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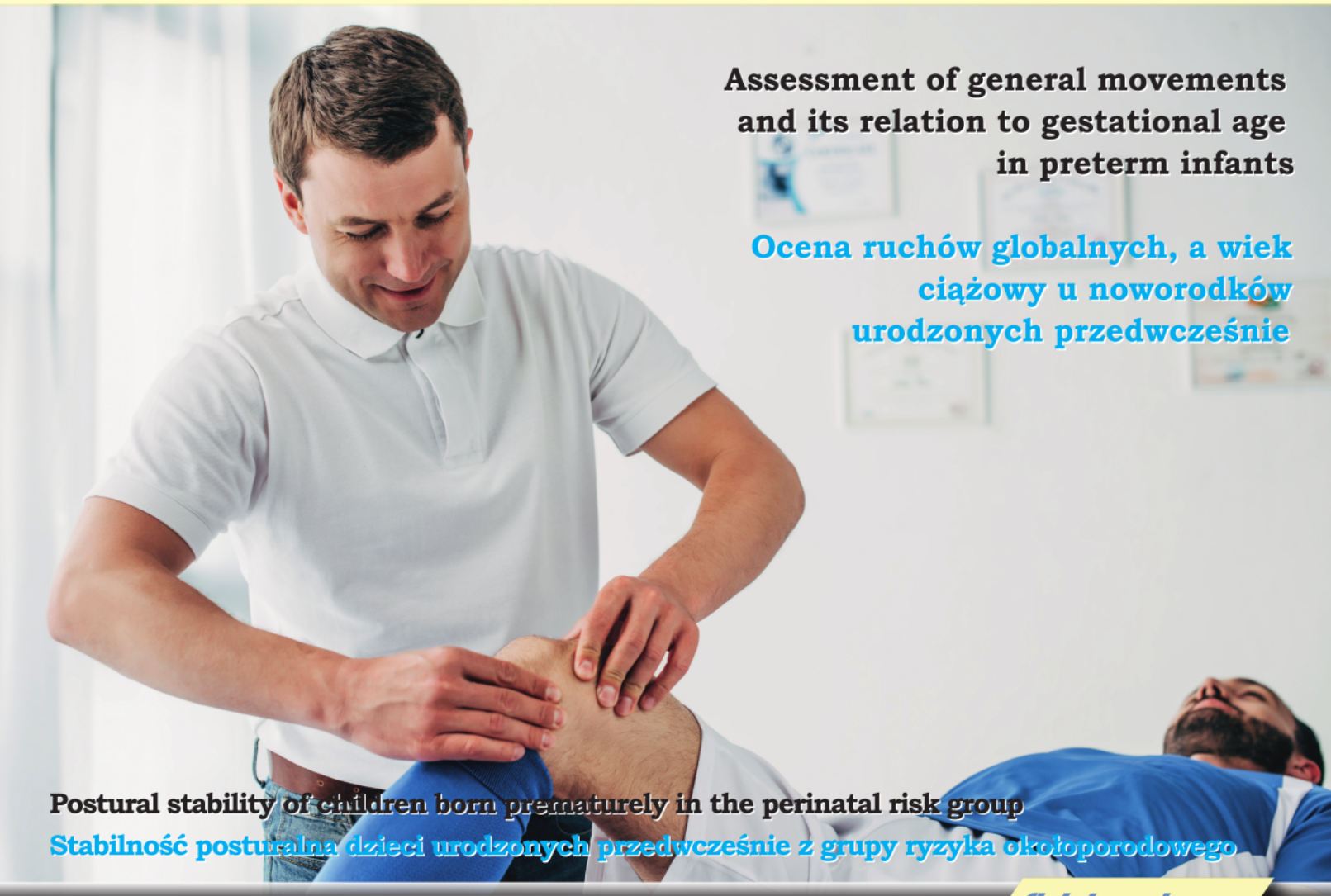

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Cervical stabilization exercises on forward head posture and cervical myofascial pain syndrome: A randomized controlled trial

Wpływ ćwiczeń stabilizujących odcinek szyjny na protrakcję głowy i zespół bólu mięśniowo-powięziowego szyjnego: randomizowane badanie kontrolowane

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Abstract

Purpose of the study. The aim of this study was to investigate the effect of cervical stabilization exercises on Forward head posture and cervical myofascial pain syndrome.
Methods. fifty participants with Cranio-vertebral angle (CVA) less than 50° and cervical myofascial pain syndrome (age from 20-35 years), from both genders were included in this study and randomly assigned into two groups: control group A received postural correction exercises while study group B received cervical stabilization exercise and postural correction exercise, three sessions per week for four weeks. Cranio-vertebral angle (CVA), pressure pain threshold (PPT) of the upper fibers of trapezius both sides were measured pre-treatment and post treatment.
Results. within-group analysis showed that there was a significant increase of CVA and PPT right and left sides post treatment at groups A, and B as ($p < 0.05$). In-between-group analysis showed no significant change in pre values of all variables as ($P > 0.05$) while post-treatment there was a significant increase in post values of all variables in both groups, also there was significant difference of the mean values of the "post treatment" test between both groups with ($p < 0.05$) and this significant difference in favour to group B.
Conclusion. cervical stabilization exercises are considered to be an effective method for FHP correction and thus improving cervical myofascial pain syndrome.

Key words:
cervical stabilization exercises, forward head posture, myofascial pain syndrome

Streszczenie

Cel. Celem pracy było zbadanie wpływu ćwiczeń stabilizujących odcinek szyjny na protrakcję głowy i zespół bólu mięśniowo-powięziowego szyjnego.
Metody. Do badania włączono pięćdziesięciu uczestników z kątem czaszkowo-kręgowym (CVA) mniejszym niż 50° i zespołem bólowym szyjno-powięziowym (wiek 20-35 lat), obu płci i podzielono losowo na dwie grupy: grupa kontrolna A wykonywała ćwiczenia korekcyjne postawy, podczas gdy grupa badana B wykonywała ćwiczenia stabilizujące odcinek szyjny i ćwiczenia korekcji postawy, trzy sesje tygodniowo przez cztery tygodnie. Przed i po leczeniu zmierzono kąt czaszkowo-kręgowy (CVA), próg bólu uciskowego (PPT) górnych włókien mięśnia czworobocznego po obu stronach.
Wyniki. Analiza wewnątrzgrupowa wykazała, że nastąpił znaczny wzrost CVA i PPT po prawej i lewej stronie po leczeniu w grupach A i B ($p < 0,05$). Analiza międzygrupowa nie wykazała istotnej zmiany wartości wszystkich zmiennych przed leczeniem ($P > 0,05$), podczas gdy po leczeniu nastąpił istotny wzrost wartości dla wszystkich zmiennych w obu grupach; zaobserwowano również istotną różnicę wartości „po leczeniu" między obiema grupami ($p < 0,05$) na korzyść grupy B.
Wniosek. Ćwiczenia stabilizujące odcinek szyjny są uważane za skuteczną metodę korekcji protrakcji głowy, a tym samym łagodzenia bólu szyjno-powięziowego.

Słowa kluczowe
ćwiczenia stabilizujące odcinek szyjny, protrakcja głowy, zespół bólu mięśniowo-powięziowego

Introduction

Neck pain is a common type of musculoskeletal pain that leads to disability. Many studies reported that the prevalence of neck pain is ranging from 20 to 60% at developed and developing countries [1]. The most common musculoskeletal impairments of the cervical spine observed by clinicians are myofascial pain syndrome and postural imbalances of the head and neck [2]. FHP is a common type of postural abnormality in cervical region, and it is generally defined as an anterior translation of the head in relation to the vertical line of the body's center of gravity (head forward, upper cervical spine extended, lower cervical spine flexed) [3].

Myofascial pain syndrome is one of the most common sources of pain in chronic non-specific neck pain. It is characterized by an intense and deep pain that originates from one or more skeletal muscles and their fasciae. Also it is characterized by the presence of one or more hypersensitive sites in the affected muscles known as myofascial trigger points (MTrP). Among subjects with chronic non-specific neck pain many factors cited as predisposing to MPS which include abnormal posture, overstretching, over-shortening or repetitive mechanical stress [4]. Identification of causative factors for MTrPs is a first step to prevent deterioration and secondarily to develop treatment that prevents recurrence [5]. Although the precise mechanisms are still unknown, it is accepted that mechanical factors are involved in the development of MTrPs [6]. In this regard, various studies reported that prolonged abnormal posture is one of the causes of MPS [7].

Various studies in the cervical region indicate that abnormal sagittal plane alignment of the cervical spine, such as anterior head translation, can result in abnormal stresses and strains, resulting in premature and accelerated degenerative changes in the muscles, ligaments, bony structures, and neural elements [8]. Furthermore, preliminary randomized trials have demonstrated improved neck pain, and disability in patient groups receiving treatment to restore normal cervical sagittal alignment [9]. Myofascial pain can be easily suppressed in clinical observations, but it frequently recurs within few days to weeks if the related pathologic lesion is not eliminated [10]. Only when the underlying causative factor is completely eliminated can the active MTrPs be permanently inactivated [11].

Jensen and Westgaard [12] demonstrated that cervical stabilization exercises (CSE) could be used as a useful exercise program for controlling forward head posture. Cervical stabilization exercises could be an effective intervention to correct the head forward angle. Therefore, it can be useful to improve forward head posture [13]. Cervical stabilization exercises are applied as an exercise program to improve the stability of the cervical spine, reduce pain and promote function [14]. For individuals suffering from neck pain, stabilization exercises start with low-load exercises so that the deep cervical flexors (DCF) muscles are activated and superficial muscle activity is reduced [15]. Cervical stabilization exercises are based on the knowledge that the strength and endurance of DCF muscles are diminished in individuals suffering from neck pain [16].

Postural correctional exercises are considered as effective treatment program for FHP correction, this program consists of two strengthening exercises for (deep cervical flexors and scapular retractors) and two stretching exercises for cervical extensors (sub-occipital muscles) and pectoral muscles [17].

Despite the popularity of stabilization training in the treatment of lumbar and pelvic pain [18]; there is a lack of well-designed randomized controlled trials to identify its effect in the management of neck pain. The aim of this study was to investigate whether CSE is effective in the management of FHP and cervical myofascial pain syndrome when this intervention is added as a supplement to conventional treatment.

Materials and methods

Study design

This research was a randomized controlled trial conducted at EL-Shiekh Zayed Al-Nahyan hospital, during the period of September 2020 to July 2021.

Ethical Approval was attained from Faculty of Physical Therapy, Cairo University, Interventional Clinical Researches Ethics Board, and Approved number: P.T.REC/012/003317

Participants

Fifty participants of both genders (30 female and 20 male) were recruited from outpatient clinic of EL-Shiekh Zayed Al-Nahyan hospital. The included participants' ages ranged from 20 to35 years, their BMI between 19 and 25 kg/m2 and have FHP with CVA less than 50° and cervical myofascial pain syndrome evidenced by the presence of trigger points in the upper fibers of trapezius. The participants who have previous spinal surgery, spinal deformity, any radiological manifestation and malignancy were excluded.

After that the participants were randomly assigned into two groups equal in number (each consisted of 25 participants). Control Group A: treated with postural correction exercises and Study Group B: treated with CSE and postural correction exercises.

Randomization

Fifty participants were randomized by permuted block randomization technique before starting the study procedures into two groups; Control Group A that received postural correction exercises and Study Group B that received CSE and postural correction exercises (Figure 1). The procedures of the study were informed to participants and a consent form was signed by them before initiating the study.

Sample size estimation

Sample size: The sample size was calculated using G*Power software (version 3.0.10). F-test MANOVA within and between interaction effects was selected. Considering a power of 0.80, an alpha level of 0.05 (2 tailed) a generated sample size of at least 20 participants per group was required. To achieve the expected dropout before the study's completion, a total of 50 participants were included in the study.

Outcome measures

Craniovertebral angle and pressure pain threshold were measured by the therapist before and after the treatment program.

The CVA was used for assessment of forward head angle by taking a lateral photograph. The participant was asked to sit on a chair in normal relaxed position and take a lateral photograph, a digital camera was positioned on a tripod at a distance of 0.8 m from the participant. The therapist place the axis of

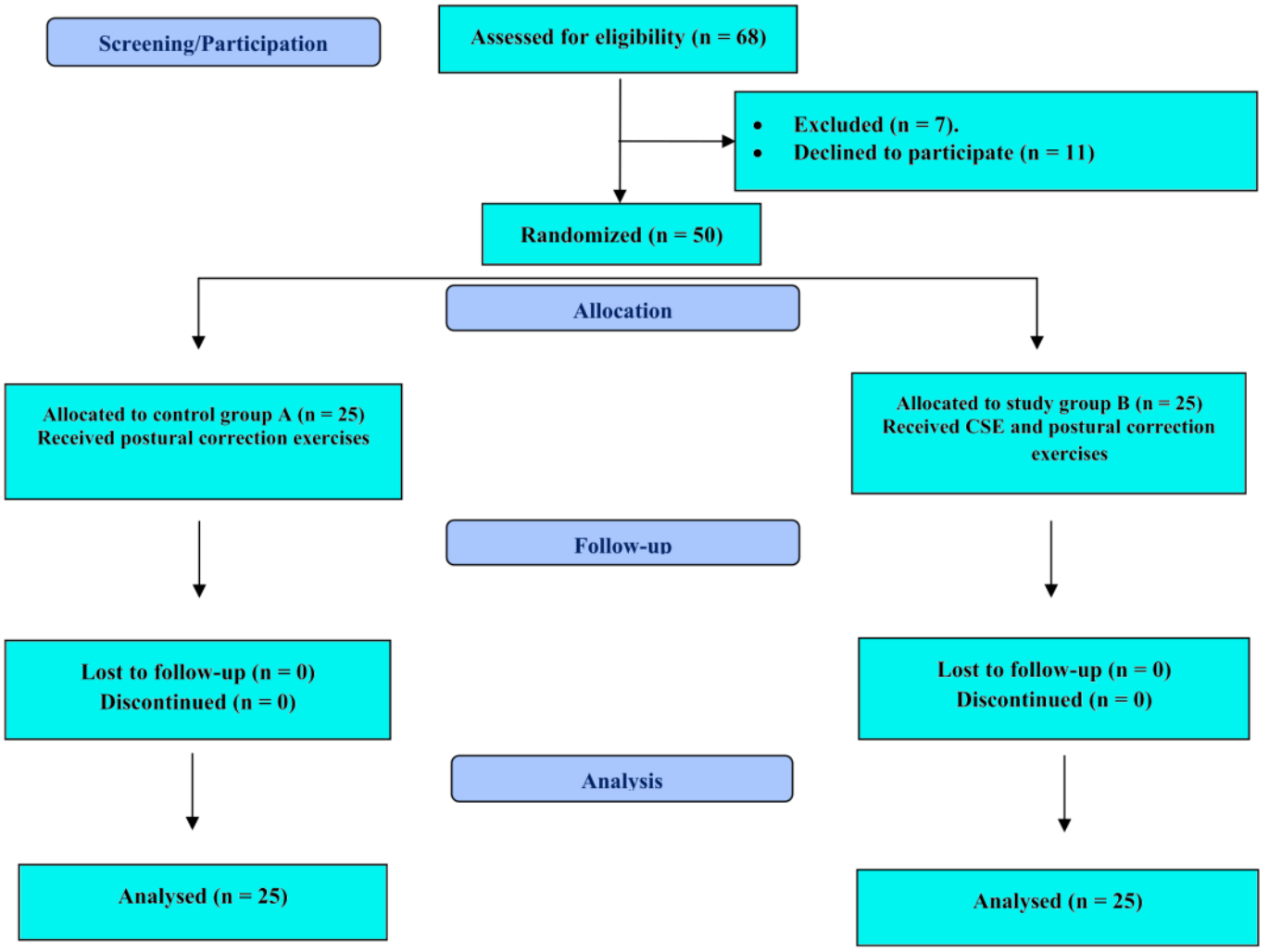

Figure 1. The flow chart of the study participants

the lens of the camera to face the sagittal plane of the participant at a height which corresponded to the seventh cervical vertebra, the therapist fixed adhesive markers on the tragus of the ear and the spinous processes of the seventh cervical vertebra. The head forward angle was measured as the angle between a line drawn from the tragus of the ear to the seventh cervical vertebra and horizontal line [19]. CVA is valid and reliable assessment tool in the assessment of forward head angle [20].

Pressure pain threshold was measured by using pressure algometer which is considered valid and reliable tool [21], patient was sitting in relaxed position and the therapist applied pressure by pressure algometer over the upper fibers of trapezius in the most painful point usually midway between C7 and acromion. Three consecutive measurements are taken and the average value was obtained each at interval of 30 sec to 1 min [22].

Intervention

Control group A

Postural correction exercises consist of strengthening exercise for deep cervical flexors and scapular retractors and stretching exercise for cervical extensors (sub-occipital muscles) and pectoralis major muscle based on a program by Harman et al [23].

Study group B

Cervical stabilization exercise and the same conventional treatment applied to group A. Regarding CSE the participants were taught to perform the contraction of deep neck flexor muscle using Stabilizer Pressure Biofeedback Unit (PBU). This device could provide biofeedback for correct deep neck flexor muscles contraction. [24] A pressure biofeedback unit was placed below the patient's neck in a supine position and the PBU was inflated to 20 mmHg, then the subject gently nodded his or her head, as if saying "yes" to perform a craniocervical flexion (CCF). They performed the posture at an initial pressure point of 20 mmHg using a bag inflated by injecting air. The exercise was performed by maintaining the targeted pressure for 10 seconds, followed by a rest for five seconds. Three sets of exercise were performed 10 times, 10 seconds each time; the pressure was increased up to 30 mmHg [25].

The progression and the combination of the exercises were designed according to the literature, stabilization exercises begin in the recumbent position and progress to quadruped, standing, and finally standing using unstable surface [26]. Applying external resistance using elastic resistance to any of the exerci-

ses increases the stabilizing challenge [27]. The progression included three phases according to the stages of motor learning as static, dynamic, and functional [28].
The static phase aimed to maintain short quick motor control and kinesthetic awareness. The exercises performed according to neurodevelopment stages (supine, prone, quadripedal, bipedal). The participants held the contraction for 10 seconds at each position for 3 sets of 10 repetitions. The main objective of dynamic phase was to teach conscious motor control and to maintain stable spine during upper extremity motions. Upper extremity range of motion exercises were added while maintaining stable spine at each position. They had 3 sets 10 repetitions held for 10 seconds each. The functional phase aimed to teach motor control. The exercises included functional training with elastic resistance and exercise on unstable surfaces to improve unconscious activation of the muscles. They had 3 sets 10 repetitions held for 10–15 seconds each [29].

Statistical analysis
Statistical analysis was conducted using SPSS for windows, version 23 (SPSS, Inc., Chicago, IL). The data were normally distributed and not violates the parametric assumption for each of the measured dependent variables. 2x2 Mixed MANOVA test was used to compare the tested variables of interest at different measuring periods at two groups. With the initial alpha level set at 0.05.

Results

Characteristics of subject
Table 1 shows characteristics associated with study participants, as indicated by the independent t-test, there were no significant differences ($p > 0.05$) in the mean values of age, body mass, height and BMI between both tested groups (Table 1).
Chi square revealed there was no significant differences between both groups in sex distribution ($p > 0.05$).

Table 1. Physical characteristics of participants in both groups (A&B)

Items	Group A Mean ± SD	Group B Mean ± SD	Comparison t-value	Comparison P-value
Age [years]	25.44 ± 3.17	25.6 ± 3.37	−0.173	0.864
Body mass [kg]	67 ± 8.55	68.34 ± 8.29	−0.562	0.577
Height [m]	1.67 ± 0.091	1.70 ± 0.076	−1.496	0.141
BMI [kg/m^2]	23.05 ± 4.44	23.3 ± 1.56	−0.26	0.796
Sex distribution [n, %]	**Group A**	**Group B**	**χ^2**	**P-value**
Males	9 (36%)	11 (44%)	0.333	0.564^{NS}
Females	16 (64%)	14 (56%)		

SD: standard deviation; P: probability; S: significance; NS: non-significant

Multiple analysis of variance (MANOVA) – 2×2 mixed design
Table 2 displays the comparison of clinical parameters within each group before and after intervention. There was no significant differences of mean values of the "pre" test between both groups ($P > 0.05$). While within control group A, statistical significant difference was observed between pre intervention and post intervention for CVA, PPT at right and left sides ($p < 0.05$). Similar result was observed for study group B for all clinical parameters ($P < 0.05$). As well as, there was significant difference of the mean values of the "post" test between both groups with ($P < 0.05$) and this significant increase in favour to group B.

Table 2. CVA and PPT right and left sides for both groups not pain and shoulder ROM

Item		Group A	Group B	Mean difference	P- value
CVA	Pre-study (Mean, SD)	43.96 ± 2.47	43.64 ± 3.01	0.32	0.683
	Post-study (Mean, SD)	49.72 ± 2.03	53.12 ± 2.90	−3.4	0.0001*
	Mean difference	−5.76	−9.48		
	% of change	13.1%	21.17%		
	P-value	0.0001*	0.0001*		
PPT RT	Pre-study (Mean, SD)	1.7 ± 0.28	1.62 ± 0.27	0.08	0.358
	Post-study (Mean, SD)	1.9 ± 0.25	2.88 ± 0.42	−0.98	0.0001*
	Mean difference	−0.2	−1.26		
	% of change	11.76%	77.77%		
	P-value	0.001*	0.0001*		

Item		Group A	Group B	Mean difference	P- value
PPT LT	Pre-study (Mean, SD)	1.73 ± 0.3	1.69 ± 0.3	0.04	0.66
	Post-study (Mean, SD)	1.98 ± 0.34	2.9 ± 0.44	−0.92	0.0001*
	Mean difference	−0.25	−1.21		
	% of change	14.45%	71.59%		
	P-value	0.0001*	0.0001*		

**Significant level is set at alpha level < 0.05; SD: standard deviation; P-value: probability value*

Discussion

This study was conducted to investigate the effect of cervical stabilization exercises on CVA and PPT right and left sides in patient with FHP and cervical myofascial pain syndrome. According to our results, there was a statistically significant improvement in the values of (CVA and PPT). This improvement caused by activation of DCF during stabilization exercises and correction of abnormal posture. So, the hypothesis sited that CSE produced insignificant change on CVA and PPT in participants with FHP and cervical MPS was rejected.

The results of the present study revealed that CSE is effective for correction of FHP, these findings are consistent with the results of Pawaria et al. [30] who investigated the effectiveness of neck stabilization exercises with feedback in addition to routine Physiotherapy treatment for six weeks in improving the respiratory status and concluded that there was significant improvement in forward head posture measured by improvement in Craniovertebral angle. Therefore it is sug¬gested that cervical stabilization exercises is an effective approach for forward head posture correction, and it should be included as treatment program for patients with forward head posture.

Several studies [31, 32] have revealed that shortening of the cervical extensor muscles, such as upper trapezius is related to the forward position of the head. According to these studies [32] this posture is likely related to the development and accentuation of pain. Any abnormal faulty posture with prolonged contraction can result in the development and increase of pain in the trigger points [33] as well as in the reduction of the PPT. Therefore correction of FHP could produce significant improvement in PPT value and thus the MTrP in upper trapezius could be permanently inactivated.

Our results were consistent with the results of Moustafa et al. [34], whose results revealed that restoration of normal cervical sagittal alignment using a device for the correction of abnormal sagittal cervical alignment 'cervical denneroll spine orthotic traction' has a strong positive impact on PPT, function, and cervical ROM in patients with cervical MPS. A one-year follow-up revealed that the improvement in all measured variables was stable. These findings provide objective evidence that biomechanical dysfunction in terms of abnormal head and cervical posture affects the outcome measures of MPS.

To the best of our knowledge, this is the first study to assess the effects of CSE on FHP and cervical MPS. Moreover, according to the current study, PPT is affected by CSE, and this finding is consistent with that of Falla et al. [35], who confirmed that stabilization exercises were reported to be beneficial for improving neck pain and PPT.

Moreover, Brantingham et al. [36] revealed that the application of neck stabilization exercises in patients with neck pain due to poor postures caused by continuous postural instability was effective for the control of neck pain. Additionally, Kim et al. [37] stated that exercises for regions around the neck that correct abnormal posture of patients with forward head posture help improve the recovery of positional distortion.

This finding is consistent with the finding of Celenay et al. [38], who stated that stabilization exercises with and without connective tissue massage were effective for decreasing pain, anxiety, improving physical health and increasing the quality of life in patients with chronic mechanical neck pain.

Furthermore, the improvement in our study may be due to activation of deep cervical flexors during stabilization exercises, as DCF training was reported to be effective in reducing pain and disability according to O'Leary and Falla. [39]. The reason might be that DCF training specifically involved upper cervical flexion and that the majority of subjects with neck pain suffered from DCF action impairment. Thus, DCF training might have directly affected pain sensitive structures of upper cervical region more than conventional training.

Jull et al. [40] reported a decrease in neck pain and functional disability when a multimodal physical therapy program which included stabilization exercises was used, and that it was superior to a self-management program that includ¬ed home exercise and advice. The reason is that neuromuscular con¬trol improvement from stabilization exercises may decreases the stresses placed on the joints [41].

It was revealed that exercises aimed to correct the faulty posture and strength of deep neck muscles increase the cervical angle [42]. Cervical Stabilization exercises were reported to control the forward head posture [43]. Dusunceli Y et al. found the neck stabilization exercises have superior effect in reducing pain and disability outcomes as compared to isometric and stretching exercises when given along with the conventional physical therapy agents for the treatment of neck pain [44].

In agreement with our study Akodu AK et al. found that CSE were effective for improving forward head posture, reducing neck pain, depression, and anxiety in subjects with nonspecific chronic neck pain. There was also an improvement in the functional status of the patients [45]. Moreover, according to this study, CSE have the following advantages: it is a conservative treatment and can be applied as home program which does not require therapist assistance.

Study limitation

This study has the following limitation: no follow up was applied in this study. Further studies are recommended to investi-

gate the long term effect effect of CSE and postural correctional exercises on FHP and cervical MPS with follow up.

Conclusion

Cervical stabilization exercises together with Postural correctional exercises had a superior effect on CVA and PPT compared to Postural correctional exercises only in subjects with forward head posture and cervical myofascial pain syndrome.

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