

Effect of Lower Trapezius, Middle Trapezius and Serratus Anterior Muscles Strengthening on Pain, Muscle Strength and Functional Status in individuals with Non-Specific Chronic Neck Pain

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Abstract

Background: Chronic non-specific neck pain is the most common chronic musculoskeletal pain condition, causing significant pain, disability, and lost productivity. Non-specific neck pain is not just a clinical problem, it can develop into a complex disorder where physical, psychological, social compensation and other possible forces interact to cause and lead to maintained disability. Neck pain is present with weakness and muscular imbalance. It has a close relationship between muscle prone to tightness and those prone to inhibition. In the case of neck pain, there is tightness of upper trapezius (UT) muscle leading to middle trapezius (MT), lower trapezius (LT) and serratus anterior (SA) muscles weakness. There is evidence that scapulothoracic muscles weakness may also be associated with neck pain. Individuals with neck pain were having significantly weaker Lower Trapezius, Middle Trapezius and Serratus Anterior muscles strength than asymptomatic individuals.

Context and Purpose: There is emerging evidence that scapulothoracic muscles weakness often is associated with neck pain and it has a close relationship between muscle prone to tightness and those prone to inhibition. In the case of neck pain, prolonged tightness of upper trapezius muscle can lead to middle trapezius, lower trapezius, and serratus anterior muscles weakness. The purpose of the study is to find out the effect of LT, MT and SA muscles strengthening along with the conventional treatment on pain, muscle strength and functional status in non-specific chronic neck pain.

Results: There was significant effect on LT, MT and SA muscles strengthening in reducing pain, improving strength and functional status in individuals with non-specific chronic neck pain.

Conclusion: Strengthening exercises to LT, MT and SA muscles along with conventional therapy is effective in reducing pain, improving muscle strength and functional status in individuals with non-specific chronic neck pain.

Keywords: Non-Specific Chronic Neck Pain, Trapezius, muscle strengthening and functional status

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Background

Neck pain is becoming common throughout the world. It has a considerable impact on individuals,

families, communities, health care systems and business¹. Non specific neck pain is not just a clinical problem, it can develop into a complex disorder where physical, psychological, social, compensation and other possible forces interact to cause and lead to maintained disability². The overall prevalence of neck pain in the general population ranges between 0.4% and 86.8% and the estimated 1 year incidence of neck pain ranges between 10.4% and 21.3%¹. Neck pain is present with weakness and muscular imbalance. It has a close relationship between muscle prone to tightness and those prone to inhibition³. In the case of neck pain, there is tightness of upper trapezius muscle leading to MT, LT and SA muscles weakness^{3,4}. There is evidence that scapulothoracic muscles weakness may also be associated with neck pain. Individuals with neck pain were having significantly weaker LT, MT and SA muscles strength than asymptomatic individuals on their side of neck pain⁴.

Methods

This Pretest Posttest Experimental study design was conducted at Department of Physiotherapy, Little Flower Institute of Medical Sciences and Research Centre, Angamaly for duration of 6 months. Ethical clearance was obtained from the IEC. 30 Subjects, both male and female between the ages of 23-52 year were recruited for the study based on the inclusion and exclusion criteria by using simple random sampling technique⁵. We included patients diagnosed and referred by orthopedician as nonspecific unilateral neck pain with duration more than 3 months⁶, who have MT, LT and SA muscle power ranging from 4-6 according to MMT (Kendall 0-10 grade) and those with stable cardiovascular parameters. Subjects were excluded if they had any malignancy, pregnancy, fibromyalgia, recent surgeries, patients with pain on scapula and shoulder region, patients with unstable cardiovascular parameters, debilitating neurological

disorders, Recent injuries and deformities of upper limb and cervical spine, Degenerative or inflammatory disorders in upper limb and cervical spine etc.

A total of 42 subjects were assessed for eligibility. 32 subjects who fulfilled the inclusion criteria were randomly assigned into two groups: 16 in experimental group (A) and 16 in control group (B). Informed consent was obtained from the subjects. Group B received conventional therapy alone, whereas Group A received conventional therapy and strengthening exercises to MT, LT, and SA. For both groups, treatment was given for 3 days per week for 4 weeks. On all treatment days home exercises were given according to the exercise leaflet. Pain was assessed by Numeric Pain Rating Scale (NPRS 0-10 Grade), muscle strength was assessed by manual Muscle Strength (MMT, Kendall 0-10 Grade) and functional status was assessed by Neck Disability Index (NDI) on first day before the treatment and last day after the treatment. The collected data was subjected to statistical analysis.

GROUP A–Treatment Procedure

In addition to the conventional treatment the following strengthening exercises were given.

Specific strengthening exercise (Each exercise with 15 repetitions and total 15 min duration, one minute of rest time was given.)⁷

- First week half kg was given, then every week weight was increased by half kg for next 3 weeks.

Middle and Lower Trapezius exercises:

1. Wide grip rowing (prone position)
2. Horizontal extension /external rotation, (standing)
3. Prone extension
4. Prone arm rise overhead ⁸

Serratus anterior exercises:

1. Serratus anterior punch⁹ (supine lying)
2. Wall slide¹⁰ (standing)
3. Dynamic hug⁹ (standing)

GROUP B-Treatment Procedure

1. Hydrocollator pack (10 min).⁷
2. Isometric neck exercises- 10 repetitions with a holding time of 6 seconds (15 min, one minute of rest time was given).
 - Flexion
 - Extension
 - Side bending
 - Rotation
3. Stretching for Upper trapezius- 30 seconds, 5 repetitions (5 minutes), one
4. Minute of rest time was given.

TREATMENT PROTOCOL

1st week of treatment

- Pre assessments were taken before treatment
- Supervised exercise program was given for both groups
- 3 days treatment given for both Groups. Group A received conventional treatment and specific scapular strengthening with weight and Group B received conventional treatment alone.
- Weight given was ½ kg in starting.

2nd week

- Strengthening exercise for Group A with 1 kg and for Group B the same

- Conventional treatment was given for 3 days.¹¹
- 3rd week
- Strengthening exercise for Group A with 1½ kg and for Group B
- same conventional treatment was given for 3 days.
- 4th week
- Strengthening exercise for Group A with 2 kg and for Group B the
- same conventional treatment was given for 3 days.
- At the end of the 4th week post assessment were taken.

Results

30 subjects who fulfilled the inclusion criteria were included in the study. Pretest and post test scores of both groups were analyzed using Mann-Whitney U test. The characteristics of the subjects at baseline were normally distributed and are presented in Table 1.

In pretest scores, calculated value is greater than table value so there proved no significant difference between 2 groups. In post test scores, as the calculated value is greater than the table value, there proved a significant difference between 2 groups and alternate hypothesis is accepted that is, there is significant effect on lower trapezius, middle trapezius, and serratus anterior muscles strengthening in reducing pain, improving strength and functional status in individuals with non-specific chronic neck pain.

Table 1. Demographic presentation of subjects

GROUP	AGE IN YEARS(MEAN)	SD	DURATION IN MONTHS (MEAN)	SD
GROUP A	42.47	9.09	4.6	1.5
GROUP B	39.8	9.14	5.3	1.8

Table 2. Statistical results -NPRS scores

GROUP	Pre-Test Mean	U	P-Value	Post-Test Mean	U	P-Value	Critical Value
GROUP A	6.27	88	P>0.05	2.47	26	P<0.05	64
GROUP B	6.73			4.67			

Table 3. Statistical results -NDI scores

GROUP	Pre-Test Mean	U	P-Value	Post-Test Mean	U	P-Value	Critical Value
GROUP A	25.93	69	P>0.05	8.0	26	P<0.05	64
GROUP B	29.13			21.8			

Table 4. Statistical results -MMT scores of LT, MT and SA Muscles

MUSCLE	GROUP	Pre -Test Mean	U	P-Value	Post-Test Mean	U	P-Value	Critical Value
LOWER TRAPEZIUS	GROUP A	5.13	90.5	P>0.05	8.2	62	P<0.05	64
	GROUP B	4.87			7.4			
MIDDLE TRAPEZIUS	GROUP A	5.0	112.5	P>0.05	8.0	63	P<0.05	64
	GROUP B	5.0			7.33			
SERRATUS ANTERIOR	GROUP A	4.93	107	P>0.05	8.07	55	P<0.05	64
	GROUP B	4.87			7.2			

Discussion

The study was an experimental approach to find out the effectiveness of strengthening exercises to Lower Trapezius, Middle Trapezius and Serratus Anterior on pain, functional status and muscle strength in non-specific chronic neck pain.

The result showed that both groups had reduction in pain, improvement in functional status and muscle strength. Even though both groups showed improvement, the Group A showed more significant changes in NPRS, NDI and MMT values than the Group B. It indicates that LT, MT and SA muscles strengthening along with conventional treatment is more effective in reducing pain, improving in functional status and muscle strength in individuals with non-specific chronic neck pain.

Individuals with neck pain have significantly weaker LT, MT and SA muscles on their side of neck pain. Patients with neck pain often have subjective complaints of muscle stiffness, tension and upper

trapezius tightness. This in turn may cause LT, MT and SA weakness and muscle imbalances in the scapulothoracic region^{3, 4}. These imbalances disrupt normal scapular positioning and result in impaired biomechanics and pain³. Changes in the recruitment properties and pain may influence muscle stability function. Pain can also deteriorate the quality of life^{12,8}.

In patients with chronic neck pain, histopathologic investigations have detected muscular fatigue, pain and significantly low trapezius muscle blood flow at low contraction intensities on the more painful than the less painful side due to atrophic muscle fibers. It may cause the weakness of trapezius muscles. The adequacy of blood supply, which transports oxygen and nutrients to muscle and removes waste products, affect the tension producing capacity of a muscle and its resistance to fatigue.¹¹

Strengthening programs focusing on the cervical and scapulothoracic region give short and long-term benefit on pain and function in chronic mechanical

neck disorders². The stabilizations function of stability muscles is influenced by postural changes of muscles and changes in connective tissue may influence muscle function⁸. Proper firing patterns and recruitment of muscles require coupling of the serratus anterior muscle with the upper, middle, and lower trapezius muscles, consequently resulting in “force couples,” which are considered necessary for normal scapular orientation. Combining information from training physiology and clinical studies provides strong evidence for the effectiveness of exercise therapy for chronic neck pain, as well as the disability it causes.²

Hence, this study suggests that the strengthening LT, MT and SA along with conventional therapy is effective in reducing pain, improving muscle strength and functional status in individuals with non-specific chronic neck pain.

Conclusion

The study primarily tried to analyze the effect of strengthening exercises to lower trapezius, Middle Trapezius and Serratus Anterior along with conventional therapy on pain, muscle strength and functional status in individuals with non-specific chronic neck pain.

Statistical analysis of data collected by NPRS, NDI and MMT recommends that strengthening exercises to MT, LT and SA along with conventional therapy has significant effect in individuals with non-specific chronic neck pain than Conventional therapy alone. Hence, this study reveals that addition of strengthening exercises to MT, LT and SA to the regimen enhances faster recover in individuals with non-specific chronic neck pain. Hence, we concluded that strengthening exercises to middle trapezius, lower trapezius and serratus anterior muscles along with conventional therapy is effective in reducing pain, improving muscle strength and functional status in

individuals with non-specific chronic neck pain.

List of abbreviations

LT -Lower Trapezius

MT -Middle Trapezius

SA -Serratus Anterior

UT -Upper Trapezius

NPRS -Numerical Pain Rate Scale

MMT -Manual Muscle Test

NDI -Neck Disability Index

IEC -Institutional Ethics Committee

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Ethical Clearance: This Pre-test Post-test Experimental study design was conducted at Department of Physiotherapy, Little Flower Institute of Medical Sciences and Research Centre, Angamaly for duration of 6 months. Ethical clearance was obtained from the IEC.

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