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**Research Article**

# A Comparative Study on Effect of Different Positional Isometric Neck Exercises Training On Neck Pain and Functional Ability in Patients with Neck Pain

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**Abstract:** Non-specific neck pain is a common reason for adults to consult health care providers. Therefore one should always seek the most effective intervention(s) within the wide spectrum of treatments available. Knowledge on neck functions and pain, its relationship at different positional isometric training are important for developing exercise protocols, but very few studies have examined neck functions and pain in relationship to different positional isometric training. The purpose of this study was to quantify the diffence in isometric neck strength training at neutral and functional position.A total of 34 male patients with non-specific neck pain with mean age of 29.3±2.8years participated in the study. Based on inclusion criteria the participants were randomized into a group- A (isometric exercise at neutral position) and group-B (isometric exercise at functional position), n=17 in each group. Outcome measurements such as perceived neck pain and the functional disability were assessed by a visual analog scale (VAS), and the neck disability index (NDI) respectively at the baseline (0), 3rd week and at 8th week after respective intervention for both groups. The total duration of the study was for 8weeks.VAS and NDI within group-A and group-B were significantly reduced at 3rd week and 8th week ($p<0.05$). Whereas between groups analysis showed the difference in improvements in VAS and NDI were statistically non-significant at any point of interventional period ($p>0.05$). The Current study concluded that VAS and NDI considerably improves with isometric neck exercises, however there is no added advantage of neutral and functional positional changes during isometric neck exercise training in treating patients with neck pain.
**Keywords:** Neck pain, Isometrics, positions, VAS, NDI, Functional Positions

## INTRODUCTION

A high prevalence and incidence of neck pain is present in the working population, especially sedentary workers [1]. Working groups with high levels of static contraction, prolonged static loads, or extreme working postures involving the neck/shoulder muscles are exposed to an increased risk for neck/shoulder musculoskeletal disorders. Although various factors are related to neck pain, representative causes include reduced range of movement and abnormal activation patterns of para-cervical muscles [2]. This pain disorder is costly in terms of treatment, individual suffering, and time loss due to work absenteeism [3].

Numerous studies have demonstrated that neck pain is associated with altered behavior of the cervical muscles [4,5,6]. Studies have been observed that muscle dysfunction with neck pain in particular, the deep cervical muscles show dysfunction in patients with neck pain including reduced activation of the deep cervical flexors during a task of craniocervical flexion [7] and lower activation of the deep semispinalis cervicis muscle during multidirectional isometric contractions [8] and during cervical extension performed in a neutral craniocervical position [9]. Furthermore, the semispinalis cervicis muscle shows lower directional specificity of activation in patients with neck pain, that is, patients demonstrate a reduced ability to produce a well-defined muscular activation that appropriately reflects the anatomic position of the semispinalis cervicis relative to the spine during the performance of circular isometric contractions [8].

A study observed lower activity of the semispinalis cervicis and multifidus, as measured with muscle functional magnetic resonance imaging, and was also found in patients with mechanical neck pain when assessed at the levels C5-C6 and C7-T1 during cervical extension with the head positioned in a neutral position [9]. The observation that the semispinalis cervicis muscle was similarly altered across different spinal levels, suggests a generalized change in activation in all fascicles rather than a change localized to a specific segment.

The less-defined activation of the semispinalis cervicis muscle in patients with neck pain during the multidirectional isometric task is in accordance with decreased directional specificity found for the sternocleidomastoid, [10] and splenius capitis [5], muscles in patients with neck pain. Lower specificity of neck muscle activity may be interpreted as a functional adaptation or possibly maladaptation to pain and might reflects impaired neural drive to the neck muscles in patients [10]. It may represent an attempt to increase cervical spine stability similar to co-activation of cervical muscles by activating muscles over a larger range of motion [11]. This multidirectional activation of the cervical muscles could provide muscle tension when moving in all directions which would support cervical stability, even though the overall EMG amplitude of semispinalis cervicis was reduced in patients compared with pain-free controls.

The mechanisms underlying lower activation of the deep cervical muscles in patients with neck pain remain unclear and the variability of change in muscle activation observed across patients is not fully understood. Therefore, the purpose of this study was to investigate the relationship between neutral and functional positional isometric exercise training on pain sensitivity and assess the effect of exercise on short-term neck-related disability scores.

## EXPERIMENTAL SECTION

A total of 34 male patients with non-specific neck pain, recruited on the basis of clinical examination by physicians referred from various corporate sectors were selected for the study. A randomized controlled trial was conducted at Delhi NCR. The participants were randomized into a group- A (i.e. isometric exercise at neutral position) and group-B (i.e. isometric exercise at functional position), n=17 patients in each group. Four subjects were dropped out from the study due to inability to adhere to the treatment sessions. The following inclusion criteria were used: male subjects, aged 25 to 35 years, 3-5 years of practicing IT workers with computer usage of 6-8 hours per day, diffuse neck pain without radiation, motivated for rehabilitation, and constant or frequently occurring neck pain for more than 2 weeks. Exclusion criteria were patients under any form of neck exercise and treatment, intake of any form of analgesic, severe disorders of the cervical spine, such as disk prolapse, spinal stenosis, postoperative conditions in the neck and shoulder areas, history of acute trauma, instability, spasmodic torticollis, frequent migraine, peripheral nerve entrapment, fibromyalgia, shoulder diseases (tendonitis, bursitis, capsulitis), inflammatory rheumatic diseases, severe psychiatric illness and other diseases that prevent physical loading. These states were assessed mainly by medical history and clinical examination before entering the study.

Baseline variables included age, weight, height, years of job and daily working hours. Outcome measurements were taken at the baseline, 3rd week and at 8th week after of intervention periods in both groups. Subjectively perceived neck pain was assessed by a visual analog scale (VAS), and the functional disability was assessed by the neck disability index (NDI). Before starting the intervention patients were under gone a brief introduction lecture on posture correction, exercise demonstration and practice session for their respective group. Both training regimens consisted of 3 sessions per day for 5 days in a week for first 3 weeks and subsequently 2 sessions per day for 5 days in a week for 3weeks, and finally last 2 weeks it has reduced to 1 sessions per day for 5 days in a week. 10 seconds hold with 5 repetitions on each side with 5 second rest between each exercise and 30 seconds rest time during change over of flexion to extention and right to left lateral flexion. Each session were lasting approximately 15 minutes. Both groups were given hot fermentation for 3-5minutes pre and post session. This study was approved by the relevant Human Ethics committees and all participants gave written informed consent prior to data collection.

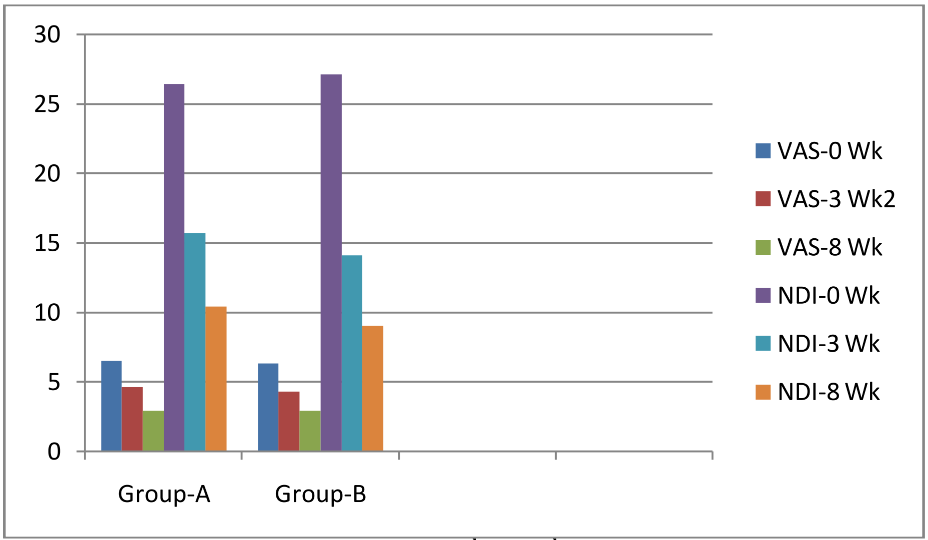
## RESULTS AND DISCUSSION

Baseline variables were showed age 29.3±2.8years, weight 74.2±2.2kgs, height 169.3±6.5cm, years of work 4.1±1.1years and daily working hours 7.13±.74hrs. Clinical outcome variables of VAS and NDI analyzed at baseline (0), 3rd and 8th week. Statistical comparison among the variables and groups were made by using the paired and unpaired t-test. VAS and NDI was insignificant at the baseline for both groups **(Table1.1)**.

**Table1.1 Visual Analogue Scale (VAS) analysis at baseline (0), 3rd and 8th weeks**

| Groups | VAS-0 Wk | VAS-3rd Wk | VAS-8th Wk | Mean diff. | p-Value |
|---|---|---|---|---|---|
| **Group-A** | 6.5±0.24 | 4.58±0.31 | 2.88±0.35 | -1.95±0.32x*<br>-1.70±0.29y*<br>-3.66±0.37z* | 0.000x<br>0.000y<br>0.000z |
| **Group-B** | 6.32±0.23 | 4.28±0.91 | 2.88±0.39 | -2.03±0.24x<br>-1.40±0.30y<br>-3.44±0.40z | 0.000x<br>0.000y<br>0.000z |
| **Mean diff.** | 0.22±0.33 | 0.30±0.39 | 0.00±0.53 | *x=p and MD between 0-3wk | |
| **p-Value** | 0.519 | 0.452 | 1.0 | *y=p and MD between 3-8wk<br>*z=p and MD between 0-8wk | |

VAS in group-A significantly reduced at 3rd week, mean reduction in score was 1.95±0.32 and the change from 3rd to 8th week was also significant i.e. mean reduction in score was 1.7±0.29, ($p<0.05$). In group-B VAS significantly reduced at 3rd week, mean reduction in score was 2.0±0.24 and the change from 3rd to 8th week was also significant i.e. mean reduction in score was 1.4±0.30($p<0.05$).Whereas between group analysis showed the difference in improvement in VAS was not statistically significant at any point of interventional period ($p>0.05$) (**Graph1.1)**.




**Graph1.1 VAS and NDI at baseline (0), 3rd and 8th weeks in group A and B**

NDI in group-A significantly reduced at 3rd week, mean reduction in score was 3.37±0.87and the change from 3rd to 8th week was also significant i.e. mean reduction in score was 3.65±0.94, ($p<0.05$). In group-B VAS significantly reduced at 3rd week, mean reduction in score was 2.93±0.75 and the change from 3rd to 8th week was also significant i.e. mean reduction in score was 3.33±0.86($p<0.05$).Whereas between group analysis showed the difference in improvement in VAS was not statistically significant at any point of interventional period ($p>0.05$) (**Table1.2)**.

**Table1.2 Neck Disability Index (NDI) analysis at baseline (0), 3rd and 8th weeks**

| Groups | NDI-0 Wk | NDI-3rd Wk | NDI-8th Wk | Mean diff. | p-Value |
|---|---|---|---|---|---|
| **Group-A** | 26.4±0.68 | 15.73±0.8 | 10.4±0.95 | 10.66±0.87x* | 0.000x |
| | | | | 5.33±0.94y* | 0.000y |
| | | | | 16.0±0.90z* | 0.000z |
| **Group-B** | 27.06±0.75 | 14.1±0.64 | 9.0±0.71 | 12.99±0.75x | 0.000x |
| | | | | 5.13±0.86y | 0.000y |
| | | | | 18.06±0.94z | 0.000z |
| **Mean diff.** | -0.66±1.02 | 1.6±1.03 | -1.4±1.19 | *x=p and MD between 0-3wk | |
| **p-Value** | 0.519 | 0.135 | 0.249 | *y=p and MD between 3-8wk | |
| | | | | *z=p and MD between 0-8wk | |

The level of pain decreased in both groups significantly and pattern of pain improvement noted for both groups was also similar. The reason on mechanism of pain reduction was exercise isometric exercise regimes might be due to increase in endorphins that occurs usually after training and better neuromuscular control. The strong muscle contractions happen during isometric exercises which activate muscle stretch receptors. These afferent from these receptors cause endogenous opoids to be released and also causes the release of bête endorphins from the pituitary gland, these secretions may cause decrease in pain.

Localized changes in muscle structure have been shown to occur specifically at painful segments of the spine [12, 13], although generalized changes in muscle composition that are not isolated to one level of the spine have been demonstrated. In the present study, the most painful segment or muscle was not specifically investigated; therefore, further investigations are required to reveal the extent or distribution patterns of altered EMG activity across spinal levels with respect to the painful segments.

The deep cervical flexors and extensors form a muscular sleeve enclosing and supporting the cervical spine [14]. Lower activation of the deep muscles during movements of the head might compromise cervical spine stability and increase the risk of injury and pain [7, 15]. As such, specific exercises aimed at activating these deep muscles are considered essential, especially in the early phase of rehabilitation [16]. In this study all subjects were also in the in the early phases of rehabilitation, this could have been added the positive results on both interventional groups.

The flexion–relaxation (FR) phenomenon, a normal pattern in muscle activation, originates from the lumbar region and is defined as an electrical silence response in the erector spinae muscles during a full forward-bending trunk posture [17]. The causes of this phenomenon were seen as transferring extensor moment from superficial erector spinae to passive paraspinal structures or deep muscle such as quadrates lumborum [18, 19]. These phenomena might have been added the positive results on functional position isometric interventional groups.

Although lateral flexion and rotation movement were closely associated in the cervical area [20], cervical rotation occurred in a wider region in the cervical spine than did lateral flexion and required combined activity between the musculature of the ipsilateral and contra lateral sides [21]. We believe that the subjects participated in the functional position isometric training might be influenced by the FR ratio.

According to previous work, researchers have suggested that duration of computer usage of more than 6 h per day was highly associated with musculoskeletal symptoms including the limitation of range of motion [22]. Subjects were recruited in this study as participants had average daily working hours 7.13±.74hrs; therefore, they had potential risk for musculoskeletal dysfunction, by considering their usual work hours.

It is generally agreed that muscles play an important role in the support and protection of joints. In the past decade, a number of studies have indicated that strengthening of the neck muscles in patients with chronic neck pain results in reduced pain and decrease in disability, in some studies only minor or short-term improvements were found with active exercise [23, 24]. However in the current study, patients were undergone 8 weeks long exercise regime given significant result in both interventional groups.

Hence, the reduction in pain could be partly or simply a result of spontaneous recovery. Several studies had also showed that intensive training of the neck muscles for 6-12 weeks resulted in a significant reduction of self-reported neck pain [25, 24, 26].

The design of the present study is such that the observed improvement could be attributed to the effect of the isometric exercise programme without being confounded by the possibility of spontaneous recovery. Although there was no significant difference between the groups, as was noted by previous investigators [25, 26] the tendency was in favor of the intervention groups. Moreover, a study also supports that the improvement in the exercise groups was better than that in the TENS group and after six weeks, patients shad significant improvement in their isometric neck muscle strength [27].

A study compared the relative efficacy of neck exercise and spinal manipulation for managing patients with chronic neck pain. Substantial improvement in the Neck Disability Index was observed in the different groups of patients [21]. Thus our study also supports the effect of exercise may improve neck functional abilities. It is suggested that the improvement in this score might be due to the combined effects of reduction in neck pain and improvement in neck muscle strength as shown in the reduction of VAS score.

Jordan suggested that the gain in strength in these subjects was probably a result of increased confidence [25]. Similarly, a study suggested that an improvement in the cognitive perception of pain, and the fear-avoidance belief about physical activities might contribute to the improvement of isometric muscle strength in patients with chronic back pain [28].

The amount of decrease in pain occurred during the first 3 weeks and last five weeks was almost same. the reason for this could be the protocol followed that consisted of three times a week for first three weeks and twice daily for last five weeks i.e. increased frequency of supervised sessions for the initial weeks would have led to a better performance.

## CONCLUSION

Results of this study may suggest that the isometric exercise groups in neutral or functional positions had better improvement especially in terms of pain reduction and neck functional ability and however, there was no statistical difference between the two positional training groups in any of the outcome measures for neck pain.

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