture or dislocation
5. Rheumatoid arthritis
6. Osteoarthritis
7. Osteoporosis
8. Malignancies
9. Sympathetic dystrophy

b) Extrinsic problems such as

1. Neuro-muscular disorders or referred pain from an associated condition such as cervical disc prolapse with radiculopathy
2. Musculoskeletal disorder with hypermobility.
3. Patients who have taken cortico steroid injections.

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OUTCOME MEASURES: Pain was assessed on Visual Analog Scale (VAS), Shoulder Range of Motion using Universal Goniometer and Functional Disability of Shoulder with Shoulder Pain and Disability (SPADI). These outcome measures were assessed at baseline before treatment and at 3 weeks at the end of treatment session.

1. Visual Analogue Scale (VAS) A horizontal line was drawn on a paper and participants were asked to mark a point on the line best defined the present pain level, where 0 is indicated no pain and 10 indicated severe pain.
2. Shoulder range of motion was measured using universal goniometer.
3. Shoulder Pain and Disability Index (SPADI).

The Shoulder Pain and Disability Index (SPADI) is a self-administered questionnaire that consists of two dimensions, one for pain and the other for functional activities. The pain dimension consists of five questions regarding the severity of an individual's pain. Functional activities are assessed with eight questions designed to measure the degree of difficulty an individual has with various activities of daily living that require upper extremity use.

PROCEDURE: Sixty subjects fulfilling the inclusion and exclusion criteria diagnosed with adhesive capsulitis are considered for the study. The study population consisted of individuals between 40 and 60 years of age.

After explaining the subjects about the treatment, written consent is taken. Pre -assessment will be taken prior to the commencement of treatment with self-report outcome measures of VAS, shoulder pain and disability index, and range of motion with goniometry.

After evaluation sixty subjects are divided into two group's i.e.

Group-A and Group-B. Each group consists of 30 subjects each.

INTERVENTION:

Group-A: will receive treatment using high grade mobilization, therapeutic ultrasound and active exercises.

Group-B: will receive treatment using capsular stretching, therapeutic ultrasound and active exercises

All the subject of both the group A and B will be given therapeutic ultrasound prior to mobilization and capsular stretching.

Using pulsed ultrasound therapy(1MHz) for 8 minutes with an intensity of 1W/cm², and the mark space ratio is 1:1 along with 1.5g of a standard coupling medium for the treatment .

Treatment Parameters:

Frequency-1MHz

Intensity-1W/cm²

Mode- Pulsed mode

Mark Space Ratio-1:1

Position of patient for ultrasound therapy: Subject will be in sitting position positioned in back rest chair with arm adducted and internal rotated and ultrasound, along with the coupling medium over the transducer, is given on the area of pain in the affected shoulder.

Duration of the treatment: 5 days per week for three weeks.

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GROUP-A: 30 subjects will be treated with high grade mobilization.

- a) Caudal glide (increases abduction):** Position of patient: Supine, with the arm abducted to the end of its available range. External rotation of the humerus should be added to the end-range position as the arm approaches and goes beyond 90°. Position of therapist and hand placement: Therapist stands facing the patient's feet and stabilizes the patient's arm against the trunk with the hand farther from the patient. Place the web space of the other hand just distal to the acromion process on the proximal humerus. Mobilizing force: With the hand on the proximal humerus, glide the humerus in an inferior direction.
- b) Posterior glide (increases flexion and internal rotation):** Position of patient: Supine, with the arm flexed to the end of its available range. Internal rotation of the humerus with elbow flexion should be added to the end-range position as the arm approaches and goes beyond 90°. The arm may also be placed in horizontal adduction. Position of therapist and hand placement: Stride standing facing the patient. Place padding under the scapula for stabilization. Place one hand across the proximal surface of the humerus. And the other hand over the patient's elbow. Mobilizing force: Glide the humerus posteriorly by pushing down at the elbow through the long axis of the humerus.
- c) Anterior glide (increases external rotation):** Position of patient: prone, with the arm abducted to the end of its available range. Position of therapist and hand placement: Therapist stands facing the patient's feet and stabilizes the patient's arm against the trunk with the hand farther from the patient. Mobilizing force: With the hand pushing on the posterior part of the humeral head, glide the humerus.

Duration of the Treatment: High grade Mobilization was given as 5 sets of 10 – 15 glides with a rest period of 1 minute in between the sets for 5 days a week for duration of 3 weeks.

GROUP-B: 30 subjects will be treated with capsular stretching.

- a) Anterior capsular stretch:** Patient is made to stand on the door way and made to hold the door frame with the elbow straight and the shoulder abducted to 90 degrees and externally rotated and is made to walk through the doorway until the stretch is felt at the front of the shoulder and made to hold for 10sec.
- b) Posterior capsular stretch:** The therapists grasp the elbow of the involved arm across the chest to stretch the back of the involved shoulder and made to hold for 10sec.
- c) Inferior capsular stretch:** The therapist holds the involved arm overhead with the elbow bent and the arm straight ahead and the arm is farther stretched overhead. And the stretch is made to hold for 10sec.

Duration of the stretch: The patient was instructed to hold the stretch for 10 seconds and repeat 5 times for 3 weeks.

All the subject of both the group A and B will be given active exercises which are mentioned below:

- **Pendulum (Codman's) exercises:**
Patient position and procedure: standing with the trunk flexed at the hips about 90 degrees. The arm is held loosely in downward position. A swinging motion of the arm is initiated with

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Motions of flexion, extension, horizontal abduction, adduction and circumduction. If the patient experiences back pain from bending over prone position can be used.

- **Wand exercises such as:**

Shoulder flexion and return: The wand is held with the hands with shoulders in wide position. The wand is lifted forward and upward through the available range, with the elbows kept in extension.

Shoulder horizontal abduction and adduction: The wand is lifted to 90 degrees flexion. Keeping the elbows in extension, the patient pushes and pulls the wand back and forth across the chest through the available range.

Shoulder internal and external rotation: The patient is on supine position. The patients arm is at the sides and the elbows are flexed to 90 degrees. Rotation of the arm is accomplished by moving the wand from side to side across the trunk while maintaining the elbows at the side.

- **Gear shift exercises:** Patient is in sitting position with holding the wand in involved arm. With the tip resting on the floor to support weight of the arm. Patient is instructed to move the wand in forward, backward and diagonal directions similar to gear shifting movements in driving a car.

- **Towel exercises:** Patient is in sitting position. Patient is instructed to hold the ends of the towel with one arm overhead and the arm to be stretched behind the lower back and then pull up the towel with the overhead hand.

- **Finger ladder/ wall climbing exercises:** The patient stands, facing the finger ladder or wall an arm's length away and places the index or middle finger on a step of the ladder. The arm is moved into flexion by climbing with the fingers.

The same exercise mentioned above is performed with patient standing side-ways.

Each exercise is performed twice a day with ten repetitions. The patient is advised to perform the above mentioned active exercises and hot water fermentation at home to maintain range of motion within available pain free range.

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Fig. 1: MATERIALS USED IN THE STUDY

Fig. 2: APPLICATION OF THERAPEUTIC ULTRASOUND

Fig. 3: POSTERIOR GLIDE OF THE GLENOHUMERAL JOINT

Fig. 4: INFERIOR GLIDE OF GLENOHUMERAL JOINT

Fig. 5: ANTERIOR GLIDE OF THE GLENOHUMERAL JOINT

Fig. 6: ANTERIOR CAPSULAR STRETCH

Fig. 7: INFERIOR CAPSULAR STRETCH

Fig. 8: POSTERIOR CAPSULAR STRETCH

Fig. 9: FINGER LADDER

Fig. 10: WAND EXERCISE

Fig. 11: TOWEL EXERCISE

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RESULTS: The VAS, ROM and SPADI percentage across baseline (pre) and 3rd week(post) follow up showed a significant improvement statistically in their mean scores within Group A and Group B ($P < 0.001$). Statistically significant greater changes in score were found in High grade mobilization with active exercise (Group A) for VAS, ROM and SPADI as compared to Capsular Stretching with active exercise (Group B).

DISCUSSION: Adhesive Capsulitis is characterized by painful stiffness of the shoulder that may persist for several years. The annual incidences of adhesive capsulitis are 3-5% in the general population and up to 20% in people with diabetes. It most commonly affects women aged between 40 and 60 years.^{4, 5}

This study was carried out to determine the efficacy of High Grade mobilization with active exercise versus capsular stretching with active exercise on patients with adhesive capsulitis.

In the study it was found that adhesive capsulitis was reported to be more common in women, especially between the age group of 40 to 60 years. This is in accordance to the study done by Neviaser RJ; Neviaser TJ in which they concluded the condition is more prevalent in Women.

In this study group A 53.3% were females and in group B 60% were females. In group A 46.7% were males and in group B 40 % were males.

In this study in group A between age 41-50 is 40% and in Group B between age 41-50 is 36.7%. In group A between age 51-60 is 60%. In group B between age 51-60 is 63.3%.

Adhesive Capsulitis is a contracture of the capsule and depending on how severe the contracture is (for it varies in intensity from patient to patient) the treatment is decided. The first objective in the treatment of patients with adhesive capsulitis is pain relief. This is essential, for it permits patients to more readily participate in an exercise program aimed at restoring motion and recovering function. The primary mode of treatment for adhesive capsulitis is prevention.

The overall goal of treatment is to relieve pain, restore motion, and to restore function.

Although adhesive capsulitis is generally considered to be a self-limiting condition that can be treated with physical therapy, the best treatment has been the subject of and numerous studies have demonstrated successful results.

Griggs et al reported that following a physical therapy programme consisting of passive stretching exercises (forward elevation, external rotation, horizontal adduction and internal rotation) at a mean follow-up of 22 months, patients demonstrated a reduction in pain score from 1-57 to 1-16 in a range from one to five points, improvements in active range of motion, and 64 patients (90%) reported a satisfactory outcome.¹¹

Vermeulen HM did a study on effectiveness of End range mobilization technique in adhesive capsulitis of shoulder joint in 45 subjects and the results suggested End range mobilization technique to be beneficial in improving joint mobility. In the present study it was found that the group which received mobilization as an intervention showed to be effective in decreasing pain and increasing the mobility of the shoulder.⁶

Thus in this study high grade mobilization and capsular stretching with active exercises were considered to check its effectiveness in increasing shoulder range of motion and functional limitation in patients with adhesive capsulitis.

On further analysis it also supported the hypothesis that there is significant difference in effectiveness of both High grade mobilization with active exercise and Capsular stretching with active

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exercise. From this study it can be said that High grade mobilization techniques with active exercise is better than capsular stretching with active exercise and can be used as method of choice for the treatment of patient with adhesive capsulitis.

In this study VAS is used for measuring shoulder pain, GONIOMETER for active and glenohumeral range of motion and SPADI for shoulder disability as their validity and reliability are already established.

Based on the statistical analysis, the result of this study shows that in Group A (High grade mobilization with active exercise) the value of VAS before the treatment in group A is 7.97 and after 3 weeks of treatment the VAS was 3.90.

Whereas in group B (capsular stretching with active exercise) the VAS value before the treatment was 7.77 and after 3 weeks of treatment was 5.37. Hence when compared the pre and post treatment VAS values it showed that the improvement in Group A is more than Group B.

The p- value pre-treatment is 0.409 and p-value post treatment is <0.001 . Hence the improvement result is shown to be significant.

The comparison of average improvement of ROM in Group A (high grade Mobilization with active exercise) and Group B (capsular stretching with active exercise) shows that the improvement in flexion of group A was 133.67 whereas in group B was 120.0. The p value pre is 0.348 to post p value <0.004 . Hence the improvement result is shown to be significant.

The comparison of average improvement of ROM in Group A (high grade Mobilization with active exercise) and Group B (capsular stretching with active exercise) shows that the improvement in abduction of group A was 115.17 whereas in group B was 101.0. The p value pre is 0.484 to post p value <0.001 . Hence the improvement result is shown to be significant.

The comparison of average improvement of ROM in Group A (high grade Mobilization with active exercise) and Group B (capsular stretching with active exercise) shows that the improvement in internal rotation of group A was 33.73 whereas in group B was 25.63. The p value pre is 0.382 to post p value <0.001 . Hence the improvement result is shown to be significant.

The comparison of average improvement of ROM in Group A (high grade Mobilization with active exercise) and Group B (capsular stretching with active exercise) shows that the improvement in external rotation of group A was 23.93 whereas in group B was 15.77. The p value pre is 0.245 to post p value 0.001. Hence the improvement result is shown to be significant.

In total Shoulder pain and disability index the average improvement is 54.73 in group A and 91.17 in group B. The p value pre is 0.693 to post p value 0.001. Hence the improvement result is shown to be significant.

CONCLUSION: This study was conducted on 60 subjects at Out Patient Department of Physiotherapy, Kempegowda Institute of Physiotherapy, Bangalore with an aim to find out the effectiveness of high grade mobilization techniques with active exercise over capsular stretching with active exercise on patients with Adhesive capsulitis.

The subjects were divided into two groups of 30 each. Group A received High grade mobilization techniques with active exercise was given for 5 sets of 10 – 15 glides with a rest period of 1 minute in between the sets for 5 days a week for a duration of 3 weeks

Group B received capsular stretching with active exercise for holding stretch for 10 seconds and repeat 5 times for 3 weeks.

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Both the group A and group B was told to perform each exercise twice a day with ten repetitions.

The outcome measure includes VAS for pain, goniometer for Range of motion (ROM), and Shoulder Pain and Disability Index (SPADI) for functional ability.

The VAS, ROM and SPADI were taken prior to treatment and after 3 week of treatment .The analysis led to the finding that:

1. Both the groups showed improvement in pain, shoulder range of motion and function after 3 weeks of treatment.
2. Group A of High grade mobilization with active exercise showed better results when compared to Group B of capsular stretching with active exercise in the improvement of range of motion and function.
3. High grade mobilization with active exercise showed a highly significant difference when compared to exercise alone in its effectiveness on adhesive capsulitis.

This proves and concludes that both can be preferred for treatment of adhesive capsulitis whereas the High grade mobilization with active exercises is more effective in decreasing pain, improving shoulder range of motion and function in adhesive capsulitis.

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AUTHORS:

1. H. B. Shivakumar
2. Chanappa T. S.
3. R. Balasaravanan
4. Swathi K. R.

PARTICULARS OF CONTRIBUTORS:

1. Professor, Department of Orthopaedics, KIMS, Bangalore.
2. Associate Professor, Department of Orthopaedics, KIMS, Bangalore.
3. Professor, Department of Physiotherapy, KIMS, Bangalore.

4. 2nd Year Post Graduate, Department of Physiotherapy, KIMS, Bangalore.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Swathi K. R,
#173, K.H.B. Colony,
5th Block, 4th Cross,
Koramangala, Bangalore- 560095.
Karnataka.
E-mail: swathikrgowda@gmail.com

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