

# Comparison of Isometric Exercises and Stretching Versus Isometric Exercises and Stretching With Ergonomic Modifications in Patients with Mechanical Neck Pain

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## Author's Contribution

<sup>1</sup>Data analysis, Conception, Synthesis, Discussion

<sup>2</sup>Planning of research, Manuscript writing, Interpretation

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## A B S T R A C T

**Background:** Mechanical neck pain is the most common musculoskeletal disorder of general population. Mechanical neck pain is also known as axial neck pain or nonspecific neck pain as it is non radiating pain and has an acute or sudden onset without known etiology.

**Objective:** To compare the effectiveness of isometric exercises and stretching versus isometric exercises and stretching with ergonomic modifications for mechanical neck pain.

**Material and Methods:** This is a randomized control trial, single blind study which consists of 30 subjects (n=30) of age 20-45 years, with 15 subjects (n=15) in experimental group (isometric exercises and stretching with ergonomic modifications were applied) and 15 subjects (n=15) in control group (isometric exercises and stretching were applied). Duration of study was 6 months. Pre and post treatment assessment was done. Interventions were applied with moderate intensity 3 times a week (10rep/ 3 set per day) for 4 weeks (12 sessions) in both groups. Questionnaire, visual analogue scale (VAS) for pain intensity and neck disability index (NDI) for functional disability was used as data collection tools. Sample size was calculated through epitool.

**Results:** Both VAS and NDI scores showed more improvement in experimental group (isometric neck exercises and stretching with ergonomic modifications) as compared to control group (isometric neck exercises and stretching). One way ANOVA was used for between group analysis and paired t-test was used for within group analysis. As P-value < 0.05 so we rejected null hypothesis, there is a significant difference between groups.

**Conclusion:** This study concluded that ergonomic modifications with isometric exercises and stretching result in improvement of posture, reduce muscle stress, increase muscle balance, increase range of motion as compared to isometric exercises and stretching.

## Introduction

Mechanical neck pain is the most common musculoskeletal disorder of general population.<sup>1</sup> Mechanical neck pain is also known as axial neck pain or nonspecific neck pain as it is non radiating pain and has an acute or sudden onset without known etiology.<sup>2</sup> Mechanical neck pain is a generalized neck pain with symptoms which are increased by stoop postures, cervical muscles palpation and neck movement.<sup>3</sup>

Mechanical neck pain is usually associated with headaches that radiate into skull base, temporal and per orbital areas. These headaches are called cervicogenic headache.<sup>4</sup>

Neck pain due to abnormal mechanics may leads to poor posture, increase muscle imbalance, muscle spasm, neck stiffness and decreased range of motion.<sup>5</sup> Leading cause of disability in general population is

mechanical neck pain with an annual prevalence of 30%.<sup>6</sup> Neck pain affects 15% of the general population annually.<sup>7</sup> Prevalence of activity limitation due to neck pain in adults is 16-75 %.<sup>8</sup> Prevalence of neck pain ranges from 6% to 22% and prevalence in elderly population is up to 38%.<sup>7</sup> Lifetime prevalence ranges from 14.2% to 71%.<sup>3</sup> Neck pain peaks at middle age and affects women more than men.<sup>6</sup> People with a working age group of 20-50yrs are most commonly affected. Possible risk factors are of a physical, psychosocial, cultural, societal or personal origin.<sup>9</sup> One reason of neck pain is people sedentary way of life which is connected with using a personal computer during daily activity. Work place and duration are not properly adapted to the personal physical conditions of the employees.<sup>10</sup> Risk factors include repetitive work, poor ergonomic work design, poor posture, Physical overload, Stress, Smoking, Poor psychological health.<sup>11</sup> Disturbance in oxidative metabolism and elevation of pain-generating substances in neck muscles, suggests impairment of muscle circulation locally and accumulation of waste products.

Stretching and isometric exercises with ergonomic modifications cause immediate and long term relief in mechanical neck pain. In electrotherapy low level laser (830 to 904 nm) causes immediate decrease in pain and increase in function in mechanical neck pain<sup>12</sup>. The goal of ergonomic modifications is to create environment suitable for the physical needs of patients and to guide patients to perform workplace exercises. Guide proper standing with neck and back straight.<sup>13</sup> Use a firm pillow support while sleeping. Guide yoga for improving neck posture. Ergonomic modifications lead to improved workplace conditions through participation, communication, and problem-solving, and has positive impact on health and exposure of workers.<sup>14</sup> Ergonomic modifications results in the enhancement of working posture and decline in incidence of musculoskeletal symptoms.<sup>15</sup> Kilroy, Niamh in 2000 determined that Ergonomics intervention resulted in an improvement in working posture and a decrease in musculoskeletal symptoms and body discomfort. Ergonomic guidelines, which include avoid slouch posture, sit upright,<sup>16</sup> Frequently used items should be within close reach, Alternate activities like drinking water, speaking on phone, speaking to a colleague, whole body stretch should be

done, Avoid maintaining same position for long period.<sup>17</sup> Stretching and isometric exercises helps to improve flexibility, range of motion, blood circulation and muscle strength.

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## Methodology

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This is an RCT randomized controlled trial, single blind study, duration of study was 6 months. Patients with age 20–45 years sub-acute or chronic cases (4 to 12 weeks), who had neck pain without radiculopathy and who had not taken any treatment for neck pain earlier and both males and females were included in the study. Patients who showed signs of serious pathology (e.g. malignancy, inflammatory disorder, infection), History of Cervical spine surgery in previous 12 months, History of fractures in cervical spine, Signs of cervical radiculopathy, Vascular Syndromes such as vertebrobasilar insufficiency, Bilateral upper limb symptoms, History of whiplash injury, Diminished or absent sensation to pinprick in upper limb were excluded from the study. Matching of experimental and control group was done. Participants were blinded.

Simple random sampling was done through tossing a coin. Questionnaire, visual analogue scale (VAS) for pain intensity and neck disability index (NDI) for functional disability was used as a data collection tool. A data of 30 patients from Allied health hospitals (Holy family hospital, Benazir Bhutto hospital and District headquarter hospital) was collected for this study. Sample was divided into two groups' experimental group and control group each containing 15 subjects.

Pre and post treatment assessment was done, pre assessment was done at zero week and post treatment was done at 4<sup>th</sup> week. Interventions were applied with moderate intensity 3 times a week (10rep/ 3 set per day) for 4 weeks (12 sessions) in both groups. To patients allocated to control group isometric exercises and stretching were applied and to patients allocated to experimental group isometric exercises and stretching with ergonomic modifications were applied.

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## Results

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Appropriate analysis skills with SPSS version 21 were applied. Efficacy of Interventions was analyzed through One-way ANOVA and paired t-test. Power 0.8, Level of significance= 5% or 0.05, P value 0.05, Confidence interval 0.95. Sample size was calculated through epitool. Mean±SD of age was 2.13±1.40. Out of 30 subjects 5 were male and 25 were female, 16 subjects had age between 21-25 years, 3 had 26-30 years, 4 had 31-35, 5 had 36-40 years and 2 had age between 41-45 years, 15 subjects were students, 2 were office workers, 2 were computer user, 5 were teachers and 6 were housewives. 19 subjects were single and 11 were married. Critical

isometric strength training and dynamic endurance training effectively decreased pain and disability<sup>19</sup> Hannu K, Pekka H, Jari Y in 2008 determined that strength training and stretching resulted in long term improvement in neck pain and disability.

The study conducted by Arpita Desai and Shruti M Shah in 2004 on a 100 computer professionals by using ergonomic intervention and intermittent exercises for neck in the work day concluded that educating computer operators the importance of ergonomics and work modification techniques and intermittent exercises

**Table I: Shows comparison of pre and post treatment in control and experimental group.**

NDI	Mean± standard deviation				F	P-value
	Control		Experimental			
	Pre-test	Post-test	Pre-test	Post-test		
	2.33±0.617	2.33±0.617	2.27±0.961	0.60±0.632	57.707	<0.001
VAS	6.80±1.568	3.33±0.900	6.53±1.187	1.90±1.100	14.561	0.001

NDI= Neck disability index, VAS= Visual analogue scale SD= Standard deviation, one way ANOVA, P-value<0.05; there is a significant difference between two groups.

**Table II: Shows comparison of pre and post treatment in control and experimental group**

Measure	Group	Mean± standard deviation		P-Value
		Pre-test	Post test	
NDI	Control	2.33±0.617	2.33±0.617	0.858
		0.60±0.632	0.60±0.632	0.000
VAS	Experimental	6.80±1.568	3.33±0.900	0.000
		6.53±1.187	1.93±1.100	0.000

NDI= Neck disability index, VAS= Visual analogue scale SD= Standard deviation, Paired t-test, P-value<0.05; there is a significant difference within groups, P-value>0.05; there is no significant difference within groups.

region: Reject  $H_0$  if  $F_{cal} > 2.05$ . One way ANOVA and paired t-test were performed to compare the treatment outcomes between groups and within groups.

## Discussion

The findings from this study suggest that mechanical neck pain may be relieved by isometric exercises and stretchings with ergonomic modifications. This study shows the resemblance with some aspects of literature review. There was evidence of statistically significant effect of ergonomic modifications on mechanical neck pain as study conducted by Kilroy, Niamh in 2000 showed that ergonomics intervention resulted in an improvement in working posture and a decrease in musculoskeletal symptoms and body discomfort.<sup>18</sup> Jari Ylinen in 2003 determined that both

protocol can reduce risk of cumulative trauma disorders<sup>20</sup>. There was also evidence of statistically significant effect of strengthening exercises and stretchings on mechanical neck pain as study conducted by Kary TN, Gross A in 2005 (used 16 trials with multiple comparison, 6 studies compared stretching and strengthening exercises to control treatment showed that there is evidence that stretching and strengthening exercises have benefit on neck pain. Shikda AA, Al-Kindi in 2007 determined that 30 % of the computer users develop neck pain, due to ergonomic deficiencies in computer workstation and ergonomic interventions were effective to improve it. <sup>21</sup> Häkkinen in 2007 determined that both manual therapy and stretching were effective for reducing both spontaneous and strain-evoked pain in patients with chronic neck pain.<sup>22</sup> All the

studies discussed above showed the effect of active muscle training, isometric exercises, stretching and ergonomic modifications on chronic neck pain, cumulative trauma and in computer users none of the study studied the combined effect of isometric exercises and stretching with ergonomic modification in mechanical neck pain on both genders in 20-45 years of age that's why this study was conducted.

This study concluded that the statistically significant effect of Isometric neck exercises and stretching with ergonomic modifications on mechanical neck pains compared to isometric exercises and stretching as our calculated value was greater than table value ( $F_{cal} = 6.40 > 4.24$ ) so I rejected null hypothesis. The patients in experimental group showed more improvement in range of motion, reduction in pain, better sleep, no headache and increased ability to do ADLs and IADLs without pain as compared to patients in control group.

One must question the mechanism by which isometric exercises and stretching's with ergonomic modification causes reduction in pain, improvement in range of motion and increased ability to do ADLs and IADLs. Disturbed oxidative metabolism and elevated levels of pain-generating substances in neck muscles, suggests impaired local muscle circulation and accumulation of waste products that causes neck pain. Isometric exercises and stretching cause removal of waste product from neck muscles by improving blood circulation that reduce muscle stiffness and spasm which causes pain relief and improves range of motion. Ergonomic modifications improve posture alignment of body that reduce stress, increase muscular balance and reduce muscle spasm. So combined effect of isometric exercises and stretching with ergonomic modifications showed more improvement in mechanical neck pain.

In control group subjects showed improvement but without ergonomic modification proper alignment of the body was not maintained that caused less decrease in mechanical stress on neck muscles and less increase in muscle balance So this study concluded that ergonomic modifications with isometric exercises and stretching result in improvement of posture, reduce muscle stress, increase muscle balance, increase range of motion as compared to isometric exercises and stretching.

## Conclusion

It is concluded that isometric neck exercises and stretching with ergonomic modifications applied to experimental group were more effective than isometric exercises and stretching applied to control group for mechanical neck pain. As Mechanical neck pain is due to poor ergonomic work design, poor posture, stress which causes neck muscle spasm. Delayed diagnosis, improper management of mechanical neck pain will cause weakness of neck muscles, straightening of spine and headache so stretching, isometric exercises and ergonomic modifications should be used for management of mechanical neck pain. In future more research needs to be done on effectiveness of ergonomic modifications and workplace exercises with greater sample size, long duration and large resources.

**Limitation of Study:** Sample size was small. Duration of study was short. Limited resources were available. Study had not included subject below 20 and above 45. Study had not included subjects with cervical fracture, degeneration and radiculopathy.

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