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The effects of neck, core, and combined stabilization practices on pain, disability, and improvement of the neck range of motion in elderly with chronic non-specific neck pain

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Abstract.
BACKGROUND: Chronic non-specific neck pain is the most prevalent neck pain with notable impacts on the quality of life in the elderly.
OBJECTIVE: The impacts of the neck, core, and combined stabilization practices on pain, disability, and improvement of the neck range of motion in the elderly with chronic non-specific neck pain were examined.
METHOD: A quasi-experimental (open label) study was carried out through a cluster sampling in two phases in Tehran-Iran in 2017. Totally, 102 patients were randomly allocated to three groups of specific neck stabilization, specific core stabilization,

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and combined practices through envelope method. The intervention took 12 weeks. To measure the severity of pain and neck disability, the visual analog scale (VAS), neck disability index (NDI), and neck pain and disability scale (NPDS) was used. A goniometer was used to measure the range of the motion. To examine data, used SPSS (v.20).

RESULT: The results, confirmed a significant decrease in pain over the time in the three therapeutic groups ($p = 0.000$). In addition, there was a significant difference between neck, core, and combined stabilization groups. Moreover, there was a significant increase in the angle of motion in all treatment groups with different treatment duration ($P = 0.000$). The highest increase in the angle of motion was after 12 weeks of practice in right lateral flexion (RLF) ($p = 0.000$).

CONCLUSION: Twelve sessions of the neck, core, and combined stabilization practices can alleviate the pain and improve the strength in the elderly with chronic non-specific neck pain. In addition, compared to two other methods, the combined method was a more efficient way to improve the range of motion in patients.

Keywords: Neck stabilization practices, core stabilization practices, combined practices, chronic nonspecific neck pain

1. Introduction

Musculoskeletal disorders (MSDs) refer to any damages to nervous and musculoskeletal systems, and MSDs lead to disorders in the function of limbs [1–3]. Neck and upper limb musculoskeletal problems are highly prevalent [4] so that about 67% of individuals experience at least one period of neck pain in their lives [5–8]. It is believed that the source of the neck pain is multifactor while in most cases, the pathophysiological mechanism of neck pain is not recognized [9]. Continuous neck pain for more than three months is considered chronic pain. Moreover, 14% of neck pain cases are considered chronic pain, and 5% of it causes disability [10, 11]. Like back pain, neck pain has the potential of becoming a chronic problem, which mostly results in long-term disability. Moreover, the costs of healthcare for such a long-term disability create a considerable economic load and a serious challenge to healthcare systems [12]. So, patients with chronic neck pain tend to use health-therapeutic services twice as many as other people, which negatively affects the economy [8]. Several studies have shown that neck pain degrades the quality of life and job satisfaction levels [13, 14]. Different factors cause neck pain, and unhealthy habits and improper body position at work are notable among them. For instance, if the head bends forward when sitting behind a table to study, working with computers, or working, it creates an extra load on the neck anti-gravity muscles, which can be a starting point for chronic neck pain [15, 16]. The complication limits the natural range of the motion and decreases the performance of different body systems and musculoskeletal systems in particular. Due to the decreased activity, the joints' range of motion decreases, and the individual has to gradually deal with less flexibility, muscle weakness, decreased muscle strength, and endurance. This situation paves the way for different types of pains in different parts of the body, and neck in particular [14]. Senior citizens are among the vulnerable groups in society and need more healthcare services [17]. On the other hand, the elderly population is growing in the world. While only13% of the world population in 2000 were older than 65 years old, in 2040, 20% of the world population will be older than 65% [18]. Neck pain is more prevalent in middle-aged adults, which leads to severe disability in 5% of the individuals afflicted with the problem. The outbreak of the complication is worryingly growing along with the development of societies [19, 20] so that the outbreak is between 30–50% among the adult population [21]. The problem is more common in women compared to men [21]. The main cause of chronic neck pain in the elderly is the gradual corrosion of the intervertebral disk and joint, which mostly causes disorder in the nerve or spinal cord. In addition, the limits the range of the neck motion and rotatory motion[23–25]. There are various treatments for chronic neck disorders such as traditional pain alleviation methods, group exercising, manual treatments, specific neck strengthening practices, and making ergonomic changes in the work environment [26, 27]. Kay et al. concluded that activity is more efficient than resting, using a therapeutic belt, and education [28]. Evidence-based therapeutic practices for chronic non-specific neck pain are rare. A variety of therapeutic interventions such as specific neck practices, shoulder practices, active practices, stretch, strengthening the positional performance, and deep sensory practices are recommendable. Nowadays, therapeutic practice is one of the efficient ways for neck pain, still, treating the problem remains a major challenge [29]. The body trunk represents the core of the body and core stability, as the motion and capacity control of the core area muscle, is to keep the stability of this section in different situations and against external forces. Central stability practices add to the strength of muscles and improve balance and position control. In addition, the body core contains the gravity center and the body movements start from the core [30]. Neck stabilizing practice is a method to improve the internal mechanism of the vertebral column, which increases the stability and strength of the cervical vertebral [31]. Ielbeighi et al. showed that core stabilization practices can attenuate the side effects of back pain, and they are recommendable for individuals with back pain [32]. Safdari et al. reported that stabilization practices were efficient for rehabilitation in patients with back pain and improved the patients' performance power [33]. According to Akbari et al., neck stabilization practices alleviate the pain severity and disability and improve surface and deep cervical muscle power in patients with chronic neck pain [34]. The present study was an attempt to examine the impacts of 12 weeks of neck, core, and combined stabilization practices and neck angle of motion on pain and disability of the elderly with chronic non-specific neck pain living in Tehran, Iran.

1.1. Methodology

The study was carried out through the intervention without control in a pre-test/post-test (open-label clinical trial) method in Tehran, Iran in 2017. The study population constituted the elderly with chronic non-specific neck pain in Tehran-based elderly care centers. The participants were selected through cluster sampling in two phases. Tehran City was first clustered into 22 municipal districts, and then each cluster was divided into two clusters. One cluster was selected randomly from each district and then, one elderly care center was selected in each cluster. Afterward, four male and female senior citizens were selected from the centers based on a set of inclusion criteria. By assuming that 20% will leave throughout the study, 106 subjects were selected. Among the participants, one did not meet the inclusion criteria and three left the study. Finally, the study was conducted on 102 participants. At first, demographical indices were measured and recorded, and then, the severity of pain and neck disability was measured using VAS, NDI, and NPDS. Using a special goniometer (HPSCI), angle and range of motion of the neck (Table 1) were measured.

Table 1
Abbreviations of variables

Variables Full phrase	Abbreviations
Right Lateral Flexion	RLF
Left Lateral Flexion	LLF
Right Rotation	RR
Left Rotation	LR
Neck Disability Index	NDI
Visual Analogue Scale	VAS
Neck Pain and Disability Scale	NPDS

1.2. Study population

The inclusion criteria included; age between 65 and 80 years, neck pain without diagnosing cause by treating physician that lasts for 3 months or more (nonspecific neck pain). It also has a minimum score of 3 on the VAS scale. The exclusion criteria were a history of neck surgery, regular exercising, the history of a specific disease except for neck pain, psychological diseases, cardiovascular diseases, neurological diseases, failure to complete the treatment course, using other treatment methods and intensification of pain and disability despite physical practices.

1.3. Questionnaires

A demographic questionnaire was used to record the data of the participants, including height, weight, and body mass index (BMI).Visual analog scale (VAS) is a tape with 100 mm length was marked from 0 (no pain) to 10 (most severe pain). The scale is widely used in similar studies, of which reliability and validity are supported with internal consistency (ICC) equal to 91% [12].

The neck disability index (NDI) was used to measure the neck disability in the patients. The questionnaire contains 10 subscales that measure the respondent's ability to do the tasks like studying, concentrating, driving, personal care, lifting things, headache, working, sleeping, and playing. The items are scored from 0 (no problem) to 6 (maximum disability). The validity of the questionnaire has been supported by other studies and the reliability is equal to 0.864 based on Cronbach's alpha. The value of ICC for the questionnaire based on the test/retest method is equal to 0.93 [19, 20].

Neck pain and disability index (NPDI) was used to measure the disability after the pain. The tool contains 20 items that measure the pain in different positions (viz. standing, sleeping, walking, driving, participating in a social activity, doing leisure activity,

Table 2
Demographics of the participants

		Treatment group (n)		
		Neck stabilization (33)	Core stabilization (33)	Combined (36)
Gender (n)	F (34)	6(18.2%)	12 (36.4%)	16 (44.4%)
	M (68)	27 (81.8%)	21 (63.6%)	20 (55.6%)
Education (n)	No high school diploma (2)	13 (39.4%)	11 (33.3%)	8 (22.2%)
	High school diploma (37)	8 (24.2%)	11 (33.3%)	18 (50.0%)
	College degree (33)	12 (36.4%)	11 (33.3%)	10 (27.8%)
Age (years) (Mean±SD)		72.06 ± 5.91	72.36 ± 5.30	69.39 ± 5.20
BMI (kg/m^2) (Mean±SD)		30.98 ± 7.85	30.49 ± 8.05	31.95 ± 8.89

working, and doing self-care activities). In addition, the impact of pain on one's attitudes about life and future (depression and hopelessness), emotions, concentration, and thinking are measured. The questionnaire also measures neck stiffness, head and neck rotation limitation, problems to look up and down, and problems in raising one's head. The items are scored from 0 (no problem) to 10 (maximum problem). The validity of the tool is supported by other studies and the reliability was obtained equal to 91% [8, 21].

1.4. Practices

To examine the impacts of the three practices on the severity of pain, the patients were randomly allocated to three groups. To randomize the allocation of patients, the envelope method was used. Group one received neck stabilization-specific practices, group two received core stabilization-specific practices, and group three received combined practices (neck and core stabilization practices). The practices were performed under the supervision of a physiotherapist expert every other day for 12 weeks. The sessions were 25–30 minutes long and the practices were designed to improve core stabilizing muscles of the vertebrate column and neck stabilization based on reliable references [34–37]. Pain severity was measured before doing the practices, at the end of the eighth week, and one week after the completion of the practice.

1.5. Ethical concerns

After selecting the participants based on inclusion criteria, they were briefed about the intervention and assured that the intervention not cause any physical or mental problem for them. In addition, they were reminded that they can leave the study at any step and their personal and medical information will remain confidential. Afterward, those interested in the study signed a written letter of consent. It is notable that it was not possible to take a photo from the elderly care centers due to the regulations.

The study was approved by the Ethics Committee [IR.USWR.REC.1396.156], the University of Rehabilitation and Welfare Sciences, and registered with the clinical trial center [IRCT20180412039280N2].

1.6. Data analysis

The collected data were analyzed in SPSS (v.21) using the ANOVA test.

2. Results

Totally, 102 participants from 22 municipal districts of Tehran City took part in the study. There were 34 women (33.3%) and 68 men (66.7%) among the participants. In terms of education level, 32 (31.4%) did not have a high school diploma, 37 (36.3%) had a high school diploma, and 33 (32.4%) had a college degree. The mean age of the participants was 71.22 ± 5.59 years, and the mean BMI was 31.16 ± 8.24 kg/m^2. Table 2 lists the demographics of the participants. The findings (Table 3) showed that the most efficient practice of RLF was the combined practice. The mean angle of motion in this group increased from 32.8 ± 0.22 to 37.39 ± 0.85 ($P = 0.000$). There was also a significant increase in flexion motion in this group from 39.73 ± 0.23 to 43.68 ± 0.90 ($P = 0.000$). Moreover, the extension motion increased significantly in this group ($P = 0.000$). Also, A similar increasing trend was observed in core and neck stabilization groups in terms of angle of motion.Assessment results based on the three methods of measuring pain (Table 4) showed that core stabilization practices decreased the pain in the subjects significantly ($P = 0.000$). Pain level based on VAS decreased from 6.01 ± 0.47 to 4.45 ± 0.51 in 12 weeks. In addition, the level of pain,

Table 3
Comparison of angle of motion level after practices in the three groups

	Neck			*P*-value	Core			*P*-value	Combined			*P*-value
	Before intervention	After 8th week	After 12th week		Before intervention	After 8th week	After 12th week		Before intervention	After 8th week	After 12th week	
Flexion	39.40 ± 1.25	40.20 ± 1.10	41.43 ± 1.21	0.000**	39.67 ± 0.19	40.62 ± 0.34	42.38 ± 0.69	0.000**	39.73 ± 0.23	41.18 ± 0.64	43.68 ± 0.90	0.000**
Extension	35.51 ± 0.21	36.28 ± 0.23	37.61 ± 0.56	0.000**	35.61 ± 0.16	36.48 ± 0.32	37.96 ± 0.59	0.000**	35.74 ± 0.25	36.57 ± 0.29	38.78 ± 0.86	0.000**
RLF[1]	31.71 ± 5.69	32.94 ± 5.94	35.12 ± 6.35	0.000**	32.70 ± 0.19	34.05 ± 0.50	36.34 ± 0.96	0.000**	32.80 ± 0.22	34.34 ± 0.62	37.39 ± 0.85	0.000**
LLF[2]	32.89 ± 0.15	34.23 ± 0.58	35.72 ± 0.31	0.000**	32.85 ± 0.19	34.33 ± 0.69	36.02 ± 0.43	0.000**	32.96 ± 0.19	34.59 ± 0.93	36.85 ± 0.24	0.000**
RR[3]	42.76 ± 0.09	43.59 ± 0.40	45.29 ± 0.47	0.000**	42.81 ± 0.11	43.70 ± 0.51	45.66 ± 0.67	0.000**	42.87 ± 0.14	44.28 ± 0.81	46.99 ± 0.70	0.000**
LR[4]	45.86 ± 0.14	46.52 ± 0.21	48.00 ± 0.73	0.000**	45.96 ± 0.17	46.67 ± 0.26	48.04 ± 0.62	0.000**	45.99 ± 0.24	46.92 ± 0.27	48.47 ± 0.66	0.000**

* Repeated measures ANOVA. ** $P < 0.01$. 1. Right Lateral Flexion. 2. Left Lateral Flexion. 3. Right Rotation. 4. Left Rotation.

Table 4
Comparison of the severity of pain level after practices in the three groups

Intervention group (n)	Measurement	VAS (Mean ± SD)	*P*-value†	NDI (Mean ± SD)	*P*-value†	NPDS (Mean ± SD)	*P*-value†
Neck stabilization (33)	Before intervention	6.01 ± 0.47	0.000**	50.0 ± 2.78	0.000**	56.59 ± 1.94	0.000**
	After 8th week	5.11 ± 0.87		44.97 ± 3.19		53.77 ± 0.85	
	After 12th week	4.45 ± 0.51		39.45 ± 2.62		49.53 ± 1.74	
Core stabilization (33)	Before intervention	6.09 ± 0.48	0.000**	49.48 ± 2.5	0.000**	57.17 ± 2.2	0.000**
	After 8th week	5.11 ± 0.87		44.48 ± 3.79		53.17 ± 0.89	
	After 12th week	4.42 ± 0.61		40.33 ± 2.46		48.44 ± 1.17	
Combined (36)	Before intervention	6.01 ± 0.47	0.000**	49.58 ± 2.31	0.000**	56.82 ± 2.11	0.000**
	After 8th week	5.11 ± 0.87		44.97 ± 2.58		53.49 ± 0.82	
	After 12th week	4.45 ± 0.51		37.3 ± 2.43		46.75 ± 1.75	

*Repeated measures ANOVA. ** $P < 0.01$. ** $P < 0.01$.

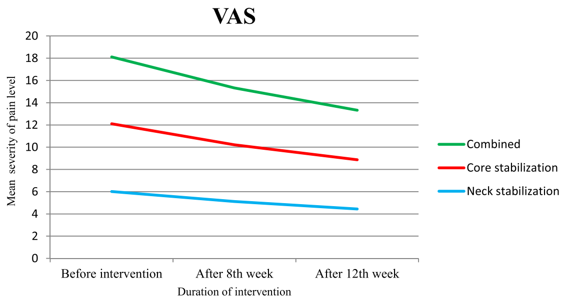

Fig. 1. Changes in the range of VAS during the three times of the test.

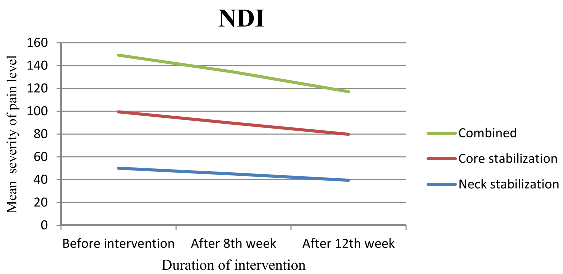

Fig. 2. Changes in the range of NDI during the three times of the test.

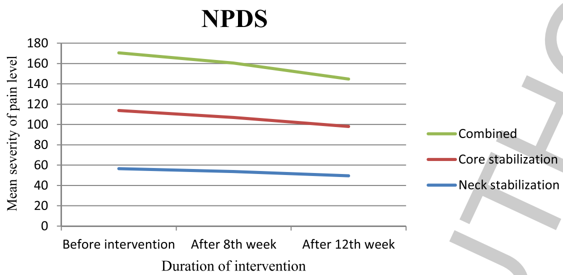

Fig. 3. Changes in the range of NPDS during the three times of the test.

according to NDI and NPDS decreased by 10.5 and 7 units, respectively, which are statistically significant ($P = 0.000$). The results showed that core stabilization practices decreased the pain level based on VAS, NDI, and NPDS by 1.7, 9.1, and 8.7 units, respectively ($P = 0.000$) (Table 4 and Fig. 1–3). In addition, the decrease in pain level in the combined practice group based on VAS, NDI, and NPDS were about 1.6, 12.3, and 10 units, respectively ($p = 0.000$).

As listed in Table 5, by adding variability of intervention group as a therapeutic intervention and domicile and demographics (gender, education, age, and BMI), the mean score of pain demonstrates a significant trend based on VAS with an error level of 5%. In other words, the difference between the pain before the practice and eight and twelve weeks afterward is significant when the background and group variables are taken into account ($F = 233.83$, $P = 0.000$). It is notable that the intervention group had a significant impact on the alleviation of pain ($F = 3.28$, $P = 0.04$); while there was no significant difference in terms of pain alleviation in terms of background and group of intervention.

Based on NDI, the mean decrease in disability had a significant trend over time so that there was a significant difference between a score of disability before and eight and twelve weeks after the intervention when background variables and a group of interventions is taken into account ($F = 345.34$, $P = 0.000$). In addition, the difference between the groups in terms of decrease in disability was significant ($F = 3.99$, $P = 0.000$). Moreover, gender ($F = 6.11$, $P = 0.015$) had a significant impact on disability; while there was no significant difference in the decrease of disability in terms of other variables (Table 5).

NDI, VAS, and NPDA indicated that the mean pain decreased over time ($F = 741.46$, $P = 0.000$). Moreover, the treatment group ($F = 10.22$, $P = 0.000$), age ($F = 4.65$, $P = 0.034$), and BMI had significant impact on alleviation of pain ($F = 5.25$, $P = 0.024$).

By adding an intervention group, domicile, and demographics (gender, education, age, and BMI) variables to compare the angle of motion of the participants (Table 6), the impact of time and group of intervention on increasing all motions was significant. In addition, age had a significant impact on increasing flexion ($F = 3.27$, $P = 0.041$) and RLF ($F = 2.59$, $P = 0.039$). Gender did not have a significant impact on increasing RLF motion ($F = 6.03$, $P = 0.003$).

3. Discussion

The impact of 12 weeks neck, core, and combined stabilization practices on pain and disability in senior citizens with chronic non-specific neck pain and improvement of neck range of motion were examined. The three types of exercises had a significant impact on the alleviation of chronic non-specific neck pain. The mean score of pain decreased in the three groups of intervention. The purpose of the stabilization practices is to improve the muscle support and control of vertebral column joints and eventually to alleviate and prevent the intensification or chronification of pain [38]. Bolandian, Taheri, and

Table 5
Comparison of the severity of pain after practices in the three groups taking into account the impact of time and the background variables

Index	Effect of variable	Sum of square	Df	F-value	*P*-value
VAS	Time	153.74	1.8	233.83**	0.000
	Intervention group	1.48	2	3.28*	0.04
	Domicile	0.18	1	0.43	0.514
	Gender	0.01	1	0.025	0.87
	Education level	0.856	2	1.01	0.367
	Age	0.057	1	0.134	0.715
	BMI	0.415	1	1.84	0.178
NDI	Time	5861.1	1.76	345.34**	0.000
	Intervention group	48.71	2	3.99*	0.022
	Domicile	0.036	1	0.006	0.939
	Gender	37.3	1	6.11*	0.015
	Education level	7.35	2	0.602	0.55
	Age	3.25	1	0.533	0.467
	BMI	5.58	1	0.915	0.341
NPDS	Time	3886.54	1.58	741.46**	0.000
	Intervention group	46.95	2	10.22**	0.000
	Domicile	0.032	2	0.014	0.906
	Gender	0.856	1	0.373	0.543
	Education level	3.13	2	0.68	0.509
	Age	10.68	1	4.65*	0.034
	BMI	12.07	1	5.25*	0.024

*Repeated measures ANOVA. **$P < 0.01$.

Arami [39–41] showed that doing exercise alleviated chronic non-specific neck pain, which is consistent with our results. Letafat Kar et al. studied senior citizens with chronic pain and showed that three months of stretching and strengthening practices decreased the pain score [42]. A controlled and randomized clinical trial by Asgari Ashtiani et al. showed that stabilization practice in 50 patients with chronic non-specific neck pain decreased the pain, disability, and avoidant attitudes due to pain [38]. Several studies [43–50] have shown that the core stabilization practices decrease the pain in patients with chronic back pain. Rastegar argued that at least five weeks of core stabilization practices decreased chronic back pain in elderly women significantly [49]. Sartipzadeh showed that core stabilization practices decrease the pain in the elderly [51]. The results of the present study indicated that the core stabilization practices, significantly decreased the pain scores. The efficiency of stabilization practices in decreasing the pain in patients with chronic back pain has been indicated in different studies [52–55]. El-Bandrawy and Dusunceli showed that stabilization practices decreased the pain as measured by VAS and improved the disability in patients with neck pain [56, 57], which is consistent with our results. Kaka showed that stabilization practices decreased the pain of patients with chronic non-specific neck pain [58]. Levoska and Keinanen-Kiukaanniemi et al. showed that massage therapy and practices three times a week for more than five weeks decreased chronic pain [59].

After 12 weeks of practice, chronic neck pain decreased significantly so that the mean score of neck stabilization practices decreased significantly based on VAS, NDI, and NPDS. Consistent with the present study, Celenay [60] showed that a combination of stabilization practices and manual treatment was more efficient than stabilization practices in decreasing the disability and pain and increasing the quality of life in patients with neck pain. Shakeri [55] examined the impact of therapeutic massage, stabilization practices, and a combination of both pain and disability in patients with chronic back pain. He showed that the combination of treatments was more efficient than the two other interventions alone, which is consistent with the present study. The results showed that the mean score of the neck and core stabilization practices was higher than the neck stabilization and core stabilization practices alone. Dusunceli et al. assessed the impacts of neck stabilization practices compared to isometric and stretching practices and found that the neck stretch practices were more efficient in decreasing the disability in patients [61].

The results also indicated that the highest improvement was in the combined group and with RLF so that the mean angle of motion increased from 32.8 ± 0.22 to 37.39 ± 0.85; in addition, flexion motion in the combined practice group increased significantly from

Table 6
Comparison of the angle of motion after practices in the three groups taking into account the impact of time and the background variables

Index	Effect of variable	Sum of square	Df	F-value	*P*-value
Flexion	Time	223.81	2	781.73**	0.000
	Intervention group	8.47	4	29.57**	0.000
	Domicile	0.34	42	1.2	0.214
	Gender	0.07	2	0.232	0.794
	Education level	0.262	4	0.915	0.457
	Age	0.937	2	3.274*	0.041
	BMI	0.038	2	0.133	0.876
Extension	Time	166.92	2	748.99**	0.000
	Intervention group	2.65	4	11.88**	0.000
	Domicile	0.191	42	0.859	0.712
	Gender	0.355	2	1.593	0.207
	Education level	0.068	4	0.305	0.874
	Age	0.05	2	0.222	0.801
	BMI	0.305	2	1.370	0.257
RLF	Time	398.95	2	992.69**	0.000
	Intervention group	3.69	4	9.20**	0.000
	Domicile	0.266	42	0.661	0.940
	Gender	2.42	2	6.034**	0.003
	Education level	0.591	4	1.47	0.233
	Age	1.04	2	2.597*	0.039
	BMI	0.490	2	1.22	0.299
LLF	Time	282.04	2	1204.56**	0.000
	Intervention group	2.77	4	11.82**	0.000
	Domicile	0.164	42	0.702	0.908
	Gender	0.391	2	1.67	0.192
	Education level	0.118	4	0.502	0.734
	Age	0.168	2	0.720	0.489
	BMI	0.166	2	0.708	0.494
RR	Time	270.16	2	1009.82**	0.000
	Intervention group	6.29	4	23.53**	0.000
	Domicile	0.26	42	0.973	0.525
	Gender	0.099	2	0.369	0.692
	Education level	0.085	4	0.319	0.865
	Age	0.223	2	0.834	0.436
	BMI	0.232	2	0.869	0.422
LR	Time	131.33	2	709.67**	0.000
	Intervention group	0.424	4	8.29**	0.000
	Domicile	0.202	42	1.09	0.341
	Gender	0.159	2	0.859	0.426
	Education level	0.008	4	0.041	0.997
	Age	0.117	2	0.631	0.533
	BMI	0.306	2	1.65	0.195

*Repeated measures ANOVA. **$P < 0.05$.

39.73 ± 0.23 to 43.68 ± 0.90. The extension motion also had a significant increase in this group. The increasing trend was also visible in the two other groups in terms of angle of motion.

Ghodrati et al. used a combination of practices and treatments (soft tissue release, muscle energy technique, and doing exercises) on patients with non-specific neck pain and showed that the practices decreased the pain and disability and increased the range of motion in all directions [62]. Elfering et al. used neck stabilization practices along with manual treatment and found them more efficient than stabilization practices in decreasing the disability and pain severity and in improving the rotational motion range of the neck [63]. Main et al. used stretching practices of the neck and reported a significant increase in the neck range of motion [64]. Lau et al. reported that there was a positive relationship between the angle of thoracic vertebrae and pain and its severity. In addition, they showed that there was a negative relationship between the neck angle of motion (craniovertebral angle) and pain [65]. Some studies have shown that a combination of multi-facet treatments including special practices, exercising, relaxed, and supportive behaviors were more efficient than practices at home [66].

Therefore, in addition to alleviating pain and decreasing the disability caused by non-specific neck pain, combined practices were efficient in improving the neck motion range in different angles and directions.

4. Limitations

The absence of comprehensive studies on the impacts of stabilization, core stabilization, and a combination of them in the elderly with chronic non-specific neck pain and the lack of a control group in this study are among the limitations. In addition, the authors were not allowed to take photos and videos of the elderly care centers due to ethical considerations. Another limitation of our study was the lack of a suitable control group. Therefore, this study was performed on individuals before and after the intervention.

5. Recommendations

Neck and core stabilization practices and a combination of them under the supervision of experts can be used to alleviate the pain and strengthen the cervical muscles in senior citizens with chronic non-specific neck pain. There is a need for periodical examination of neck pain disorders to diagnosis the disorders and treat the side effects.

6. Conclusion

Neck and core stabilization, and combined practices, helped the senior citizens with chronic non-specific pain. In addition, these interventions improved the range of the neck motion. The results also showed that the highest improvement was with RLF in the combined group. There was also a significant improvement in flexion and extension groups in the combined group. The angle of motion increased during the intervention in the core and neck groups as well. Moreover, flexion and extension motions in the combined group had a significant increase and angle of motion in the neck and core groups had an ascending trend.

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Conflict of interest

None to report.

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