CONSULTANT SHOULDER & JOINT REPLACEMENT SURGEON

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# Table of Contents

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CHAPTER 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Scapular Principle</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Scapulo-humeral rhythm</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Golf ball concept</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Concept of impingement</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Frozen Shoulder</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Temporal profile of shoulder conditions</td>
<td>3</td>
</tr>
<tr>
<td><strong>CHAPTER 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Conservative Shoulder Rehab</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>PSRP – Phasic programme</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Phase I</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Anterior capsule stretches</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Inferior capsule stretches</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Posterior capsule stretches</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Therabands</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Scapular Stabilisation Programme</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Setting in neutral</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Assisted Setting, passive control</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Dynamic control or Dissociation</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Deltoid Strengthening</td>
<td>11</td>
</tr>
<tr>
<td><strong>CHAPTER 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Modalities-Steroids/IFT/SWD</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Intra-articular steroids</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Role of IFT / SWD</td>
<td>13</td>
</tr>
<tr>
<td><strong>CHAPTER 4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surgical Protocols</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Specific Shoulder procedures</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Arthroscopic Subacromial Decompression</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Arthroscopic Bankart Repair</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Arthroscopic SLAP repair</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Excision Lateral end clavicle</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Rotator cuff repair</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Important Tips</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Differential Diagnosis</td>
<td>19</td>
</tr>
</tbody>
</table>
Introduction

Basics about the shoulder joint – Definition, anatomy, biomechanics, clinical nomenclature & exploding common myths.

The shoulder joint is often loosely talked about as the gleno-humeral joint. In reality the two are quite different. The shoulder joint encompasses the gleno-humeral joint along with scapulothoracic, acromio-clavicular & sterno-clavicular joint, all in toto. If any of these four joints are affected the shoulder function will be severely compromised. The net result of each is the same – pain & stiffness. But the treatment – as a therapist & surgeon – has to be directed at the joint that is at fault. Present day therapy is often directed at the gleno-humeral joint irrespective of the site of pathology.

Scapular Principle – Ben Kibler’s contribution

The relationship of the scapula to the Shoulder joint is like that of the foundation to a building. However strong the shoulder muscles, they are of little use without a sound scapular anchor. Kibler introduced this concept and revolutionised shoulder rehabilitation. Normal scapular function would envisage two aspects

1) scapular muscle strength, including that of rhomboids, serratus anterior and to some extent levator and lower trapezius.

2) Apart from strength the scapulo-humeral rhythm has to be normal. This is a slightly sublime parameter as it is difficult to appreciate and even more difficult to restore to normal.

Without either of these two parameters it is difficult to envisage normal shoulder function.
Scapular Dyskinesia

This is a non specific response to Gleno-humeral pain / injury / pathology - Ben Kibler

Definition of normal scapulo-humeral rhythm

*It is a motor pattern learnt through practice and repetition.*

This is normal tracking of scapula which ensures smooth movement of the greater tuberosity under the acromion without pain or impingement. Normally this occurs in a 2:1 ratio though the ratio is not proportionate from start to end.

Golf Ball concept

The shoulder joint is a ball and socket joint like the hip joint. The difference lies in the fact that it is far more mobile. This mobility is obviously at the cost of stability vis-à-vis the hip joint. The glenoid articulating with the head of humerus is similar to the golf ball on a tee, with minimal coverage. The onus of stability lies on multifactorial parameters such as concavity compression, vacuum effect, strong rotator cuff, intact labrum and dynamic factors such as muscle strength and proprioception.

The concept of Impingement

One must be aware that for complete pain free abduction to occur, the greater tuberosity has to clear the acromion. To ensure this arc, the person has to have a normal anatomy, good cuff strength, normal scapulo-humeral rhythm and achieve reflex external rotation as the arm reaches 90 degrees abduction. Conversely, any shoulder problem – a minor one like joint laxity, supraspinatus tendinitis or a major one like bankart tear, rotator cuff tear or winging of scapula will lead to impingement. Therefore every shoulder problem will manifest as impingement as a presenting feature.

Frozen Shoulder / Adhesive Capsulitis

Most if not all shoulder conditions get labeled as “Frozen Shoulder”. Not always is this true. In reality frozen shoulder is a rather rare condition and perhaps truly occurs only in diabetic patients. By definition “frozen shoulder” means true restriction of external rotation
and abduction after having ruled out all causal conditions such as, labral pathology, rotator cuff tear and Acromio-clavicular joint arthritis. Having established so, what remains, is a true contracture of the anterior capsule including coraco-humeral ligament and inferior capsule and its associated ligamentous complex. This is perhaps more accurately described as Adhesive capsulitis. As you are now aware, any chronic shoulder problem will present as a stiff joint. In any chronic shoulder problem, as any lay person would suggest, the joint is “frozen” but the true cause of such an event must be evaluated by history, clinical evaluation and USG or MRI tests for the shoulder. Very often a preexisting lesion will be diagnosed and until we address this specifically the shoulder joint will not yield to the rehabilitation programme. Frozen shoulder would suggest a rather old terminology may not reflect the rapid advances achieved by modern shoulder science.
Conservative Shoulder Rehab

Principles of shoulder rehabilitation – do’s & don’ts

The entire success of shoulder rehabilitation relies on normal scapular function – including scapular muscle strength and scapulo-humeral rhythm. The stress is essentially on Rhomboids, Serratus Anterior along with levator scapulae & lower Trapezius. The strengthening programme is reasonably straightforward, although some patients may find it difficult to comprehend. Patients with poor posture, kyphosis and elderly patients are difficult to train and emphasis should be placed on correct techniques which can be assisted by the therapist. Restoration of normal scapulo-humeral rhythm is more difficult and requires perseverance. Most patients with chronic shoulder problems lose their sense of proprioception. Their perception of correct scapular tracking is absent. To restore normality one has to rely on sheer exhaustive repeatability and help the patient develop their proprioception sense by comprehension of what is right & what is wrong.

Phasic programme

The Pune Shoulder Rehabilitation programme (PSRP) has been designed to ensure complete patient compliance and at the same time providing optimal rehabilitation in the minimum time interval. The programme for Primary impingement, rotator cuff tears and arthritis is designed as a two-phase therapy. The first phase is totally supervised for about two weeks followed by a home programme for about four weeks. Patients with chronic shoulder problems for more than two years and patients of adhesive capsulitis especially with Diabetes are given an extended first phase of three weeks.

Patients of SLAP tear, Bankart repair and multidirectional instability require additional inputs in the form of scapular setting
exercises & restoration of scapulo-humeral rhythm. Some of these young patients are keen to pursue an overhead sports hobby, in which case they need to attend the third phase, six months after surgery or normalisation before they enter their desired sports programme.

**Phase I**

Phase I essentially comprises of scapular strengthening programme along with capsular stretching exercises if the shoulder is stiff. Patients who have pain and disability without shoulder stiffness can be offered scapular setting exercises in lieu of the capsular stretching exercises. This is a crucial time for the therapist to gain confidence of the patient. From the patient's perspective this can be a painful experience, especially so on the first few days, due to the dramatic increase in stresses on the shoulder joint. During the capsular stretches, all patients tend to be apprehensive and resist the stretches. It is important for the therapist to continuously distract the patient with plenty of shop talk and at the same time concentrate on gentle stretches. Each patient has his/ her own individual parameters of tolerance. Each therapist has to in turn exceed these restraints, by marginal fractions each day.

Therapist who are new to this programme must at all times perform the stretches with the patient in supine position as this helps artificially stabilise the scapula without the support of the scapular muscles. If scapular muscles remain weak & unstable, then stretching in sitting position can encourage impingement, leading to pain and further non-compliance from the patient.
Anterior Capsular stretches

1. Self stretching of inferior capsule in forward flexion. 2. Self stretching of inferior capsule in abduction. 3. Self stretching of anterior capsule in external rotation with the shoulder in neutral.

Stretching of the anterior capsule achieves improvement of external rotation and is usually the last movement to return to normal. The anterior capsule tends to be a thick obstinate structure which yields only with time particularly in Diabetic patients and longstanding contractures. The anterior capsule should be stretched to its tolerance limit and held in the terminal position to a count of 10. This should be done as 10 repetitions of each stretch. The initial stretch may be done with the shoulder in neutral followed by shoulder in 90 degrees of abduction (if possible) for similar repetitions of ten each. This helps stretch different segments of the anterior capsule.

Inferior capsule stretches

These involve guiding the shoulder without scapular elevation to occur in forward flexion and abduction. Similarly the therapist must reach to maximum point of patient tolerance and hold for 10 seconds with ten repetitions each. One must be careful to avoid impingement, especially in abduction, for fear of provoking pain. Experienced therapist will realise that forward flexion yields much earlier than abduction. The reason for this is unless a normal external rotation is restored it is impossible for the greater tuberosity to clear the acromion. In fact it is
our experience that the progress of external rotation and abduction is interlinked and is often the last bastion to fall.

**Posterior capsular stretches**

Occasionally the posterior capsule can behave like a tenacious unrelenting structure and restoration of internal rotation can thus be delayed. This is a very functional movement that a patient requires to reach his/her mouth and back and scratch the back or tie their bra strap. Stretches should be given in forward flexion adduction across the body and adduction internal rotation manoeuvre behind the back. Patients can be taught self stretches with a towel to lift the affected hand behind their back.

![Self stretching of posterior capsule to restore internal rotation.](image)

![Self stretches to restore extension using the assistance of the good arm.](image)

**Scapular strengthening**

The emphasis is again on the Rhomboids, Serratus anterior, and Levator scapulae along with the lower Trapezius. It is important to include anti-gravity exercises as it is rather difficult to train these muscles for resistive exercises. The therapist must understand the correct technique for each muscle and confirm whether the required muscle is recruited during the particular exercise. So often wasting or pain inhibition will allow a neighbouring muscle to be activated – this is a common problem for failure of the programme. Each muscle shoulder contracted for about 10 seconds followed by ten repetitions. With each passing day the repetitions and the old time can be progressively increased.

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**CAVEATS**

- Watch for pain
- Avoid scapular elevation
- Every week 10 degree +
- IFT/USG for pain relief
Therabands

Therabands are useful to follow a closed chain exercise programme against resistance. Closed chain principle is all the more important in the shoulder joint which tends to be unstable. The knee joint can tolerate open chain exercises in most conditions and thus leading to controversies over pursuing an open or closed chain programme. For the shoulder joint which is inherently unstable and prone to impingement the entire PSRP is based on the closed chain principle. These are colour coded bands ranging for yellow to red, followed by green, blue and black in increasing range of resistance. It is not mandatory to use only Therabands and the PSRP does not patronise any particular brand as such. There are cheaper substitutes which can be used provided a reasonable standardisation is achieved. PSRP does not advice starting Therabands training on day one. Principally one must wait for some semblance of scapular control and increased tone of the scapular muscles. Hence depending on patients’ physical fitness and response to Phase I, Therabands are started at about the 5th day. Bracing the shoulders (often referred to as Ground Zero) is expected. Also while strengthening supraspinatus the maximum elevation allowed is 75 degrees in mid-abduction otherwise this can provoke impingement, leading to pain and non-compliance cycle. Smooth gentle movements without any jerks or kickback are advised. Maintaining a hold of ten seconds followed by ten repetitions is standard practice. These can progressively be increased daily. It is the therapist’s duty to supervise correct technique of Therabands exercise as patients are seen to frequently do these wrongly. Eccentric strengthening is also emphasized during rehabilitation i.e. controlling return movement during exercises with elastic bands.
Scapular Stabilising Programme

(Scapular proprioception restoration / Scapular setting)

There are three main components of the Scapular Stabilising Programme.

i) Setting in Neutral
ii) Assisted Setting with Passive control
iii) Dynamic Control / Dissociation.

It is essential that muscle imbalance problems are addressed to facilitate optimal scapula stability and scapulo/gleno-humeral alignment to minimize the risk of impingement and/or instability.

Setting in Neutral

The scapular muscle strengthening programme addresses the scapular stabilisation in neutral. The focus is on strengthening essentially Rhomboids and the serratus anterior. However, along with these exercises, the levator scapulae with the lower trapezius is also exercised. By far the most important exercise here is the prone rhomboid strengthening – which is done in 3 steps. Step I is in prone & replicates the standing bracing exercises by rolling the shoulder blades (Scapulae) towards each other. Frequently patients mistake this for levator strengthening and end up shrugging their shoulders. Once shrugged it is difficult for the shoulders to brace themselves. Therapists need to practice this exercise a few times themselves to achieve the correct movement pattern. The correct exercise involves rhomboid contraction for upto ten seconds followed by ten such repetitions to start with.
Step 2 & 3 involve recruiting different segments of the rhomboids and can be quite difficult to do for elderly, obese and patients with stiff shoulders. Hence we advocate step 2 & 3 only for the young instability patients as it is preferable to do few exercises but with the correct technique. Step 2 is a variation of the same theme where the patient lies prone and braces the scapula and then with flexed elbows maintains the palms in contact with the bed and lifts the flexed elbows upwards. The patient does not bear any weight through the palms but only lightly keeps them on the floor or bed. Step 3 is a further variation where instead of the palms the patient makes contact with the flexed elbow and lifts the palms up in the air. Similarly the patient does not bear weight through the flexed Elbows. Each of step 2 & 3 exercise is done for ten seconds hold followed by ten repetitions.

* Patients should progress from Step 1 to 3 only after achieving proficiency at each stage.

**Assisted Setting with Passive control**

With the therapist facing the patients scapula the patients affected arm is taken through the full arc of forward flexion passively. One hand of the therapist is supporting the inferior angle of the scapula and the other outer hand is supporting the hand to control the downward movement of the arm. The arm has to be brought down very slowly as the patient is required to develop cognition of the scapular position and also regenerate proprioception sense of the scapulo-humeral rhythm. The restoration of proprioception pathways is a time consuming therapy. Repetitive simulation of the correct movement pattern will help the patient take cognition of the correct rhythm. The scapular stabilisation program is recommended for three weeks during which patients are encouraged to understand correct scapular positioning and start to grasp control of their scapular positioning. Some intelligent patients, especially with a medical background, will achieve this within two weeks whereas chronic patients with muscle imbalance do take more time.

**Dynamic Control / Dissociation**

After achieving the goals of the previous two sets the patient is usually ready to go on the home exercise programme. Apart from the
other standard rehab programme the younger instability patients are encouraged to develop dynamic control of their scapular rhythm & movement. By now patients have developed an awareness of their scapular position and at home are advised slow forward flexion (upto 90 degrees) and abduction (upto 60 degrees) exercises. During this 90/60 degree range of flexion/abduction patients should ideally achieve movement independent of scapular movement. Patients are warned about the fact that if they lose control over the scapular movement they will have to restart supervised proprioceptive exercises all over again. It is our experience that most patients develop their independent scapula control over three weeks and only patients with severe scapular instability have had to extend their program for a total of six weeks.

**Deltoid Strengthening exercises**

Deltoid responds quickly to resisted exercises. However in the absence of rotator cuff function, the deltoid contraction will result in proximal migration of the humerus (Refer to Chapter 1 – Introduction). Basically the cuff contraction helps bind the head of the humerus to the glenoid resulting in effective abduction by deltoid without causing impingement. Hence, in patients with a rotator cuff tear or dysfunction, or post operative rotator cuff repair patients deltoid strengthening should not be taken up. The therapist should be awake to this problem and hence his/her clinical assessment is very important.
Intra-articular Steroid injections

Therapeutic/ Diagnostic/ Assistive

Intra-articular steroid injections have been used for every shoulder pain for many years, and that to quite effectively. Steroids are effective anti-inflammatory agents and if targeted at the organ of interest – such as intra-articular they act more specifically. It is a myth that locally given steroids do not influence the blood sugar levels. In fact very often in bilateral inflammatory pathology steroid injection in one joint will help reduce the inflammation of the opposite joint. Blood sugar levels also can rise dramatically. Steroids should not be used liberally. Only in the presence of inflammation are steroids effective. Chronically painful and stiff shoulders do not respond to injections. In the presence of rotator cuff tears, injecting steroids into the shoulder joint will eliminate any remaining healing potential at the tear site. The steroids do not cure the shoulder problem unless it is primary impingement. The injection does have a diagnostic role as only genuine shoulder impingement patients will respond positively. Patients that do not respond must be worked up for cervical spine disorders, thoracic outlet syndrome and polyarthropathy. Steroids have a dramatic effect on the acute calcific tendonitis of the shoulder. At the same time a chronic calcific deposit within the supraspinatus in the absence of inflammation will elicit no relief after an intra-articular injection.

My rationale of using steroids is to assist the rehabilitation of the shoulder. I prefer injection depomederol as it is long acting. Triamcinalone is also long acting but there is some evidence in literature that it can lead to crystallisation. The admixture of lignocaine with depomederol is oft practiced. I have given up adding
lignocaine as it does not seem to have any immediate effect. About 10% of my patients that were injected developed severe pain on the same day as the injection. Presumably this was a result of induced crystallisation due to the presence of lignocaine. If the clinical impression is of synovitis and constant pain the depomederol injection is given on the day of starting rehabilitation exercises. The addition of lignocaine is now given up. The intra-articular depomederol injection helps the therapist proceed with the capsular stretches faster and also allows the patients to tolerate physiotherapy better. Utmost care should be maintained while giving intra-articular injections and strict asepsis is a must. A casual approach to intra-articular injection can lead to disastrous septic arthritis. Needless to say, the surgeon must avoid immunocompromised patients for steroid injections.

Role of IFT/SWD

These intervention modalities are certainly useful in the acute painfully inflamed shoulder. The purpose of using modalities would be to promote exercise tolerance and improve compliance from the patient. These are predominantly used in the first few days of starting phase I rehab. Occasionally, it has been noted, patients with multidirectional instability with ligament laxity develop a severe inflammatory and painful shoulder. There is generally no recent injury but the stress of over work or extra hours of routine work can be a precipitating cause. This pain is not amenable to anti-inflammatory medication nor do these patients respond to intra-articular injection. The average age group of these acute MDI shoulders is about 17 – 25 years. The common factor remains the presence of ligament laxity and Multidirectional instability of the shoulder. Both dominant and non-dominant shoulders are equally affected. It has been my observation that usually the over worked shoulder affects the dominant side whereas in overhead sports it is the non-dominant shoulder that becomes symptomatic. Most of these will settle down on their own. To offer immediate relief IFT and rarely SWD are useful modalities to bring the pain to more tolerable levels. Both IFT and SWD have no curative value nor do they reduce the inflammation. The basic treatment is rehabilitation which has to be done in the pain free state to avoid further impingement and improve patient compliance. Both these modalities help achieve that state.
Surgical Protocols

Principles of protected phase & rehab phase

The foundation of post surgical rehab is almost similar to the conservative therapy. The main differences are with reference to individual conditions and repaired structures. All tendons, cartilages and labrum repairs take about six weeks to heal. The first six weeks are thus the protective phase where mobilization is permitted but within limits. Most surgical procedures on the shoulder are arthroscopic. Surgeons prefer expensive suture anchors to repair the damaged tissue. These are made of titanium and poly and have a very good pull out strength (from 50 Newton to 470 Newton). The goals in modern surgery are to encourage mobilization without compromising on the repaired tissue integrity. Hence progressive mobilization should be carried out from the 3rd or 4th post-operative day once the operative pain is not a hindrance. The therapist must be careful not to provoke pain as this could bring about reflex spasm of the antagonistic muscle jeopardizing the repaired tissue. There are prescribed goals to be achieved at each stage after surgery although some patients are psychomotor artistes and achieve their goals quicker whereas others are maladroit and achieve their goals very late with a lot of effort. It is this skill that a therapist needs to develop, to identify the character of the patient and push him/her towards a redefined goal. It is unrealistic for all patients to reach their destination at the same time with the same ease. The therapists' responsibility is far greater with the post-operative patient as a surgical repair is at risk, patients tend to be more apprehensive after surgery and the patient has also spent a lot of money and time towards surgery.

In general shoulder movement upto 90 degree of forward flexion and 60 degrees of abduction is safe and does not put significant pressure on the commonly repaired tissue. Exceptions may be severely osteoporotic fractures of the proximal humerus and some difficult shoulder joint replacements. So unless a surgeon has explicitly written to avoid mobilization the above safe range may be freely started. Individual conditions will be briefly discussed in the next section. The therapist must watch for wound healing in the first ten days.
Scapular exercises must be started at the earliest along with posture correction. In the initial week only bracing and levator scapulae exercises are tolerated by the patient and I advice them to do these for 10 minutes every hour. By the third or fourth post-op week the increased ROM permits rhomboids and serratus strengthening. In the later days patients can freely perform all the scapular exercises including the prone scapular sets in neutral (refer page 9). Along with the Scapulars, ROM assisted passive and later active exercises may be started. These begin with pendulum exercises to start with, progressively increasing these by 20-30 degrees every week. Usually patients achieve the 90 degree restriction by fourth week. The patient is advised to repeat the exercises at home with a walking stick as active assisted exercises. Static Deltoid and static rotator cuff exercises are allowed only if these tissues are not part of the repair procedure. These may be instituted from the first week itself. Therabands are not allowed till the protective phase is on for about six weeks.

Specific Shoulder Procedures

**Arthroscopic Subacromial Decompression**

Start on 5th Post-op Day

- Active assisted Exercises of shoulder joint.
- Progress to active as pain allows.
- External rotation exercises with stick.
- Posture correction.
- Scapular strengthening exercises
- Isometric rotator cuff exercises.
- No restriction for ROM exercises

**Caveats**

- Avoid Deltoid strengthening of open Subacromial decompression done for 6 weeks.
- Total of two weeks of aggressive Phase I

**MILESTONES**

- Wk 6 - ROM equal to Pre Op ROM
- Extend Phase I if SLOW progress
- Hydrotherapy/IFT if Pain
- 6-8 weeks for normalcy
2\textsuperscript{nd} week

- Check improvement in Active & Passive ROM
- Start Therabands for cuff if scapular control +
- Start full range of Scapular ex. In Neutral (Pg. 9)
- Prepare for home programme if 80\% Rom & Scapular control OK

**Arthroscopic Bankart Repair**

**First 6 weeks**

- Sling on & off for 1\textsuperscript{st} 3 weeks
- All Elbow,Wrist,Hand exercises
- Isometric Rotator Cuff & Deltoid
- Posture correction.
- Scapular strengthening exercises
- Active assisted. Improve 20\° weekly
- Zero External Rotation

**CAVEATS**

- Zero Ext. Rotation for 6 wks
- Forward Flexion upto 90\°
- Abduction 60\°-70\°
- No throwing activity for 3 months

**3\textsuperscript{rd} Week**

- Sling on & off for 1\textsuperscript{st} 3 weeks
- All Elbow,Wrist,Hand exercises
- Isometric Rotator Cuff & Deltoid
- Posture correction.
- Scapular strengthening exercises
- Active assisted. Improve 20\° every week

**MILESTONES**

- Wk 4 Pre-Op Rom except Abd, ER
- Week 8 – ER 75\% of Pre-op
- Week 12 Full ROM, Strength
- Week 24 Resume Sports
6th Week – Start 2 weeks of Phase I

- Start Active assisted. No restriction
- Progress to active as pain allows.
- Correct abnormal movement pattern
- Rotator Cuff & Deltoid Therabands
- Capsular Stretches
- Scapular stabilization programme

Arthroscopic SLAP Repair

- The rehab programme is identical to the Bankart repair programme - except avoid resisted Biceps. The SLAP repair patients usually regain their ROM very quickly and it is important to slow them down lest the repair tissue may come under pressure.

- If along with SLAP repair, a rotator cuff repair is also done, then follow the programme as per rotator cuff protocol.

Excision of AC Joint

The programme is similar to that of Subacromial decompression although patients achieve their milestones sooner.

Rotator Cuff Repair - Start on 5th day

- Sling on & off for 1st 3 weeks
- All Elbow, Wrist, Hand exercises
- No Isometric Rotator Cuff & Deltoid
- Posture correction.
- Scapular strengthening exercises
- Active assisted. Improve 20° weekly
- Zero External Rotation

MILESTONES

- Week 4 – Passive ROM 50% of Pre-Op
- Week 8 – Passive ROM 80% of Pre-Op
- Week 12 – Active ROM 75% of Pre-Op
- Week 16 – Active ROM 100% of Pre-Op
6th Week

- Start Active assisted. No restriction
- Progress to active as pain allows.
- Correct abnormal movement pattern
- Capsular Stretches
- Rotator Cuff Therabands after scapular control
- Scapular stabilization programme
Important Tips

- On completion of phase I the patient is advised to proceed to a twice daily home programme for all the previous exercises for a period of one month when he/she is followed up.

- For initiators perform Capsular stretches and Active assisted exercises with the patient lying down. This helps stabilise the scapula automatically, avoiding impingement,

- Scapular setting and proprioception restoration are best demonstrated practically during your actual programme to give you a palpatory feedback.

- It is important for patients to report to the physician if they have no improvement for a week or if they actually deteriorate.

- Most patients will achieve a full pain free function at the end of the four week home programme.

- It is advisable to do a UCLA score before phase I and at the end of phase II to establish objective criteria of improvement.

Watch out for neighbouring conditions which mimic shoulder problems

<table>
<thead>
<tr>
<th>DIFFERENTIAL DIAGNOSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical Disc Disease</td>
</tr>
<tr>
<td>Suprascapular Nerve palsy</td>
</tr>
<tr>
<td>Long Thoracic Nerve Palsy</td>
</tr>
<tr>
<td>Rheumatoid Arthritis</td>
</tr>
</tbody>
</table>