

EVALUATING THE IMPACT OF DEEP NECK FLEXOR EXERCISES ON PAIN, MOBILITY, AND QUALITY OF LIFE IN MECHANICAL NECK PAIN PATIENTS

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Abstract

It has been reported that neck discomfort is a common disturbance of people's wellbeing and parameter of life that are health-related especially in their productive life. The study assessed the effectiveness of exercising neck's deep flexor muscles (NDFM) on discomfort, movement and health-related life parameters in patients that have mechanical neck discomfort. Twenty individuals ascertained with discomfort at the neck of mechanical origin were studied. Deep neck flexor exercises (Switching on deep neck flexor muscles; side neck muscles; back neck muscles and front neck muscles) were administered sequentially for 5-10 seconds each for a session and each session was repeated 10 times thrice in a week for six weeks. Pain, neck movement and parameters of life that are health-related were measured before treatment, week 3 and in week 6. Information gathered were scrutinized using descriptive and inferential statistics with level of significance to be 0.05.

The outcome indicated an important decline when before-treatment, third week and sixth week of NDFM exercise were compared on pain intensity ($F=30.349$, $P=.000$), Neck disability index ($F=6.596$, $P=.005$) and HRQoL ($F=6.678$, $P=.005$). It was also revealed that there was significant increase among pretreatment, third week and sixth week of cervical range of motion for flexion ($F=11.630$, $P=.000$), right side flexion ($F=6.490$, $P=.000$), and right rotation ($F=7.280$, $P=0.000$).

Considering the result from the research, it can be said that administration of DNFE has positive effect in treatment of mechanical or pain at the neck of no organic origin with respect to discomfort, disability, movement and parameter of health related to life

Keywords: neck pain, Range of motion, exercises, Quality of life

Introduction

Research has reported that cervicalgia which on the other hand called discomfort at neck pain is a rampant situation affecting more than 60% of population at least once in their lives¹. According to Ogwumike (2015) in a study on which considered occurrence of neck pain in a Nigerian settlement especially in North-West less city, prevalence as at the time of that study, was close to 17 %, a year before the study was about 66% and a through out-life occurrence was about 68%². Meanwhile, Ogwumike found males to be more affected with neck pain contrary to some other studies that observed it more among the opposite sex².

Health-related parameters of life have been badly affected by some characteristics displayed by a long term non-specific discomfort at the neck according a study³. These features includes limitation in neck movement, impaired activities of the neck, emotional work pressure and pain at the myofascial section of the neck muscles³. It has been observed that pain at the neck had a significant effect especially at the

individuals age of productivity on health in general and parameters of life related to health; the parameters of life related to health involves vitality, useful work role, physical, state of mind and relationship with the society⁴. Clinic researches established that a connection exist between health related parameters of life and neck discomfort and that mental and physical parameters of health were majorly affected in comparison with individuals with no pain at neck⁵⁻⁷. Ektor-Andersen et al, reported that as pain in the shoulder-neck area increases there is sequential decrease in self experience health⁸

Physical, mental and societal quality were the components that have been used to explain the word health in its totality. World Health Organization's definition is, "State of complete physical, mental, and social well-being, and not merely the absence of disease or infirmity"⁹. Patric and Erickson defined parameters of life related to health as the quality allocated to period of life as amended by favorable circumstances, ken, functionalities, damaged to the body that are affected by illness, body damage medical care and policy¹⁰. Although the concept HRQoL as used then was concluded to be confusing, but Karimi and Brazier came about a potential solution, defining parameters of life related to health as the process of estimating health, using empirical values on how it changes life; better still employ the condition to identify the association between the state of health and utility of an individuals. The main focus of quality of life in relation to health is how an individual as being able to live a fulfilled life in consideration to the impact of health¹¹.

Researchers agreed that HRQoL is multidimensional and includes domains that are related to physical, mental, emotional, and social functioning and the social context in which people live¹². Measures of quality of life as related to health is in various dimension including areas in relation to areas of people life like intellectual, body, feeling, and human relation where people are living. Some of the attribute that quality of life related to health can capture include assessment subjectively, current status of health, physical emotional and social in relation to promoting health care system, quality and equality and orientation promotion.¹³

In patients with neck pain researchers have documented activities impairment on the longus colli and logus capitis which are deep neck flexors^{14,15}. Therefore, for the patient with neck pain to gain strength, endurance, joint movement and restoration of neck muscle and sustenance of normal life activities the most frequent means of treatment is exercises¹⁶. More to this, isometric exercises and training to gain strength have been reported to positively improve pain at the neck^{17,18}. On the other hand, symptoms of neck pain, enhancing deep cervical flexors muscle activation during performance of the clinical test of neck flexion which may lead to improvement of cervical movement and quality of life related to health can be achieved by retraining the DFN muscles¹⁹

Though there are studies on effect of exercising deep neck muscle on the pain relieve in patients with pain at the cervical region,¹⁷⁻¹⁸, but no significant evidence to prove it impart on the patients' ROM and quality of health related to life. Thus, the research sets examined the effectiveness of exercising of deep neck flexors exercise on discomfort, movement, and quality of life related health of patient that have neck pain.

Materials & Methods Participants

The target populations were individuals with neck pain either directed from the Orthopedic section of the medical facility, diagnosed with neck pain or already on outpatient visit at the Physiotherapy Department of Teaching Hospitals of the Obafemi Awolowo University in Ile-Ife.

Inclusion Criteria

i) Patient diagnosed with mechanical neck pain.

Exclusion Criteria

i) Patient with neck pain resulting from cancer infection and other pathological condition.

Study Design

This is a Quasi-experimental design; one-way repeated measure design over time.

Sampling Technique

Participants for the study were recruited using a sampling technique known as purposive.

Sample size calculation/determination

$M = c \times \pi_1(1-\pi_1) + \pi_2(1-\pi_2) / (\pi_1-\pi_2)^2$; according to Chan ²⁰

C = 7.9 for 80% power π_1 and π_2 are proportion estimates

$\pi_1 = 0.25$ and $\pi_2 = 0.65$

$M = 7.9 \times 0.25 (1-0.25) + 0.65 (1-0.65) / (0.25 - 0.65)^2$

M = 20.49 approximately ²¹

Site of Study

Outpatient unit of the Physiotherapy Department in a Teaching Hospitals belonging to the Obafemi Awolowo University Ile-Ife, Nigeria was used for the study.

Instruments

i. Health-related quality of life questionnaire (SF-12); which assesses the parameters of life related to health- patient was used in the study. The questionnaire consists of some information needed to be answered with yes/no. This information examined restrictions in role functioning resulting from of physical and emotional health. There are also some information which needs to be answered as on three-point scale (e.g., limited a lot, limited a little, or not limited at all), these questions evaluated restriction in physical activity and physical role functioning. More to these, there are other interrogation needs to be answered like not at all, a little bit, moderately, quite a bit and extremely, which evaluated intensity of pain, and a scale that assesses overall health (excellent, very good, good, fair, and poor) are included. The SF-12 also has a scale that contain six point (e.g., all the time, most of the time, a good bit of the time, some of the time, a little of the time and none of the time) that examine the mental status, vitality, and social functioning. The total score for the questionnaire is on a scale of 0-100, while the Physical domains (PCS) and mental domain (MCS) will be standardized to a mean of 50, with scores above and below 50 representing better than and poorer than average summaries respectively²¹.

- ii. Goniometer; movement in the joint is being measured by this instrument. The universal standard goniometer made of plastic material was used. It consists of three parts; the body, designed like a protractor and forms a full circle. It has an inscription in degree for the evaluation of the joint flexibility. The inscription extends from 0 to 360 degrees, with the intervals on the scales varying from 0 to 10 degrees.
- iii. Semantic Differential Scale (SDS); The response of an individual is assessed using this scale. It consists of seven -point rating scale which the patient will pick one of the points that addresses the fillings of the patients
- iv. Neck Disability Index: The disability of the neck of the patients is examined using using the Neck Disability Index (NDI). This is an outcome measured which is being used regularly to assess the what patients perceived as a disability²². There are ten information in NDI, activities of daily living are seven, two were related to pain, concentration was captured by one²³. The question are scored from zero to five and the total score was expressed as a percentage, with higher scores indicating greater disability.

Informed consent was obtained from each patient to participate in the study. Research and Ethic Committee of the Teaching Hospitals Complex belonging to the Obafemi Awolowo University Ile-Ife approved the study (IRB/IEC/0004553, NHREC/27/02/2009a). The mode of treatment was explained to the patient

Deep neck flexor (DNF) exercises

1. Switching on deep neck flexor muscles; patient sat up tall and draw their chin down and back as if they're nodding 'yes.' This was sustained for 5-10 seconds and repeated for at least 10 times. If patient can, two sets can be done. Fig 1
2. Stretching side neck muscles; one arm of patient is placed behind his/her back as shown in the picture below. The head will then be tilted to one side, tilting away from the arm that is behind. Patient felt a stretch in his/her side neck muscles. This will be sustained for about 30 seconds. Three set of this will be done on each side. Fig 2
3. Stretching the back neck muscles; patient sits upright on a chair. Patient chin is tilted down towards the chest as far as can be sustained for 30 seconds. The stretch will be repeated three times. Fig 3
4. Stretching the front neck muscles; patient is allowed to sit all the way back on a raise both arms behind their head so that their neck is supported. Then lean backwards over the chair, looking up to the ceiling. Patient will feel a stretch in the front of their neck. This position will be held on to for about 30 seconds and repeated three times. Fig 4



Whittington Health, NHS Trust)

The goniometric measurement of the Neck ROM;

1. Switching on deep neck flexor muscles, 2 Stretching side neck muscles 3 Stretching the back neck muscles; (4) Stretching the front neck muscles From [www. cervical Health](http://www.cervical Health), NHS Trust

Goniometry of the movement at the neck

1 Side Flexion

Patient was in a sitting position, with the thoracic and lumbar spine well supported by the back of the chair. The cervical spine was positioned in 0-degree flexion, extension and rotation. This was measured by placing the fulcrum of the goniometer on the spinous process of C7 vertebra, with the stationery arm aligned with the spinous processes of the thoracic vertebrae so that it is perpendicular to the ground. The moveable arm was aligned with the dorsal midline of the head, using the occipital protuberance for reference²⁴. Patient was asked to bend the head to the right side. The movable arm was aligned to the reference points, and the flexibility was read on the scale. Then the patient bent the head to the left, and the goniometer was aligned as well and read.

2. Neck flexion

Patient was in a sitting position, with the thoracic and lumbar spine well supported by the back of the chair. The cervical spine was positioned in 0 degree of rotation and lateral flexion. The fulcrum of the goniometer was centered over the external auditory meatus. The stationery arm was aligned to be perpendicular to the ground. The moveable arm aligned with the base of the nares for reference point. The goniometer will read 90 degrees in the zero starting position²⁴. Patient was asked to bend the head down; the movable arm of the goniometer was realigned with the nares. The reading was done on the scale of the goniometer

3. Neck extension

This is a motion that also occurs in the sagittal plane around a medial-lateral axis. The testing position and alignment are the same as for measuring the neck flexion²⁴.

4. Neck rotation

Patient was in a sitting position, the low back and the thorax leaned on the chair's back rest. The neck was positioned in 0 degree of flexion, extension and lateral flexion. The fulcrum of the goniometer was placed on the vertex of the head. The stationery arm and the moveable arms pointed to the noise. The patient was

asked to rotate the head to the right side, the moveable arm was manipulated to point to the noise while the immovable arm remained in the former direction.

The angle of rotation was then recorded from the scale. The procedure was repeated for the left side rotation.²⁴.

Participants were treated three times in a week. The treatment lasted for six weeks. Patient response were assessed after each third treatment session of 1st, 3rd, and 6th week of treatment;

The primary outcome measure was goniometric measurement while secondary outcome measure was Semantic Differential Scale. Health-related quality of life questionnaire (specifically, SF-12) was used to measure the self-perceived general health status. It is designed to provide a global measure of HRQoL.

Assessment of Findings

Patient discomfort was assessed using Semantic Differential Scale (Olaogun 2003) Neck movement was measured using Universal Goniometer.

Parameters of life related to health was evaluated with SF 12 health-related quality of life questionnaire and disability was measured using Neck Disability Index. Evaluation was done before the treatment, 3rd and six weeks in the treatment session.

Data Analysis

Descriptive and statistics that can make an inference from the data was used to sum up the data. Repeated measure Analysis of variance called repeated measure was used to examine the effect of DNFE on Disability, HRQoL, ROM & Discomfort pretreatment, 3rd & 6th week of treatment. Alpha level is at 0.05.

RESULTS

Physical characteristics of participants.

Presented in table 1 are the physical characteristics of participants. The minimum age was 20.0years; the maximum was 60.0years, while the average age of participant was 33.00 years. The minimum BMI was 19.4 kg/m², the maximum was 26.4 kg/m², while the mean BMI was 22.00.

Table 1: Physical characteristic of participants

Variables	Minimum	Maximum	Mean + SD
Age (Years)	20.00	60.00	33.00±16.30
Height (m)	1.60	1.80	1.70± 0.07
Weight (kg)	55.00	70.00	63.60±5.46
BMI (kgm ⁻²)	19.40	26.40	22.00±0.31

Socio-demographic distribution of participants

Shown in table 2 is the socio-demographic distribution of participants. There were 40% female and 60% male who partook in the study. 80% of the study population has O'level, 10% NCE and 10% MSc as their highest academic qualification. There are 70% single and 30% married participants. 30% of the population are schooling, 30% are artisan while the remaining 40% are others (civil servant, retiree, teacher and trader).

Table 2: Socio-demographic variables of participants

Variables	Frequency	Percent
Sex		
F	4	40
M	6	60
Total	17	100.0
Education		
O'level	8	80
NCE	1	10
MSc	1	10
Total	10	100.0
Marital status		
Single	7	70
Married	3	30
Total	10	100.0
Occupation		
Schooling	3	30
Artisan	3	30
Others	4	40
Total	10	100.0

Others include; civil servant, retiree, teacher and trader.

Effectiveness of deep neck flexor exercise (DNFE) on pain intensity and health-related quality of life (HRQoL)

There was a important difference among pretreatment, third and sixth week of pain intensity ($F=30.349$, $P=.000$), Neck disability index ($F=6.596$, $P=.005$) and HRQoL ($F=6.678$, $P=.005$).

Table 3: Summary of repeated measure ANOVA for effect of DNFE on pain intensity, NDI and HRQoL. N=21

Variables	mean±SD	F value	P value
Pain intensity			
PreRx	5.50±1.43 ^a		
pain			
Week 3 pain	3.10±1.37 ^b	30.349	.000
Week 6 pain	1.30±.67 ^c		

**Neck disability index
(NDI)**

PreRx NDI	26.00±14.94 ^d		
Week 3 NDI	17.40±13.17 ^e	6.596	.005
Week 6 NDI	6.00±7.83 ^f		

HRQoL

PreRx HRQoL	30.00±7.21 ^g		
Week 3 HRQoL	36.30±5.37 ^h	6.678	.005
Week 6 HRQoL	40.57±4.86 ⁱ		

Post analysis of least significant difference (LSD); mean values with the same superscript (a,b,c,d,e,f,g,h & i) shows no important difference but mean values with superscript that different from each other shows an important difference.

Effectiveness of deep neck flexor exercises on cervical range of motion (ROM)

Presented in table 4 are the effects of deep neck flexor exercises on cervical range of motion at various directions. There was an important difference among pretreatment, third week and sixth week of neck movement in the following directions; neck flexion (F=11.630, P=.000), neck extension (F=4.400, P=.020), right side flexion (F=6.490, P=.000), left side flexion (F=2.870, P=.070), right rotation (F=7.280, P=0.000) and left rotation (F=3.42, P=0.04).

Table 4: Summary of repeated measure ANOVA for effect of DNFE on cervical range of motion (ROM)

Variables	Mean±SD	F value	P value
Neck flexion (NF)	45.50±5.58 ^a		
PreRx NF			
Week 3 NF	53.60±5.62 ^b	11.630	.000
Week 6 NF	57.86±4.88 ^c		
Neck extension (NE)	35.70±6.11 ^d		
PreRx NE			
Week 3 NE	43.00±6.00 ^e	4.400	.020
Week 6 NE	45.00±9.27 ^f		
Right side flexion (RSF)	31.40±5.23 ^g		
PreRx RSF			

Week 3 RSF	37.20±5.30 ^h	6.490	.000
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Week 6 RSF	39.86±4.22 ⁱ		
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Left side flexion (LSF)

PreRx LSF	34.10±4.58 ^j		
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Week 3 LSF	37.60±4.35 ^k	2.870	.070
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Week 6 LSF	39.00±4.32 ^l		
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Right rotation (RT)

PreRx RRot	38.10±8.04 ^m		
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Week 3 RRot	48.00±8.93 ⁿ	7.280	.000
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Week 6 RRot	52.86±7.40 ^o		
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Left rotation (LRot)

PreRx LRot	42.10±8.10 ^p		
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Week 3 LRot	48.50±10.21 ^q	3.420	.040
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Week 6 LRot	53.57±8.50 ^r		
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Key: NF = Neck flexion, NE = Neck extension, RSF= Right side flexion, LSF = Left side flexion

Rot= Rotation. Rx = treatment Post analysis of least significant difference (LSD); mean values with the same superscript (a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q & r) shows no important difference but mean values with different superscript are significantly different.

DISCUSSION

This study focused on assessing the effectiveness of exercising of deep flexors muscles of the neck discomfort, movement and HRQOL in patients complaining of pain at the cervical region. The results revealed that the mean age and BMI of the patients reflected that an average individual complaining of neck discomfort may be within the productive age and within the normal weight range this is against a previous study of Nilsen et al., which report more musculoskeletal problems in daily life of overweight and obese than their normal-weight peers (especially LBP and neck/shoulder pain)²⁵. The causes of neck pain have been attributed majorly to repetitive injury, postural abnormality. Overloading of mechanical tissues due to repeated work especially flexion and extension maneuver during daily activities is one of the major causes of neck pain²⁶. This is common especially among the middle-aged individuals which constituted the patients in this study. It was observed from the study that there was significant reduction when the variables before the treatment week three of the treatment and week six were compared on pain intensity, neck disability index and HRQoL. Abdel-aziem & Draz, investigated the effectiveness of DNFE in addition with physiotherapy agents as supplements, when the pain at the neck is being managed, it was then, recommended that further studies that involves DNFE alone without PTA be done²⁷. The current study has

successfully confirmed that exercising deep muscles of the neck in isolation is in patients with neck pain. Its effects on pain may be due to the direct activation of deep cervical flexor musculature by the DNFE²⁸. Also, bouts of resistance training/exercises could have led to hypoalgesic response²⁹. In the muscle, there are mechanosensitive afferent nerve fibres called A-delta and IV (C) fibres. These nerves are always stimulated from rhythmic muscle contractions. Such contractions will stimulate the mechanoreceptor which leads to the release of central opioid which is a strong pain-relieving chemical. This is the mechanism how exercises leads to pain

reduction.^{30,31}

It is logical to document that the lesser the pain the better the HRQoL of participants. In as much as the DNFE improves the pain intensity, there is the tendency that HRQoL of patient will be increased. This is in contrary to the results of a research conducted by Rezai, who submitted there was no significant association between the mental health domains of HRQoL and prevalence of neck pain, however a weak association was observed between the prevalence and physical domains.³². Ataoglu et al observed that the more the discomfort, the poorer the quality of life which was in line with the findings of our study³³. In a study conducted by Ali et al, it was asserted that there was a small to average effects of exercises intervention on HRQoL of stroke survivors, the improvement of physical health among these patients was also linked to effect exercise³⁴. We et al in their study concerning the time and duration of exercises reported that an healthy older adult exercising twice a week for 30 minutes will record an improvement in QOL³⁵

. It was also revealed that there was an important change among before treatment, week three and week six of all range of motion for cervical region. This might have been as a result of the improved cervical posture created by the DNFE, that is, the continuous sustained stretching of the deep neck muscles that has been shortened overtime due to pain induced neck posture²⁸. Movement at the neck and lumbar region have been reported to improve with physical exercise³⁶. Again Freimann et al examined the effectiveness of a home exercise for a period of 8 weeks on both neck and lumbar movements among the Intensive Care Unit nurses³⁷. An important improvement was recorded in flexion, extension, lateral flexion and rotation of the neck, also in the lumbar lateral flexion, after the intervention, this is in partial agreement with our study. Exercises have been reported to have a profound improvement on muscle metabolism and function, it also reduces or delay regeneration of muscle fibers, increase satellite cells and enhances activation of muscles, reduces formation of fibrosis and increase myogenic potential³⁸. In addition, exercise have been found to improve muscle cell and contraction of tissues³⁹

CONCLUSION

Considering the result from the research, it can be said that administration of DNFE has positive effect in treatment of mechanical or pain at the neck of no organic origin with respect to discomfort, disability, movement and parameter of health related to life.

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