A STUDY ON EFFECTIVENESS OF UPPER EXTREMITY NEUROMUSCULAR TRAINING IN ROTATOR CUFF TENDINOPATHY

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ABSTRACT

PURPOSE: This study was aimed to evaluate the effectiveness of an upper extremity neuromuscular training program on the shoulder function of diabetic patients with a rotator cuff tendinopathy. The objective of this study wasto determine the effects of an upper extremity neuromuscular training program on the shoulder function of diabetic patients with a rotator cuff tendinopathy to find the difference between the pre-test and post-test values of NPRS and Push and Pull Hand Held Dynamometer for rotator cuff tendinopathy.

METHODS: 30 subjects based on inclusion and exclusion criteria, and the study settings are taken from outpatient department of SCPT. The intervention was given for 2 weeks, 5 days/week. A baseline analysis NPRS and Push and Pull Hand Held Dynamometer was done before the intervention began. 2nd weeks of the intervention was given to the subjects following which a post-test was conducted and done to analyse the sustained effects of the intervention.

RESULTS: A comparison between the mean values showed that there was a significant difference between post-test I and post-test II, hence, the results had sustained.

CONCLUSION: Therefore, it was concluded that Neuromuscular Training when given along with conventional therapy was found to be more effective than conventional therapy in NPRS and Hand Held Dynamometer leading to faster recovery in subjects with Rotator Cuff Tendinopathy.

Keywords: Rotator cuff tendinopathy, NPRS, Push and Pull Hand Held Dynamometer, Neuromuscular training, and Ultrasound Therapy.

I. INTRODUCTION

In the United States, the prevalence of diabetes has increased from 5.5% to 9.3% within past decades-1 with the disease currently affecting 29.1 million people. Diabetes is commonly associated with conditions such as cardiovascular disease and long-term negative effects on various organs in the body such as kidneys and eyes. However diabetes has been shown to affect the musculoskeletal system.1-5 Diabetes is four times more likely to have musculoskeletal disorders compared to non-diabetes with the shoulder being one of the joints most affected by the disease.6-9 Shoulder pain, a leading reason to consult physician or physiotherapist, continues to be a challenge to rehabilitate particularly with diabetes patients.6,7 Rotator cuff diseases often cause shoulder pain and joint contracture in middle-aged and elderly.10 Inflammatory cytokines produced by cells in the synovium of the sub acromial bursa (SAB) are a cause of the shoulder pain associated with this disease. In addition to shoulder pain, joint contracture occurs more frequently in patients with diabetes mellitus (DM). Who also have rotator cuff disease? The incidence of shoulder joint contracture is 2-5% in the general population, but 10-20% in diabetic patients.11-15

A rotator cuff (RC) tendinopathy, the most important source of shoulder pain, among shoulder disorders. A rotator cuff (RF) tendinopathy remains the leading source of shoulder pain. Specifically, diabetics are 3-9 times more likely to have frozen capsulitis and 5 times more likely to have rotator cuff tears compared to non-diabetics.16-20 Additionally, diabetics are mentioned to have thickened supraspinatus and biceps tendons along with reduced ROM in shoulder abduction and flexion an impaired tendon-bone recovery potential and challenge regaining range of motion (ROM) after a surgical treatment.21
The musculoskeletal symptoms described above are attributed to mechanical changes in connective tissues due to formation of advanced glycation end products (AGEs). The AGEs are formed from a reaction that occurs from bonding of sugar and amino acid.\textsuperscript{22} The AGEs cause increased cross linking between collagen fibers and increase stiffness and brittleness of the connective tissue. This change in mechanical property makes the tissue more susceptible to failure under stress.\textsuperscript{23} While accumulation of AGEs naturally occurs with aging, the process is accelerated in diabetics due to high blood glucose concentration and decreased peripheral blood flow.\textsuperscript{24} The insertion of the rotator cuff on the greater tubercle corresponds to an area of poor blood supply which may further contribute to accumulation of AGEs.\textsuperscript{25} A study by Jeyakumar et al suggests that Mulligan and Maitland mobilization training for adhesive capsulitis significantly improves upper limb function.\textsuperscript{26}

II. METHODS

Study Design: Experimental study.

Sampling Method: Convenient sampling.

Sample Size: 30 subjects.

Inclusion criteria: Age 40 to 60 years, Gender - both male and female, Reported shoulder pain, Painful arc of movement during flexion and abduction, Pain on resisted external (lateral) rotation, Empty can test (+positive).

Exclusion criteria: Prior history of shoulder surgery, Shoulder Dislocation, Fractures, Capsulitis, A full thickness RC tear, Partial tears at surgery, Less than three years of follow-up, Subsequent surgery in the same shoulder, Previous infection in the same shoulder, Cuff tear arthropathy. Material Required: Hand Held Dynamometer, Ultrasound, Gel, Cotton, Dumbbells, Thera band, Foam Roller, Towel.

Outcome Measure: Numerical Pain Rating Scale (NPRS), Push and Pull Hand Held Dynamometer.

III. PROCEDURE

30 individuals were selected according to inclusion and exclusion criteria. The consent was obtained from the participants. Participants were explained about the risk factors, safety, and procedure of the study. All the participants were selected according to a convenient sampling technique. Subjects are allocated into the, Control Group: (n=15), Experimental Group: (n=15). The control group received only Ultrasound Therapy, Stretching Exercise. The experimental group received both ultrasound Therapy, Stretching Exercise and Neuromuscular Training Strengthening Exercise is Lawn Mower Exercise and Side Lying External Rotation. Before initiation of the treatment session, NPRS and Push and Pull Hand Held Dynamometer are done as a pre-test outcome. The patient was asked to be seated for few minutes and they were explained about the procedure after which therapist demonstrated the exercises to the patient and the outcomes were measured with the same protocol of NPRS and Push and Pull Hand Held Dynamometer of the pre-test is repeated in post-test measures following the 2 weeks of the treatment procedure. Treatment Session: Sessions are 1 session/day, Frequency: 5 days/week, Duration: 2 weeks.

IV. RESULT

The collected data has been tabulated, analyzed using descriptive and inferential statistics. Hence, the parameters mean and standard deviation where it was used for paired t-test to analyze significant changes between pretest and posttest measurement. The statistical analysis made with the quantitative data revealed a statistically significant difference between Group A and Group B and also within the group. The post test mean value of NPRS in Group A was 4.80(+1.15) and in group B was 3.93(+0.96). This shows that NPRS scores in group B were comparatively lesser than group A, $P <0.0001$. The Post test mean value of Hand Held Dynamometer in group A was 10.73(+2.09) and in group B was 13.47(+1.06). This shows that Hand Held Dynamometer in Group B were comparatively more than Group A, $P=0.0001$. Statistical Analysis of post test for NPRS and Push and Pull Hand Held Dynamometer revealed that there was high statistically significant difference seen between group A and group B. Thus, Group B has high statistical difference than Group A.

The collected data were tabulated and analyzed using descriptive and inferential statistics. To all parameters mean and standard deviation (SD) was used. A paired t-test was used to analyze the significant changes between pre-test and post-test measurements. An unpaired t-test was used to analyze significant changes between the two groups.
Table 1: Comparison of Pre-test – Post test Values of Group A

<table>
<thead>
<tr>
<th>Group A</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPRS Pre-test</td>
<td>7.33</td>
<td>1.23</td>
<td>5.8240</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Post-test</td>
<td>4.80</td>
<td>1.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HHD Pre-test</td>
<td>8.47</td>
<td>10.73</td>
<td>3.00411</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Post-test</td>
<td>2.00</td>
<td>2.09</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Graph 1: Comparison of Post test Values of Group A

Table 2: Comparison of Pre-test – Post test Values of Group B

<table>
<thead>
<tr>
<th>Group B</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>t value</th>
<th>P value</th>
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</thead>
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<tr>
<td>NPRS Pre-test</td>
<td>7.67</td>
<td>1.18</td>
<td>9.5242</td>
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<tr>
<td>Post-test</td>
<td>3.93</td>
<td>0.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HHD Pre-test</td>
<td>8.27</td>
<td>1.39</td>
<td>11.5364</td>
<td>&lt;0.0001</td>
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<tr>
<td>Post-test</td>
<td>13.47</td>
<td>1.06</td>
<td></td>
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</tr>
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Graph 2: Comparison of Post test Values of Group B

Table 3: Comparison of post-test between group A and B
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group A</th>
<th>Group B</th>
<th>‘t’ test</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Standard deviation</td>
<td>Mean</td>
<td>Standard deviation</td>
</tr>
<tr>
<td>NPRS</td>
<td>4.80</td>
<td>1.15</td>
<td>3.93</td>
<td>0.96</td>
</tr>
<tr>
<td>HHD</td>
<td>10.73</td>
<td>2.09</td>
<td>13.47</td>
<td>1.06</td>
</tr>
</tbody>
</table>

Graph: Comparison of post-test between group A and B

V. CONCLUSION

From the result, it has been concluded that Neuromuscular Training when given along with conventional therapy (Group B) was found to be more effective than conventional therapy (Group A) in NPRS and Hand Held Dynamometer leading to faster recovery in subjects with Rotator Cuff Tendinopathy.

VI. DISCUSSION

The purpose of this study was to compare the effects of a 2-week shoulder exercise program on shoulder strength, and perceived shoulder function and disability between diabetics/pre-diabetics and non-diabetics. We observed that the exercise program resulted in improved shoulder function in participants with and without diabetes alike.

Maintaining adequate shoulder rotation is important in performing ADLs. For example in order to touch back of head or neck, as if washing hair, at least 50 degrees of shoulder external rotation is required. Our shoulder exercise program included stretching exercises that are aimed to improve shoulder internal rotation (Cross-arm stretch) and external rotation (door-way stretch). However, we saw improvement in ER pain, but not in TR. A previous study on healthy females reported that the shoulder ER pain decreased with aging, but that IR pain was unaffected by aging. Perhaps, and thus had room for improvement, whereas IR pain was not limited to begin with, and thus did not have much room for improvement. Weakness of the shoulder rotator muscles is associated with shoulder pain. In particular, infraspinatus and teres minor that act to externally rotate the shoulder and subscapularis that acts to internally rotate the shoulder are part of the rotator cuff that functions to stabilize the glenohumeral joint through concavity compression. Weakness in these muscles would lead to compromised glenohumeral joint stability, and thus increased risk of various shoulder pathologies, including rotator cuff tear. Similarly weakness of the muscles that control scapular movement has been linked to shoulder pain. Weakness or decreased activity of the muscles can result in scapular dyskinesis which can increase impingement of the supraspinatus and long head of the biceps tendons within the subacromial space.

LIMITATIONS & RECOMMENDATIONS

The sample size is less and the study duration was minimal, the study can be done in larger sample size & can be done in different age groups.

ACKNOWLEDGEMENT

The authors are grateful to the authorities of Saveetha College of Physiotherapy, Chennai.
CONFLICT OF INTEREST

The authors declare no conflict of interest.

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