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# Effects of Neck Stabilization Exercise on Pain, Disability, Craniovertebral Angle and Psychological Status in Patient with Non-Specific Chronic Neck Pain

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A B S T R A C T

**Background:** Nonspecific chronic neck pain (NSCNP) is a great discomfort to individual suffering from it and serious problem to physiotherapist managing them.

**Objective:** The aim of this study is to investigate the effects of neck stabilization exercises on pain, disability, craniovertebral angle and psychological status in patient with non-specific chronic neck pain.

**Methodology:** Fourteen patients (6 male and 8 female participants) with non-specific chronic neck pain with a mean age of 41.64±14.78 were involved in this study. They were recruited from selected hospitals in Lagos state. Subjects performed stabilization exercise two times in a week for eight consecutive weeks and were assessed for pain severity, level of disability, anxiety, depression and cranio-vertebral angle using the numerical pain rating scale (NPRS), neck disability index (NDI), hospital anxiety and depression scale (HADS). The craniovertebral angle (CVA) was obtained and recorded photographically and was measured using coral draw X7 software at pre-intervention, 4 weeks and 8 weeks post intervention. Data analysis were done with Friedmann test, Wilcoxon sign rank test and spearman correlation. Level of significance was set at $p \leq 0.05$.

**Results:** There was significant reduction in pain severity ($p=0.001$) and improvement in function disability level ($p=0.001$) of the subjects following intervention. There was also improvement in depression level ($p=0.001$), anxiety level ($p=0.001$) and increase in the craniovertebral angle ($p=0.001$) of the subject's post intervention.

**Conclusions:** This study revealed that neck stabilization exercises alone are effective in the treatment of individuals with NSCNP.

## Introduction

Neck pain appears to be a common ailment all over the world; it is a problem of the populace associated with significant disability.[1] Non-specific chronic Neck Pain (NSCNP) refers to neck pain whose underlying cause cannot be traced to any specific systemic disease. [2]

In Nigeria, neck pain is becoming a common problem, probably due to more frequent use of electronic gadgets such as computers, mobile phones and android tablets[3], particularly among the young population. It is seen often in our clinical setting and constitutes a significant burden on the physiotherapy care facilities.[4] The lifetime, one-year and point prevalence of neck pain in the rural community in North western Nigeria were 67.9%, 65.9% and 17.0% respectively.[4] Generally, 25% of patients with neck pain will develop into chronic neck pain which can lead to reduction in health related quality of life and increase in medical expenses.[5, 6] There are different

exercise interventions for treating neck pain using certain forms of duration, training frequency, intensity, and mode. Neck stabilization exercises are forms of exercises that are performed to improve function, and prevent reoccurrence. They require co-contraction and recruitment of the anterior and posterior cervical and shoulder girdle musculature. [7]

It is generally recognized that psychological factors play an important role in chronic non-specific neck pain patients especially anxiety and depression which seems to influence their pain intensity and level of disability in a negative way. [8] Though different psychological variables might play a role at different period in the course of neck pain, the number of patients often differs in terms of symptoms duration. [9]

It is generally recommended that in patients with neck pain, forward head posture should be included in the assessment as part of the examination procedure to assist in the diagnosis and formulation of treatment strategies for patients with neck pain. This can be used to check patient's progress.[10] Forward Head Posture is a common cervical abnormality that predisposes population to pathological ailments such as headaches, neck pain, vertebral bodies' disorders, length of soft-tissue and altered strength [11].

Craniovertebral angle (CVA) measurement is a common objective method used in the assessment of forward head posture.[12, 13] The smaller the CVA the greater the forward head posture. [11] The standard normal value of the CVA in a pain free population is about 50°. Any value below 50° leads to a form of cervical disorders.[13] Haughie et al [14] reported that FHP of patients with neck pain compared with that of asymptomatic subjects differ whereas Hanten et al,[15] failed to detect such differences in their own study.

This study is therefore aimed at determining the effect of neck stabilization exercises on pain, disability, craniovertebral angle and level of depression and anxiety of patients with non-specific chronic neck pain.

## Methodology

This study involved Fourteen (6 males and 8 female) subjects. They were recruited from the outpatient physiotherapy clinics of the Lagos University Teaching Hospital, Idi-Araba, Lagos, Nigeria Airforce Hospital Base Ikeja Lagos and Army Reference Hospital Yaba Lagos from the June to November, 2017. Included in this study were patients with non-specific chronic neck pain with or without radiation to both upper limbs. Patients were excluded from this study if they have specific disorders of the cervical spine e.g. cervical prolapsed and spinal stenosis, post operative conditions of the neck, history of severe trauma of the neck and severe migraine.

Subjects' detailed history was obtained, using assessment form that was given to them and by carrying out physical examinations. Subjects demographic data such as; age, sex, weight, and height was taken. After screening for eligibility, the subjects were included into the study.

Of the 16 subjects eligible for this study, 2 were unable to complete the study. 14 subjects completed the study (6 males and 8 females). The reasons for withdrawal by the remaining 2 subjects who could not complete the study were transportation and illness. The ethical approval was obtained from the Health Research and Ethics Committee of Lagos University Teaching Hospital, Idi-Araba Lagos with the approval number: ADM/DCST/HREC/APP/1479. The purpose, relevance and significance of the study were explained to subjects and informed written consent was signed by each subject before engaging them in any of the procedures of the study.

Subjects went through the neck stabilization exercise protocol 2 sessions per week for 8 weeks consecutively. Assessment of Pain, disability, depression, anxiety, and craniovertebral angle were done using numerical pain rating scale, Neck disability index, hospital anxiety and depression scale, digital camera and coral draw software at baseline, 4th week and 8th week post intervention. The sample size was calculated using the Cohen's formula for sample size determination.[16]

By assuming α value as 1.96 and β value as 0.84. ES = Efficient size (using a large effect size of 0.72)[1]

**Assessment of craniovertebral angle**

Adhesive markers were placed on the 7th cervical vertebrae (C7) and the tragus of the ear for the assessment of the craniovertebral angle. The subjects were told to stand in the anatomical position with the head erect. The plumb line was set 2 meters away from the

subject and a camera and tripod stand was set just behind it. The lateral landmarks marked clearly by the adhesive markers were well exposed. The plumb line was anticipated to align in front or through the tragus of the ear and before of the acromion process. Subjects' pictures were shot with the digital camera. [13]

The pictures taken from the subjects were imported to Corel draw X7 software version to evaluate the cranioveterbral angle. To measure the Craniovertebral angle [12], a horizontal line starting from the spinous process of the 7th cervical vertebrae was drawn using the angular dimension of the Corel draw X7software version. Also a diagonal line was drawn through the tragus of the ear to the spinous process of the 7th cervical vertebrae. The angle at the point where these two lines met (spinous process of the 7th cervical vertebrae) was measured and recorded as the craniovertebral angle of the subjects. [12]

**Protocol for neck stabilization exercise**

Chin Tuck-in, Neck lift, Neck flexion, Craniocervical flexion with neck flexion, Shoulder blade retraction. [17]

**Data Analysis**

Data was analysed using statistical package for social science (SPSS) version 21 and Microsoft Excel 2007 version, and summarized using descriptive statistics of frequency, percentage charts, mean and standard deviation. Friedman's test was used to find the statistical significance difference in the outcome measure across the weeks and Wilcoxon signed rank test was used to find difference at baseline and 8thweek post treatment. Spearman correlation coefficient was used to find the relationship between variables. The level of significance was set at P≤0.05.

## Results

A total of 14 patients participated in this study. 6(42.86%) of the subjects were males while 8(57.14%) were females with age ranging from 21 to 68 years. Table 1 shows the demographic characteristics of the subjects.

Table II shows the mean score of all parameters at baseline, 4th week (mid treatment) and at the end of 8th week (post intervention). Friedman's test showed that there was statistically significant difference in all the outcome measure parameters; pain (P=0.001), functional disability (P=0.001), anxiety (P=0.001), depression (P=0.001), CVA (P=0.001) assessed post intervention.

**Table I: Demographic Characteristics of The Subjects**

| VARIABLES | MEAN±SD |
|---|---|
| AGE(years) | 41.64±14.78 |
| WEIGHT(kg) | 76.07±11.75 |
| HEIGHT(m) | 1.69±0.093 |
| BMI(kg/m$^2$) | 26.77±3.85 |

Key: BMI: Body Mass Index
SD: Standard Deviation

Table III shows the comparison of the mean score of all outcome parameters at baseline and at the end of 8th week (post intervention). Wilcoxon's value showed that there was significant difference in all the outcome measures parameters, pain (P=0.001), functional disability (P=0.001), anxiety (P=0.001), depression (P=0.001), CVA (P=0.001) assessed post intervention.

Table IV shows that there was a significant correlation between pain and disability (p=0.001), depression (p=0.001), and anxiety (p=0.04) but no significant correlation with CVA (p=0.13) post intervention.

**Table II: Outcome Parameters at Baseline, 4th Week And 8th Week Post Intervention**

| Outcome Measures | Pre-Rx (Baseline) Mean±SD | Mid Rx (End of 4th week) Mean±SD | Post Rx (End of 8th week) Mean±SD | FM Value | p-value |
|---|---|---|---|---|---|
| PAIN | 7.29±1.94 | 4.93±1.33 | 1.93±0.73 | 27.53 | 0.001* |
| FD | 32.00±14.47 | 22.14±9.39 | 11.43±3.09 | 25.48 | 0.001* |
| ANXIETY | 7.43±4.29 | 4.14±2.98 | 2.07±2.13 | 27.53 | 0.001* |
| DEPRESSION | 7.89±5.25 | 4.93±4.78 | 2.57±3.23 | 25.53 | 0.001* |
| CVA | 43.91±7.73 | 48.76±5.11 | 51.97±3.81 | 28.00 | 0.001* |

*Significance at p≤0.05
Key: FD: Functional Disability, CVA: Cranio-Vertebral Angle, FM value: Friedman Test, SD: Standard deviation, Rx: Treatment

Table V shows that there was a significant correlation between disability and pain (p=0.001), depression (p=0.001), but no significant correlation with anxiety (p=0.21) and CVA (p=0.11) post intervention.

**Table III: Outcome Parameters at Baseline and at End Of 8th Week (Post Intervention)**

| Outcome Variable | Pre Rx Baseline) Mean±SD | Post Rx 8th week Mean±SD | Z value | p value |
|---|---|---|---|---|
| PAIN | 7.29±1.94 | 1.93±0.73 | 3.31 | 0.001* |
| FD | 32.00±14.47 | 11.43±3.09 | 3.30 | 0.001* |
| ANXIETY | 7.43±4.29 | 2.07±2.13 | 3.31 | 0.001* |
| DEPRESSION | 7.89±5.25 | 2.57±3.23 | 3.31 | 0.001* |
| CVA | 43.91±7.73 | 51.97±3.81 | 3.19 | 0.001* |

*Significance at p≤0.05

Key:FD: Functional disability, CVA: Cranio-Vertebral Angle, Z value: Wilcoxon sign rank

SD: Standard deviation, Rx: Treatment

**Table IV: Correlation Between Disability, Psychological Status (Anxiety and Depression), Craniovertebral Angle and Pain of The Subjects**

| | Correlation | Disability Post | Depression Post | Anxiety post | CVA Post |
|---|---|---|---|---|---|
| PAIN | $r_s$ | 0.77 | 0.79 | 0.56 | 0.42 |
| | P-value | 0.001* | 0.001* | 0.04* | 0.13 |

*Significance at p≤0.05

Key: $r_s$: Spearman correlation coefficient CVA: Cranio-Vertebral Angle

**Table V: Correlation Between Pain, Psychological Status (Anxiety And Depression), Craniovertebral Angle And Disability Of The Subjects**

| | Correlation | PAIN Post | DEPRESSION Post | ANXIETY Post | CVA Post |
|---|---|---|---|---|---|
| Disability | $r_s$ | 0.77 | 0.79 | 0.56 | 0.40 |
| | P-value | 0.001* | 0.001* | 0.21 | 0.11 |

*Significance at p≤0.05

Key: $r_s$: Spearman correlation coefficient, CVA: Cranio-Vertebral Angle

## Discussion

This study determined the effect of stabilization exercise on pain intensity, functional disability, psychological status and craniovertebral angle of patients with non-specific chronic neck pain (NSCNP). The age range of the subjects that participated was between 21 and 68 years; this is consistent with the age range of patients affected by neck pain in most epidemiological studies. [5, 3, 4]

The findings of this study revealed that neck stabilization exercise significantly reduce the severity of pain in patients with non-specific chronic neck pain (NSCNP). This result is in accordance with the findings of Kaka *et al* [18], who in their own study determined the effect of neck stabilization and dynamic exercises on patients with non-specific chronic neck pain. However, stabilization exercise resulted in better reduction in pain intensity. This is also in conformity with the result from the study by Asgari *et al* [19] who investigated the effect of stabilization exercise (SE) and proprioceptive neuromuscular facilitation exercises (PNFE) on cross sectional area of deep cervical flexor muscles in patient with chronic neck pain. The study showed that stabilization exercise had effect in the reduction of pain severity than proprioceptive neuromuscular facilitation exercises in patient with non-specific chronic neck pain.

Since a definite insult to muscle appears to be associated with pain, exercises planned to improve stability of the spine have gained recognition in the conventional management of patients with spinal pain.[20] This study demonstrated the effectiveness of neck stabilization exercise in the management of patients with non specific chronic neck pain. Jull *et al* [16] also showed the efficacy of neck stabilization exercise in the improvement of neck pain and cervical muscle performance in randomized controlled trial of patients with cervicogenic headache. The mechanism through which neck stabilization exercises reduces the pain symptoms in non-specific chronic neck pain patient may be based on the belief that intense exercise increases activity in the motor pathways, thereby exerting an inhibitory effect on pain centres in the central nervous system.[21]

In this study, there was tremendous improvement in functional ability of patients with non-specific chronic neck pain after participating in neck stabilization exercise program. This result supports the report of the study of Dusunceli *et al*, [20], who studied the effect of neck stabilization exercises and isometric exercise or physical therapy agents alone over a12

month's period and revealed that neck stabilization exercises were superior. This suggested that neck stabilization exercises are effective in improving functional disability level in patients with NSCNP. In view of the fact that disability, the mechanism of which is not yet understood, is frequently followed by a considerable influence on activity of daily living, resulting in a broad utilization of healthcare funds [22], hence to improve the patient's functional disability which would make them to return to normal activity may be the main aim of any treatment approach. With regard to our results, Neck Stabilization Exercise may be the best approach to achieving this purpose.

According to the result of this study, there was a significant improvement in the psychological status (depression) of the subjects; this could be as a result of reduction in neck pain and disability of the subjects after undergoing neck stabilization exercise. This findings supports the assertion of Dusunceli *et al*, [20] who reported a reduction in level of depression which was assessed using becks depression scale (BDS) in order to understand the factor that contribute to pain sensitivity and disability. This result is also consistent with the report of the study by Kaka *et al*, [23] who reported improvement in depression after 8th weeks of neck stabilization exercise.

The result of this study revealed that patients with chronic neck pain have psychological distress (anxiety and depression) and pain as a significant correlation with depression and anxiety. This support the findings of the study carried out by Von Korff *et al,* [24] who stated that persons with chronic pain are more likely to have depressive symptoms than those without pain. Anxiety is the most prevalent factor among the psychological factor related to pain.[25] Hadjistavropoulos *et al*, [26] reported that anxiety about health is higher in people with pain than those without pain. These physical and emotional experiences reproduce anxiety.

Findings from this study revealed that there was a significant increase in the craniovertebral angle (CVA) of patients with non specific chronic neck pain after undergoing stabilization exercise at the end of 4th week and 8th week respectively compared to the baseline measurement which reads lower CVA of ($43.91^0$) than the normal CVA of ($50^0$).[13] This corresponds with a study carried out by Yip *et al* [12] and Akodu *et al* [13] who found out neck pain subjects had a considerably lower CVA than asymptomatic subjects. The lower the CVA angle the greater the protrusion or forward head posture (FHP). This indicates a greater shift of the head from the sagittal plane (plumb line). The larger the angle the more it represents an 'ideal' sagittal plane of the head and neck alignment. It was concluded that patients with lower CVAs had greater FHP and the greater the FHP, the more the disability in the neck.[12, 13]

This study makes it known that continuous stabilization exercise has a tremendous effect on CVA and one of the factors affecting body's natural position is performing a certain activity for a long time, this corroborates with the assertion made by Taheri *et al,*[27] that repetitive actions, makes the body to take the specific position of that activity.

In this study it was shown that females are more affected with severe FHP than males. This result corresponds with the report of the study carried out by Keyvānloo *et al,* [28] in which females had more severe forward head posture than males. They reported that the only possible reason for this difference was angular measurement methods used for linear measurement.[28]

## Conclusion

Neck stabilization exercises has been found to be effective in the reduction of the pain severity, improvement of functional ability, CVA, depression and anxiety in patients with NSCNP. It is therefore recommended that NSE should be incorporated into the management of NSCNP patients. These results can be useful for clinicians and patients with neck pain in selecting appropriate treatment protocol based on the severity of the condition.

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