Effect of core stability exercises as an adjunct to conventional therapy in shoulder impingement syndrome

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Abstract

**Background:** Shoulder Impingement Syndrome causes pain, disability and reduced ROM at the shoulder. Core stability is linked to optimal shoulder functioning and impairments in the core stability would lead to shoulder dysfunction. Conventional therapy when combined with core strengthening exercises produced superior results. Incorporation of core strengthening exercises proved to reduce pain, disability and improve ROM in patients with shoulder impingement syndrome.

**Method:** 34 patients were included in the study. They were randomly allocated into two groups by chit method. Group A received conventional therapy and Group B received conventional therapy along with core strengthening exercises for 4 weeks. The values of the ROM, Pain and Disability was calculated pre and post treatment. In Group B additional core strength was noted down pre and post treatment using biofeedback unit. Statistical analysis was done and results were tabulated.

**Results:** Conventional and experimental group showed improvement post treatment (p<0.001). Experimental group showed much more reduction in pain, disability and improvement in ROM as compared to conventional group.

**Conclusion:** The results therefore conclude that core strengthening has been proven to be an effective adjunct to the conventional therapy in subacromial impingement syndrome.

**Introduction:**
The shoulder joint is a comparatively an unstable ball and socket joint that is moved and controlled by rotator cuff. The Rotator Cuff is comprised of four muscles – supraspinatus, infraspinatus, teres minor and subscapularis. These tendons attach from scapula to the humerus and are just outside the shoulder joint and its capsule. They help stabilise the shoulder and enable to lift your arm, reach overhead activities. The subacromial bursa sits over the top of the cuff, allowing for the cuff tendons to slide near the roof of the shoulder without undue friction.

Impingement syndrome (Charles Neer in 1972) is characterized by pain in the shoulder due to inflammation of the tendons of the rotator cuff or the bursa (subacromial bursa) that sits between the rotator cuff and the roof of the shoulder (acromion). Normally the humeral head gets closer to the acromion when the shoulder is moved, particularly as you reach overhead.

When the rotator cuff becomes inflamed because of injury or overuse, or when the bursa becomes inflamed, then both the swollen tendon and swollen bursa may become pinched between the humeral head and the acromion.

Neer described three stages of the impingement syndrome.
• Stage 1: a reversible edema and hemorrhage, patient <25 years that cause an aching discomfort caused by inflammation of the supraspinatus tendon and long head of the biceps brachii.
• Stage 2: tendonitis/bursitis and fibrotic changes, patients 25-40 years that cause pain with activity.
• Stage 3: bone spurs and tendon ruptures, patients >40 years that have an extended history of shoulder pain.

Core stability is the ability to control the position and motion of the trunk over the pelvis to allow optimal production, transfer and control of force and motion to the terminal segment.¹
The kinetic chain model proposes that a relationship exists between the core and the upper and lower extremities, and that optimal shoulder functions during any task require contribution from the legs and core in a way that maximizes performance but potentially minimizes harmful forces from being applied to the shoulder complex.
During overhead activities shoulder muscles along with trunk musculature become active during glenohumeral movements. In order to maintain functional stability during limb movement, muscular strength and endurance is required around the lumbar spine. This area is referred to as the core and includes the abdominal muscles anteriorly, the paraspinals and gluteals posteriorly, the diaphragm superiorly, and the pelvic floor and hip girdle musculature inferiorly.
The core musculature becomes active in a feed-forward fashion during upper extremity movement. This mechanism occurs as the body prepares for potential perturbation of spinal stability when movement begins.
Core stability has been proven to be an essential component of biomechanical efficiency, allowing the athlete to maximize force production while minimizing loads placed on peripheral joints.
Balance is an integral component of core stability. Many clinical neuromuscular imbalances occur between synergistic and antagonistic muscles. This is characterized by early dominant activation of trunk muscles and delay in activation of synergistic muscles. This imbalance can cause instability and excessive joint motion in the direction of the overhead activity. This faulty movement can lead to excessive abnormal accessory gliding, thereby increasing trauma to the joint and causing increased risk for dysfunction and pain.

**Aims:**
- To study the effect of core strengthening on subacromial impingement as an adjunct to conventional therapy.

**Objectives:**
- To study the effect of conventional therapy on pain, disability & ROM in subacromial impingement.
- To study the effect of conventional therapy & core strengthening on pain, disability & ROM in subacromial impingement.
- To compare the efficacy of the two programmes on pain, disability and ROM.

**Methodology and materials:**
- **Type of study:** Interventional study
- **Location of study:** SmtKashibaiNavale General Hospital Physiotherapy OPD
Duration of the study: 6 months
Sample size: 34
Sampling method: Convenient sampling

Tools used in the study: Pen, paper, Universal Goniometer, Pressure Biofeedback Unit.

Inclusion criteria
- Age 25-40 years
- Both males and females
- Neer’s Impingement classification stage 2
- Patients having subacute to chronic pain
- At least two special test should be positive –empty can test, Neer’s impingement test, scapula slide test

Exclusion criteria
- History of neurological deficits
- Acute onset of pain in the shoulder
- Upper limb fracture or dislocation.
- Open wound
- Any musculoskeletal disability

Outcome measure:
1. SPADI
2. Goniometer
3. Pressure biofeedback

Procedure:
The Institutional Research Committee (IRC) & Ethical Committee Clearance was obtained. The subjects were recruited according to the inclusion criteria. The subjects once recruited were explained the procedure and a consent form was signed. The subjects were randomly allocated into 2 groups by chit method:
GROUP A received conventional therapy
GROUP B received conventional therapy along with core stabilization exercises

Conventional group
- Ultrasound- continuous mode, intensity: 1W/cm² for 8 mins 5 - 5 days
- Mobility and stretching exercises: 5 rep 30 secs hold
  - Shoulder ROM exercises with wand
  - Pendular exercises
  - Pectorals stretch
  - Supraspinatus stretch
  - Capsular stretches
- Strengthening exercises: 10 sec hold 3 sets 5 rep
  - Shoulder isometrics
  - Internal and external rotation with theraband
  - External rotation in 90 degree abduction
Experimental group
Conventional protocol as mentioned above and core strengthening exercise.

**Week 1:** Core exercises: 1 set of 10x: Drawing in manoeuvre (Abdominal Hollowing Exercise), Static core muscle exercises, Cat-camel exercises, Prone on elbows, Pelvic Bridging

**Week 2:** Core exercises: 1 set 10x: Curl ups, Lunges – forward, sideways, Prone on hands, Hip strengthening exercises (calculate 1 RM, start with 50% of 1RM)

**Week 3:** Core exercises: 1 set 10x: Cycling in the air, Side planks, Single leg bridging, Continue hip strengthening

**Week 4:** Core exercises: Bird – dog exercise, Wall squats, Hip strengthening exercises (75% of 1RM)

- Pain, disability using SPADI and ROM using universal goniometer was assessed pre and post treatment.
- Abdominal muscle activation was assessed pre and post treatment using pressure biofeedback unit in GROUP B.
- Duration: 4 weeks, 5 sessions per week
- 10 reps of each exercise with 2 minutes rest interval
- Progression for the core strengthening was given every week.
- The patients were asked to maintain a daily diary to keep the records of the exercises that were to be done at home.
Results and analysis
Both the groups were compared using paired t test and unpaired t test. The data that did not pass normality, Wilcoxon signed rank test and Mann Whitney test was performed to obtain the accurate p value.

![Graph showing comparison of movement and SPADI scores](image)
Experimental (Group B)

<table>
<thead>
<tr>
<th>MOVEMENT</th>
<th>DEGREES</th>
<th>PRE</th>
<th>POST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>146.07</td>
<td>162.5</td>
<td></td>
</tr>
<tr>
<td>Extension</td>
<td>41.78</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Abduction</td>
<td>131.5</td>
<td>150.36</td>
<td></td>
</tr>
<tr>
<td>Internal rot</td>
<td>58.2</td>
<td>67.8</td>
<td></td>
</tr>
<tr>
<td>External rot</td>
<td>65</td>
<td>73.33</td>
<td></td>
</tr>
</tbody>
</table>

The diagram shows the comparison of movement degrees (flexion, extension, abduction, internal rotation, and external rotation) before (PRE) and after (POST) an experimental group.
**SPADI**

- **Pre**
  - 44
- **Post**
  - 36.5

Statistical Significance: $p < 0.001$

**Core Strength**

- **Pre**
  - 4.5
- **Post**
  - 5.5

Statistical Significance: $p < 0.001$

**Movement**

<table>
<thead>
<tr>
<th>Movement</th>
<th>GROUP A</th>
<th>GROUP B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flexion</td>
<td>10.4</td>
<td>16.4</td>
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<tr>
<td>Extension</td>
<td>4</td>
<td>8.2</td>
</tr>
<tr>
<td>Abduction</td>
<td>11</td>
<td>18.8</td>
</tr>
<tr>
<td>Internal rot</td>
<td>5.6</td>
<td>9.64</td>
</tr>
<tr>
<td>External rot</td>
<td>6</td>
<td>9.2</td>
</tr>
</tbody>
</table>

Statistical Significance:
- Flexion: $p = 0.03$
- Extension: $p = 0.03$
- Abduction: $p = 0.02$
- Internal rot: $p = 0.01$
- External rot: $p = 0.004$
• 5 patients who could not be present for the duration of the study were excluded from the data analysis.
• Both the groups showed increase in the ROM and reduction in pain & disability post treatment (p=0.0001) which is statistically significant.
• Core strength of the subjects in the interventional group increased significantly post treatment (p =0.001).
• When both the groups were compared using the mean differences, increase in ROM and decrease in pain and disability as well was observed.

Discussion
• This study was done to compare the effect of core stability exercises along with conventional therapy in subacromial impingement syndrome.
• As per the results, both the groups showed significant increased ROM and reduced pain and disability post the treatment(p = 0.001)
• Also, the subjects in the experimental group had significant increase in the ROM as compared to the conventional group
• In subacromial impingement, there is pain while performing upper extremity movements due to structures getting impinged in the subacromial arch.
• Pain is the major symptom that causes increased disability in the patients to perform ADLs . Increased pain leads to apprehension in doing the movements hence leads to reduced ROM at the shoulder along with shoulder and scapular muscle weakness.
• Ultrasound that was given to both the groups helped relieve pain and inflammation; because of reduced pain, ROM was increased.
• Kardiya et al concluded in a study that 8 mins ultrasound was beneficial in reducing pain and inflammation in subacromial impingement syndrome.8
• The mobility and stretching exercises helped reduce pain, regain& maintain the ROM, prevent tightness of the muscles and the shoulder joint capsules.
• Scapular muscle weakness leads to further compensatory movements to occur at the shoulder joint leading to possibility of the structures getting impinged further, hence the scapular and shoulder strengthening helped the patient to maintain a good posture and also prevent further impingement to occur.
Kibler WB stated that the core muscle stability is required for distal movements i.e. proximal stability is required for force generation by distal musculature. Other trunk musculature also become active during glenohumeral movements, and vertebral perturbation occurs during glenohumeral movements.\textsuperscript{1,7}

A study which was carried out in 2018, stated that core stability muscles are activated during MVIC of the upper extremity.\textsuperscript{8}

Dysfunction within the kinetic chain will affect how forces are generated, summated, or transferred from proximal segments (legs, hip, torso) to the upper extremity. Weakness within the core may contribute to the development of an overuse upper extremity injury.\textsuperscript{7}

Also, many clinical neuromuscular imbalances occur between synergistic and antagonistic muscles which can cause instability and excessive joint motion in the direction of the overhead activity. This faulty movement can lead to excessive abnormal accessory gliding, thereby increasing trauma to the joint and causing increased risk for dysfunction and pain.\textsuperscript{8}

The movement system is very adaptable to change and strives to maintain normal function. Therefore if imbalances develop, compensatory movements will occur to restore mobility, often resulting in tissue damage.\textsuperscript{8}

Core strengthening will improve force transfer to the upper extremity and prevent the compensatory UE movements to occur thus preventing unnecessary glides to occur and substitution of muscles thereby reducing tissue trauma, and allow healing to occur faster and thereby reduce pain.

Exercises included in core strengthening involves weight bearing on the hands as well, this will also lead to an isometric contraction of the scapular and shoulder muscles thereby improving blood supply resulting into washout of the waste products and reducing pain.

Hence, core strengthening along with the conventional treatment that includes shoulder ROM exs and scapular strengthening exs will lead to reduced muscle imbalance and hence lead to improved ROM.

**Conclusion:**

The results therefore conclude that core strengthening has been proven to be an effective adjunct to the conventional therapy in subacromial impingement syndrome.

**References:**

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