Bashir Kaka*, Omoyemi O. Ogwumike, Ade. F. Adeniyi, Sonill S. Maharaj, Samuel O. Ogunlade and Bashir Bello

Effectiveness of neck stabilisation and dynamic exercises on pain intensity, depression and anxiety among patients with non-specific neck pain: a randomised controlled trial

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Abstract

Background and aims: Non-specific neck pain (NsNP) constitutes a burden to the bearers and a management challenge to physiotherapists globally. Effectiveness of neck stabilisation and dynamic exercises in the management of NsNP has been documented, but it is not clear which exercise regimen is more effective in alleviating its associated pain, depression and anxiety. This study was carried out to compare the effectiveness of neck stabilisation and/or dynamic exercises on pain intensity, depression and anxiety among patients with NsNP.

Methods: Eighty-nine consenting individuals with NsNP participated in this single-blind, randomised controlled trial. They were recruited from the outpatient physiotherapy clinics of the National Orthopaedic Hospital in Dala, Kano State, Nigeria. Participants were randomly assigned into one of three intervention groups: neck stabilisation exercise group (NSEG; $n=30$), neck dynamic exercise group (NDEG; $n=28$) and neck stabilisation and dynamic exercise group (NSDEG; $n=31$). Treatment was administered thrice weekly for 8 consecutive weeks. Variables were assessed at baseline, at the end of the fourth and eighth weeks. Pain intensity was assessed through the use of a visual analogue scale, while depression and anxiety were evaluated using both the Beck Depression Inventory and Beck Anxiety Inventory. The data was analysed using descriptive statistics, multivariate analysis of variance (MANOVA) and *post hoc* tests with Bonferroni adjustment at the $p=0.05$ significant level.

Results: Ages of participants in NSEG (46.8±12.4 years), NDEG (48.6±11.6 years) and NSDEG (45.1±13.4 years) were comparable. The comparison for NSEG, NSDEG and NDEG within groups revealed that there was significant difference in pain intensity, depression and anxiety scores from baseline, in the fourth and eighth weeks of the study – ($F=62.40$, $p=0.001$, $F=13.91$, $p=0.001$ and $F=20.93$, $p=0.001$); ($F=11.92$, $p=0.001$, $F=8.75$, $p=0.004$ and $F=9.70$, $p=0.001$) and ($F=36.63$, $p=0.001$, $F=11.99$, $p=0.001$ and $F=6.59$, $p=0.001$), respectively. A group comparison of the pain intensity, depression and anxiety scores of participants in the NSEG, NSDEG and NDEG at the baseline of the study revealed that there were no significant differences in the pain intensity and depression and anxiety scores among the three groups: $p=0.159$, 0.58 and 0.179, respectively. At week 4 of the study, however, a significant difference in pain intensity and anxiety scores across the three groups was recorded – $p=0.018$, $p=0.011$, respectively, but no significant difference was noted in depression scores ($p=0.93$). At week 8 of the study, it was determined that there were significant differences in pain intensity and depression scores $p=0.001$ and $p=0.041$, but no significant dissimilarities in the anxiety scores. *Post hoc* revealed that only pain was significant and lay with NSEG.

Conclusions: The study concluded that the stabilisation, dynamic and stabilisation, plus dynamic exercises were effective in relieving pain and reducing depression and anxiety in patients with NsNP. However, stabilisation showed a more marked effect than the combination exercises of stabilisation plus dynamic exercises, and dynamic exercises in reducing pain intensity in patients with NsNP.

Implications: It is recommended that stabilisation exercises be chosen over stabilisation plus dynamic exercises, or dynamic exercise, while treating patients with NsNP. However, both are effective.

Keywords: neck pain; neck stabilisation exercises; depression; neck dynamic exercises; anxiety.

***Corresponding author: Bashir Kaka,** Department of Physiotherapy, School of Health Sciences, College of Health Sciences, University of KwaZulu-Natal, Westville, Durban, South Africa,
E-mail: bkaka.pth@buk.edu.ng; kakab@ukzn.ac.za
Omoyemi O. Ogwumike and Ade. F. Adeniyi: Department of Physiotherapy, Faculty of Clinical Sciences, College of Medicine, University of Ibadan, Ibadan, Nigeria
Sonill S. Maharaj: Department of Physiotherapy, School of Health Sciences, College of Health Sciences, University of KwaZulu-Natal, Westville, Durban, South Africa
Samuel O. Ogunlade: Department of Surgery, Faculty of Clinical Sciences, College of Medicine, University of Ibadan, Ibadan, Nigeria
Bashir Bello: Department of Physiotherapy, Faculty of Allied Health Sciences, College of Health Sciences, Bayero University Kano, Kano, Nigeria

1 Introduction

Neck pain is an unpleasant sensory experience in the neck, which may manifest as fatigue, tension or pain that radiates to the shoulders, upper extremities or head [1]. Non-specific neck pain (NsNP) refers to neck pain (with or without radiation) whose underlying cause cannot be traced to any specific systemic disease. NsNP is multifactorial in aetiology and includes gender, age, poor self-rated health and wrong posture [2]. NsNP constitutes a burden to the bearers and a management challenge to physiotherapists globally.

Neck pain appears to be a public health problem [3]. Pain is a significant public health problem, while chronic pain is one of the most common reasons for temporary and permanent work disability [4] and this is frequently accompanied by psychosocial comorbidity (such as depression and anxiety). These symptoms often present together with pain in patients with musculoskeletal disorders, such as neck pain, back pain and arthritis [4]. Research based on bio-psychosocial models links chronic NsNP to psychological factors. They include depression, anxiety and fear avoidance belief. Anxiety and depression has been reported as an important determinant of NsNP [5]. Anxiety and depression is another important psychosocial factor that is believed to be associated with the existence of higher levels of pain in musculoskeletal pain conditions [6]. Anxiety and depression presents as co-morbidity to acute, sub-acute and chronic musculoskeletal pain, with incidence rates between about 15 and 40% [7].

A wide variety of treatment protocols for NsNP are available. But it is a topic of debate which exercise therapy can bring the best improvement in pain, anxiety and depression. There is also uncertainty about the effectiveness of specific types of exercises in the management of NsNP in the medium or long-term, making it difficult to choose between exercises [6].

Neck stabilisation exercise can be utilised as a therapy for NsNP management. The curative power of stabilisation exercise derives from its ability to enhance mobility, improve sensorimotor function and increase relaxation [8]. The stabilisation exercise is a type of treatment whereby patients with NsNP can use their own body weight to resist gravity; thus, this type of exercise can be performed very safely. Dynamic neck exercises represent progressive-resistive strength training that involves the movement of other parts of the body and neck [9]. Strengthening exercises pertain to any movement achieved by the individual/patient that includes resistance. These could encompass strength training with thera-band, free weights, or low-load endurance exercises to train muscle control [10].

The effectiveness of neck stabilisation and dynamic exercises in the management of NsNP has been documented, but it is not clear which of the exercise regimes is more effective in alleviating NsNP's associated pain, depression and anxiety. Therefore, the aims of this prospective study were to assess and compare the effectiveness of an 8-week regime of neck stabilisation exercises and dynamic exercises on pain, anxiety and depression among patients with NsNP. The following hypotheses were investigated: (1) Stabilisation exercises, dynamic exercises and dynamic plus stabilisation exercises would be effective for the management of NsNP. (2) There would be significant differences between stabilisation exercises, dynamic exercises and stabilisation plus dynamic exercises in the outcomes.

2 Materials and methods

2.1 Participants

The participants in this study were patients with NsNP, aged between 22 and 65 years and recruited between October 2013 and February 2015 from the National Orthopaedic Hospital in Dala, Kano (NOHDK). NOHDK is a specialist hospital with 200 beds that provides a tertiary health care service to the northern part of Nigeria. The participants were included if they: had been diagnosed with NsNP; had moderate to severe neck pain and were able to comprehend instruction in English or the Hausa language; were not involved in any other form of exercise training during the course of the programme; and had reported a NsNP of at least 6 weeks' duration. They were excluded if they had: co-morbidities that influenced overall well-being, for example, sickle cell anaemia; specific disorders of the cervical spine, such as disk prolapse, spinal stenosis, postoperative conditions, history of severe trauma, spasmodic torticollis, frequent migraine, fibromyalgia, shoulder diseases, inflammatory rheumatic diseases and psychiatric illness; obvious spinal deformity or neurological disease, or history of cardiovascular diseases contraindicated to exercise; Beck Depression scores of <11, Beck Anxiety scores <1; and/or were below 18 years of age. All research instruments were translated into the local language during the pilot study.

2.2 Sample size determination

The sample size for the study (N) was determined using Cohen's table [11] at $\alpha = 0.05$, degree of freedom (u) = k – 1, where k is the number of groups in this study, which is equal to 3. Therefore, at $\alpha = 0.05$, u = 2, effect size (f) = 0.35 (medium value) from the pilot study and power (w) = 80, group sample size (n) = 20. Sample size (N) for the study was a minimum of 60 patients with NsNP. An extra 12 participants (20%) were added to make room for dropouts (attrition). Therefore, a minimum of 72 participants were recruited for this study, with each group having at least 24 participants.

2.3 Design

This study was a prospective, parallel, single-blinded, randomised controlled clinical trial design that had been registered with the Pan Africa Clinical Trial Registry (PACTR 201402000727807).

2.4 Procedure

Ethical approval for the study was sought and obtained from the Health Research Ethics Committee of University of Ibadan and University College Hospital, Ibadan (UI/EC/14/0003). In addition, ethical approval was obtained from the National Orthopaedic Hospital in Dala, Kano (NOHD/RET/ETHIC/60).

2.5 Clinical assessment

Volunteers were recruited through referral, if they expressed an interest in participating after the aims and purposes of the research were explained to them. Prospective participants were then assessed and screened during their first appearance by the researcher for inclusion into the study. The confirmatory test used for NsNP included: X-ray or magnetic resonance imaging (MRI), if it was available, to rule out any red flag or specific neck diseases; physical tests (compression, distraction, vertebral artery test); and laboratory tests, if available. The Beck Depression Inventory (BDI) was employed to screen participants for depression. Those with scores of >11 were included. For anxiety, the Beck Anxiety Inventory (BAI) was used to screen participants. Those with scores of ≥1 were included. They were then guided through the informed consent process and were required to sign or thumbprint a consent form. After signed, written consents had been obtained, what followed was the participants' random allocation to the three study groups – NSEG or NSDEG or NDEG. The demographic and baseline questionnaires were administered to the participants by the researcher after the randomisation. The researcher then scheduled appointments for the interventions.

2.6 Sampling and randomisation technique

There are 196 patients with neck pain at that period 123 referred for physiotherapy and 35 were excluded because they did not meet the inclusion criteria. Patients referred for physiotherapy by doctors were recruited for the study by means of a consecutive sampling technique. The subjects were screened to determine whether they met the inclusion criteria for the research. Patients who met these criteria were randomised into three groups, viz. the neck stabilisation exercise group (NSEG), the neck stabilisation plus dynamic exercise group (NSDEG), and the neck dynamic exercise group (NDEG), as they became available. One hundred and twenty-three participants met the eligibility criteria, while the 35 who did not were excluded from the study. Randomisation was achieved through the means of sealed envelopes, which were prepared in advance and marked inside with an A or B or C, indicating the NSEG, NSDEG and NDEG, respectively. The randomisation was performed by a third party, who was completely unaware of the study content. The envelopes were picked without the replacement.

The neck stabilisation exercise group (NSEG; $n = 30$), neck stabilisation plus dynamic exercise group (NSDEG; $n = 28$) and neck dynamic exercise group (NDEG; $n = 31$). However, 76 participants completed the study – NSEG; $n = 28$, NSDEG; $n = 24$, NSDEG; $n = 24$. A 13.6% dropout rate (13 out of 89 participants) was observed throughout this study, with 76 volunteers (86.36%) completing its 8-week programme (Fig. 1, flow chart).

2.7 Blinding

Participants were blind to group allocation. Blinding is an important component of a valid, randomised controlled trial, because it ensures that treatment expectation is evenly matched between groups [12]. It will not be possible to blind the treating physiotherapists. The outcome assessors and statistician who analysed the data were also blinded to group allocation.

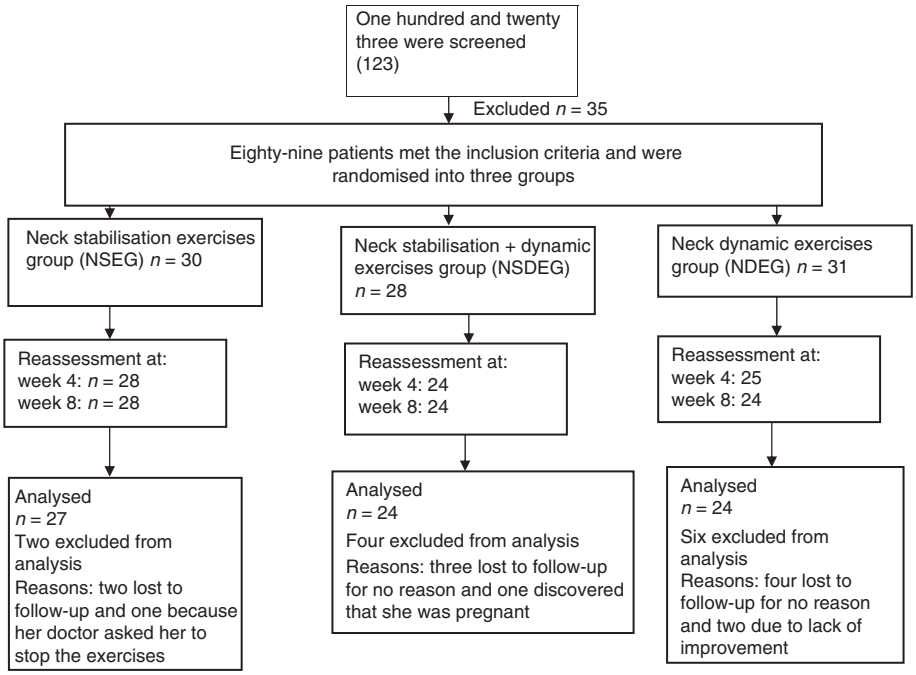

Figure 1: Flow diagram showing the progression of patients through the study.

2.8 Measurement of the parameters

2.8.1 Primary outcome

1. **Pain intensity:** This was assessed using the alternate visual analogue scale in Hausa (VAS-H). The patient was requested to rate, on a 0–10 scale, the level of pain that he or she felt 6 weeks ago and also currently. On the scale, 0 indicates no pain/no interference, while 10 is pain as bad as it could be/extreme interference [13]. The alternate VAS-Hausa has been reported to have a high validity, increased patient compliance, greater sensitivity of measurement and reduced bias [13].

2.8.2 Secondary outcome

1. **Beck Depression Inventory (BDI):** This is a 21-item multiple choice, self-reported inventory that is widely used to assess the presence and degree of depression in adolescents and adults [14]. The BDI is a self-administered questionnaire and has a high test-retest reliability (Pearson $r = 0.93$) [15], in addition to a high internal consistency (α 0.91) [14]. The BDI scores were added up by counting the numbers of correct answers to each marked question. The highest possible score is 63, while the lowest is zero. Depression is then evaluated based on the total score: 0–10 = these are considered normal; 11–16 = mild mood disturbance; 17–20 = borderline clinical depression; 21–30 = moderate depression; 31–40 = severe depression; and over 40 = extreme depression.
2. **Beck Anxiety Inventory (BAI):** This is a 21-item multiple-choice, self-reported inventory that measures the severity of anxiety in adults and adolescents. It can be completed within 5–10 min. The BAI is psychometrically sound, as its internal consistency (Cronbach's α) ranges from 0.92 to 0.94 for adults and test-retest (1 week interval) reliability is 0.75 [15]. In scoring the BAI, respondents are asked to report on the extent to which they have been bothered by each of the 21 symptoms in the week preceding (including the day of) completion of the BAI. Each symptom item had four possible answer choices: not at all, mildly (it did not bother me much), moderately (it was very unpleasant, but I could stand it) and severely (I could barely stand it). Not at all = 0, mildly = 1, moderately = 2, and severely = 3. The values for each item were summed up, yielding an overall score of 63 points. A total score of between 1 to 7 was interpreted as a "minimal" level of anxiety, 8 to 15 "mild", 16 to 25 "moderate", and 26 to 63 "severe".

2.9 Intervention

2.9.1 Neck stabilisation exercises group (NSEG)

Neck stabilisation exercises

The neck stabilisation exercise training was designed to restore cervical muscle endurance and coordination [16]. All of the participants in this group performed the following exercises:

Chin tuck
In standing position, the participant pulled back the chin (as if trying to make a double chin), while keeping the eyes level. This was done with 15 repetitions.

Cervical extension
In a standing position, the participant grasped the base of the neck, with both hands, while extending the neck as far as possible. This was done with 15 repetitions.

Shoulder shrugs
In a standing position, the participant shrugged his or her shoulders, bringing them up towards the ears. This was done with 15 repetitions.

Shoulder rolls
In a standing position, the participant rolled the shoulders forward in a circular movement. Then, he or she rolled the shoulders backwards in a circle. The participant then relaxed and repeated the procedure 15 times.

Scapular retraction
In standing position, the participant brought the shoulder blades together at the back; the participant then relaxed and repeated the procedure 15 times [16].

2.9.2 Neck dynamic exercises group (NDEG)

Neck dynamic exercises

A thera-band was utilised for dynamic muscle training, with this type of exercise training aimed at increasing muscle strength [17]. A progression of exercises was achieved through the use of different coloured thera-bands, indicating varied resistance, as shown in the Table 1.

Participants began with the thera-band with the least resistance (coloured red) and progressed to others with increasingly greater resistance (green and then blue). During the exercises, elongation was encouraged to be maintained at 100%, depending upon pain level and the ability of each participant to maintain elongation. The length of the thera-band was 3 inches, so the elongation of the band was measured to ensure that it extended to 6 inches.

Table 1: Thera-band colour progression.

Band colour	Increase from preceding Colour at 100% elongation	Resistance in pounds 100% Elongation
Thera-band red	25%	3.7
Thera-band green	25%	4.6
Thera-band blue	25%	5.8

Cervical extension-dynamic isometric (sitting)
The participant sat in an upright position and at the one end, the loop of the thera-band was attached to the participant's head and at the other, to a sturdy stand. The participant bent forward, then held the position for 30 s and slowly returned to the starting position, keeping the spine posture erect throughout the exercise. This was done with 15 repetitions in either direction [18, 19].

Cervical flexion-dynamic isometric (sitting)
The participant sat in an upright position and backed a sturdy stand. One end of the thera-band loop was securely attached to a sturdy stand and the other to the participant's head. He or she then bent forward and held the position for 30 s, before slowly returning to the starting point, while keeping the spine posture erect throughout the exercise. This was repeated 15 times in each direction [18, 19].

Chest flies exercises (standing position)
With the participant in a standing position, the middle of the thera-band was fastened securely to a sturdy stand, set at shoulder level. The participant backed the stand, with one leg slightly in front of the other. He or she then grasped the bands at shoulder height, with the elbows straight, and pulled the bands inward, with the palms facing each other, and then slowly returned to the starting position. This exercise was done 15 times in each direction [17, 20].

2.9.3 Neck stabilisation and dynamic exercises group (NSDEG)

The neck stabilisation and dynamic exercises group was treated with a combination of both the stabilisation and

dynamic as exercises, as explained above. All of the volunteers in all three groups had finished the medication prescribed to them by their doctors before the commencement of the study and were advised not to take any more until after the programme had been completed.

Frequency: Stabilisation and dynamic exercise sessions were held 3 times a week on alternate days, for 8 weeks.

The research assistants provided the treatment, which involved three sessions per week for 8 weeks, each session being approximately 45 min long, except for the NSDEG, which took about 90 min. Altogether, each participant had 24 treatment sessions.

The assistants were chief physiotherapists, trained by the researcher on treatment protocols. Each assistant was put in charge of one group, in different sections of the department, to avoid contamination during the treatment. They were vigilant about participants who were randomised to a particular group being treated in that group.

2.10 Data analysis

Preliminary analysis was performed to check for normality, linearity and homogeneity of variance, covariance and multi-collinearity, with no serious violations noted with mahal. Distance of 17.922. Descriptive statistics of mean, percentage and standard deviation were employed to describe the data. A one-way between groups and within groups multivariate analysis of variance (MANOVA) was performed to investigate the differences between the stabilisation exercise group, stabilisation plus dynamic group, and dynamic group, and three dependent variables were used – pain, depression and anxiety. Furthermore, *post hoc*, follow-up analyses were performed to identify where significant differences lay in the MANOVA, with a Bonferroni adjusted α level. The strength of the effect size defined ds of 0.2, 0.5 and 0.8 as small, medium, and large effects, respectively [11]. The α level was set at 0.05. The data analyses were carried out using the IBM SPSS version 23.0 (SPSS Inc., Chicago, IL, USA).

3 Results

3.1 Characteristics of participants

Eighty-nine participants were recruited for this study. They were randomly allocated to one of three groups: neck stabilisation exercises group (NSEG; $n=30$), neck stabilisation, plus dynamic exercises group (NSDEG; $n=28$) and neck dynamic exercises group (NDEG; $n=31$). Seventy-six participants completed the 8-week programme: NSEG, $n=28$; NSDEG, $n=24$; NSDEG, $n=24$. This gave a 13.6% drop-out rate (of 13 participants), with no intention of any analysis being performed on their data. Participants' ages ranged from 22 to 67 years, mean 46.81 ± 12.43, 45.13 ± 13.38 and 48.55 ± 11.61 years for NSEG, NSDEG and NDEG, respectively, and socio-demographic variables were presented in Table 2.

3.2 Within and between-groups; comparison of effects of neck stabilisation exercises, neck stabilisation plus dynamic exercises and dynamic exercises of participant

The within-groups comparison for NSEG reveals a significant difference in pain intensity, depression and anxiety scores from baseline, at 4 weeks and 8 weeks of the study ($F=62.40$, $p=0.001$, $F=13.91$, $p=0.001$ and $F=20.93$,

Table 2: Participants' socio-demographic characteristics.

Variable	NSEG *n* (%)	NSDEG *n* (%)	NDEG *n* (%)
Gender			
Male	11 (36.7)	16 (55.2)	16 (51.7)
Female	19 (63.3)	13 (44.8)	15 (48.3)
Marital status			
Single	2 (6.7)	5 (17.2)	6 (19.3)
Married	25 (83.3)	25 (82.8)	25 (80.7)
Tribe			
Hausa/Fulani	25 (83.3)	22 (75.9)	22 (70.9)
Yoruba	2 (6.7)	3 (10.3)	6 (19.3)
Igbo	3 (10.0)	3 (10.3)	2 (6.5)
Others	0 (00)	1 (3.4)	1 (3.2)
Educational level			
Nil	14 (47.7)	9 (31.0)	4 (10.5)
Primary/secondary	7 (23.3)	6 (20.7)	16 (51.7)
Tertiary	9 (30.0)	14 (48.3)	11 (37.1)
Employment			
Unemployed	7 (23.3)	8 (27.5)	6 (19.3)
Self-employed	14 (47.7)	14 (48.3)	19 (61.4)
Government-employed	9 (30.0)	7 (24.1)	6 (19.3)
Income per month			
Low/middle	18 (60.0)	17 (58.6)	21 (67.7)
Moderate/high	12 (40.0)	12 (41.3)	10 (32.3)
Pain duration in weeks			
6–8	5 (12.5)	6 (20.6)	4 (12.9)
9–12	20 (75.0)	17 (58.6)	19 (61.3)
13 and above	5 (12.5)	6 (20.7)	8 (25.8)

n = frequency of variables; % = percentage.

$p = 0.001$), respectively. Furthermore, the within-group comparison for NSDEG demonstrated that there was a significant difference in pain intensity, depression and anxiety scores from the baseline, at 4 weeks and 8 weeks of the study (F = 11.92, $p = 0.001$, F = 8.75, $p = 0.004$ and F = 9.70, $p = 0.001$). Moreover, the within-group comparison for NDEG showed that there was a significant difference in pain intensity, depression and anxiety scores from the baseline, at 4 weeks and 8 weeks of the study (F = 36.63, $p = 0.001$, F = 11.99, $p = 0.001$ and F = 6.59, $p = 0.001$), respectively.

Table 3 shows the comparisons of pain intensity, depression and anxiety scores between the groups of participants in the NSEG, NSDEG and NDEG, at the baseline of the study. With the aid of the one-way MANOVA, the study revealed that there were no significant differences in scores among the three groups: $p = 0.159$, 0.580 and 0.179, respectively.

Table 3: One-way MANOVA test comparison of mean pain, depression and anxiety scores of participants' treatment outcomes by treatment group at baseline.

Group	Mean ± SD		
	VAS	Depression	Anxiety
NSEG	7.56 ± 1.65 ($n = 30$)	17.76 ± 6.52 ($n = 30$)	24.66 ± 7.73 ($n = 30$)
NSDEG	7.03 ± 1.57 ($n = 28$)	14.42 ± 6.06 ($n = 28$)	21.07 ± 8.74 ($n = 28$)
NDEG	6.80 ± 1.57 ($n = 31$)	18.51 ± 7.04 ($n = 31$)	21.54 ± 7.59 ($n = 31$)
F	1.876	3.17	1.755
p-Value	0.159	0.570	0.179

α Level was set at 0.05.
NSEG = neck stabilisation exercises group; NSDEG = neck stabilisation plus dynamic exercises group; NDEG = neck dynamic exercises group; n = number of participants in the group; SD = standard deviation.

Table 4: One-way MANOVA test comparison of mean pain, depression and anxiety scores of participants' treatment outcomes by treatment groups, at 4 weeks of the study.

Group	Mean ± SD		
	VAS	Depression	Anxiety
NSEG	4.64 ± 2.07 ($n = 30$)	12.1 ± 5.54 ($n = 27$)	17.35 ± 5.95 ($n = 28$)
NSDEG	5.83 ± 1.40 ($n = 29$)	12.62 ± 5.24 ($n = 25$)	13.12 ± 5.72 ($n = 24$)
NDEG	5.76 ± 1.39 ($n = 25$)	12.34 ± 5.20 ($n = 25$)	13.24 ± 5.37 ($n = 25$)
F	6.34	0.063	4.78
p-Value	0.018	0.93	0.011

α Level was set at 0.05.
NSEG = neck stabilisation exercises group; NSDEG = neck stabilisation plus dynamic exercises group; NDEG = neck dynamic exercises group; n = number of participants in the group.

Table 5: One-way MANOVA test comparison of mean pain, depression and anxiety scores of participants' treatment outcomes by treatment groups at 8 weeks of the study.

Group	Mean ± SD		
	VAS	Depression	Anxiety
NSEG	2.60 ± 1.28 ($n = 28$)	10.14 ± 4.33 ($n = 27$)	13.67 ± 5.15 ($n = 28$)
NSDEG	4.62 ± 1.20 ($n = 24$)	11.41 ± 4.05 ($n = 24$)	13.54 ± 6.17 ($n = 24$)
NDEG	4.12 ± 0.89 ($n = 24$)	13.04 ± 3.61 ($n = 24$)	18.17 ± 6.18 ($n = 24$)
F	21.942	3.34	1.042
p-Value	0.001	0.041	0.358

α Level was set at 0.05.
NSEG = neck stabilisation exercises group; NSDEG = neck stabilisation plus dynamic exercises group; NDEG = neck dynamic exercises group; n = number of participants in the group; SD = standard deviation.

At the week 4 of the study, with the aid of MANOVA, the study revealed that there was a significant difference in the pain intensity and anxiety scores across the three groups, with $p = 0.018$ and $p = 0.011$, respectively, however, there were no significant difference in depression scores, at $p = 0.93$. A *post hoc* test with Bonferroni adjustment was performed for the dependent variables that were significant and it revealed that there were no significant differences between the three groups, with an effect size of 0.10, 0.00 and 0.12, respectively, as shown in Table 4.

Table 6: *Post hoc* test with Bonferroni adjustment $p = 0.017$ level of significance.

Variable	Comparison	*p*-Value
Pain intensity		
NSEG	NSDEG	0.001[a]
	NDEG	0.001[a]
NSDEG	NSEG	0.001[a]
	NDEG	0.411
NDEG	NSEG	0.001[a]
	NSDEG	0.411
Depression		
NSEG	NSDEG	0.779
	NDEG	0.035
NSDEG	NSEG	0.779
	NDEG	0.500
NDEG	NSEG	0.035
	NSDEG	0.500

[a]Significant at $p = 0.017$.
NSEG = neck stabilisation exercises group; NSDEG = neck stabilisation plus dynamic exercises group; NDEG = neck dynamic exercises group.

At week 8 of the study, the pain intensity and depression and anxiety scores were compared with MANOVA. The study demonstrated significant differences in the pain intensity scores between the three groups – at $p = 0.001$, and depression scores at $p = 0.041$ – while there were no significant differences in the anxiety scores between the three groups, at $p = 0.358$, as shown in Table 5. The *post hoc* test with Bonferroni adjustment demonstrated that only pain intensity was significant among the three groups and lay in the NSEG, as shown in Table 6, with an effect size of 0.37, 0.08 and 0.02, respectively.

4 Discussion

4.1 Limitation

This study compared the effects of stabilisation and dynamic exercises on pain intensity, anxiety and depression in patients with NsNP. One limitation of this study is that the long-term effects of stabilisation and dynamic exercises cannot be obtained, because the research only assesses effects for up to 8 weeks, therefore, its results should be interpreted with caution. Furthermore, it has no general applicability, as it can only be applied to the NsNP patients' population. Another limitation of the research includes the inability to blind the research assistant who delivered the intervention because, in standard RCT, both participants and those who deliver interventions are blinded, but in physiotherapy there are obstacles associated with this. Self-reported outcomes, such as VAS and Beck Depression and Anxiety scales, are also limited, as they can be influenced by placebo effects and outcome expectation. Moreover, some participants might have been taking other analgesics, which might have influenced the intervention and this would have lay beyond the control of the researcher.

4.2 Effect of stabilisation exercise, dynamic exercise, stabilisation plus dynamic exercise on pain, depression and anxiety

The age of the participants ranged from 22 to 67 years, a range consistent with those of patients affected by neck pain in most epidemiological studies [21, 22]. The results obtained in this study demonstrated that there were no significant differences in the physical characteristics of participants at the baseline, including age, pain intensity, depression and anxiety. This implied that the three groups were comparable at the point of commencement of the programme. It can therefore be concluded that the results obtained at different time points during the course of the study could have been largely due to the effect of the various treatment interventions.

Stabilisation exercises significantly reduced pain intensity, depression and anxiety in patients with NsNP. This finding was consistent with the results of previous studies on the effect of neck stabilisation exercises on NsNP [23–27]. Dynamic exercises in this study significantly reduced pain in patients with NsNP. The effect of dynamic exercises was comparable with the previous studies that used dynamic exercises in the management of NsNP [19, 28].

Neck pain not only interferes with sleep daytime functional activities, but also affects the neurotransmitters in a person's brain that are responsible for sensory input processing and memory storage, thus changing the manner in which pain is perceived and dealt with. As a consequence, these patients often become depressed and/or anxious, in addition to the fact that the chronic symptoms of neck pain can lead patients to avoid social settings, favourite physical activity and even work or sex. Ironically, because these patients had chronic pain, they might have been taking pain medication, which itself could contribute to depression. In addition, some of the pain drugs could cause nausea, which in turn caused appetite and weight loss [29]. Furthermore, changes in pain, anxiety and depression of patients after treatment might be due to dynamic exercises that led to general body relaxation, thus an increase in plasma β-endorphins [30]. Furthermore, strengthening and stabilisation exercises have some effect in reducing stress hormones and muscle tension, and will thus decrease anxiety levels [23]. Therefore, stabilisation and dynamic exercises might have more positive effects in reducing psychosocial symptoms such as depression and anxiety.

4.3 Comparison of the effectiveness of neck stabilisation exercises, dynamic exercises and stabilisation, plus dynamic exercises

Neck stabilisation exercises led to a higher, more significant improvement in pain only at the week-8 point, however, there were no differences between the three groups. This is inconsistence with the finding of Celenay et al. [23] and Yildiz et al. [2] whose reported that stabilisation exercise or stabilisation with a combination of another

intervention is effective in reducing pain depression and anxiety in patients with neck pain. Looking at the effect size of the present study, though, we can conclude that the difference was small, based on the Cohen [11] classification of effect size. So, we can say that the difference was negligible and, in a real sense, both exercises were effective in reducing the pain among patients with NsNP. Also, concerning depression at week 8 of the study, a significant difference was noted, but when controlled for type 1 error using Bonferroni adjustment, it was discovered that there were no significant differences among them. From the results, the neck stabilisation exercises group showed the greatest pain reduction and depression reduction, followed by the neck stabilisation plus dynamic exercises group and then the neck dynamic exercises group.

Concerning all of the variables, at weeks 4 and 8 of the study, no significant differences were discovered between the neck stabilisation plus dynamic exercises group and the dynamic exercises group. This may not be unconnected with the time required for dynamic strength training to strengthen the muscles. The results demonstrate the advantage of stabilisation exercises alone over a combination of stabilisation and dynamic exercises, particularly with regard to pain stabilisation exercises, which showed improvements in pain intensity scores both at weeks 4 and 8 of the study, with the latter showing the greatest improvement. However, the differences observed were not significant at week 4, after the Bonferroni adjustment and had a very small effect size. There were no significant differences between the groups after adjusting the significant level from the 0.05 to 0.17 to control for type 1 error in depression scores. Moreover, the effect size at weeks 4 and 8 revealed that the differences were small in terms of pain, depression and anxiety, so this demonstrated that, generally, exercises had the potential effect of improving depression and anxiety. This finding is inconsistence with the finding of the previous studies by Andias et al. [5] exercises has potentials to improves psychological and mental wellbeing in patients with neck pain. Dusunceli et al. [26], in a study on the efficacy of neck stabilisation exercises for neck pain, compared three treatment protocols: physical therapy agent, physical therapy agent plus isometric and stretching exercises, and physical therapy plus stabilisation exercises. Dusunceli et al. [26] concluded that the stabilisation protocol and physical therapy agent for chronic neck pain patients were equally effective in reducing pain and depression. Another study by Chiu et al. [31] examined the efficacy of exercise for patients with chronic neck pain. The intervention included the activation of the deep neck muscles and the dynamic strengthening of the neck muscles, plus infrared irradiation. Chiu et al. [31] concluded that a combined treatment of neck stabilisation exercises, plus physical therapy was a more effective intervention for the management of neck pain, with some advantages in outcomes for pain and disability over the combination of isometric exercises, plus the physical therapy agent or physical therapy agent alone.

The observed effects of the neck stabilisation group, neck stabilisation plus dynamic group and the neck dynamic exercises group in this study could be as a result of the fact that the intervention for each group contained active exercises, with some carried out in extension positions. Many studies have shown that exercises and postures in extension improve and resolve symptoms in patients with NsNP [32]. Previous studies reported that stabilisation with other interventions are equally effective in alleviating clinical symptoms and psychosocial variables associated with neck pain [7, 33]. Although the present study demonstrated that a single specific exercise intervention, in this case stabilisation alone, was effective in reducing pain and depression in patients with NsNP, it also proved that a multimodal approach could also take care of these variables in patients with NsNP. The present study also highlighted that engaging in a specific activity, such as stabilisation exercises, produced better results than a combination of two exercises in reducing pain, depression and anxiety, although both the combination of stabilisation and dynamic exercises and dynamic exercises alone were effective in the management of NsNP. Stabilisation exercises alone had a more positive effect than stabilisation plus dynamic and dynamic exercise. This may have been as a result of strength training with load – in both stabilisation and dynamic, and dynamic alone – perhaps cancelling out the effect of stabilisation in the combination group. As a result, the strength training with load may take more time to show positive effects than stabilisation alone and this is why, in the present study, stabilisation was shown to be the superior of group. The combination of both the stabilisation and dynamic exercises may have led to fatigue in the initial exercises and this may have aggravated the pain in the first instance, before the participants adapted to the programme. This may explain why stabilisation alone may have led to an improvement, rather than a combination of both the stabilisation and dynamic exercises. Moreover, stabilisation exercise alone may be related to activating the deep muscles and strengthening the whole deep and superficial muscles of the neck.

Strength training with weights may be effective in the long term, but this result should be interpreted with caution because the effect size for differences in pain was

small. Therefore, the differences may not much. Further studies need to be carried out, to establish the real differences especially in the long-term effects. The research further revealed that stabilisation exercises, stabilisation plus dynamic exercises and dynamic exercises were methods that reduced NsNP in patients with depression and anxiety. Few studies have investigated the effectiveness of exercise on NsNP in the management of patients with depression and anxiety. However, they reported an improvement in this study [23, 34].

5 Conclusion

The present study concluded that stabilisation, dynamic and stabilisation and dynamic exercises were all effective in relieving pain and reducing depression and anxiety in patients with NsNP. However, stabilisation demonstrated a more superior result than stabilisation plus dynamic and dynamic in reducing pain intensity in patients with NsNP.

6 Implications

Neck stabilisation exercises are recommended for the management of patients with NsNP. Physiotherapists and clinicians should recommend such exercises in the management of NsNP, but they reveal no superiority in terms of depression and anxiety.

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