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Research Article

Effectiveness of Trunk Control and Scapular Stabilisation Exercises among IT Professionals with Forward Head Posture

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A B S T R A C T

Introduction: As technology advances, the use of computers will further rise to lead to many musculoskeletal problems. Prolonged sitting at work or improper posture of the head during work may lead to forward head posture (FHP) among office employees, particularly among information technology (IT) professionals.

Aim: This study aimed to determine the effectiveness of trunk control and scapular stabilisation exercises as compared to scapular stabilisation exercises alone in increasing the endurance of cervical muscles and the craniovertebral angle (CVA) of IT professionals with FHP.

Materials and Methods: The study included 34 IT professionals with FHP between the ages of 25 and 35 years. Patients who fulfilled the study criteria were recruited and assessed for CVA and endurance test time for cervical muscles. The subjects were divided into two groups for the intervention (Group A and Group B). Group A performed scapular stabilisation exercises and Group B performed trunk control and scapular stabilisation exercises. The participants were re-assessed to obtain the data.

Result: The results of the study showed that both interventions led to a significant reduction in FHP. However, Group B showed a significantly greater reduction in FHP than Group A.

Conclusion: The study concluded that trunk control and scapular stabilisation exercises constitute an effective intervention for FHP. The intervention had a positive effect on neck alignment by increasing the CVA and endurance of cervical muscles.

Keywords: Scapular Stabilisation, Trunk Control, Forward Head Posture, IT Professionals

Introduction

In the literature on work-related upper extremity disorders, it was found that the forward head posture (FHP) contributed to about 71% of postural misalignment.[1] The use of computers has increased not only in the IT world but in all occupations in the recent decade due to technological advances, thus increasing the time that a person spends working on the computer and leading to changes in body posture and an increase in neck pain.[2] FHP occurs when the cervical spine is held in a protracted position to improve the visual contact with objects manipulated in front of the body, mostly experienced when viewing a computer screen.[3] The protracted position is the extension of the upper cervical spine along with flexion of the lower cervical spine.[4]

In FHP, there is lengthening and weakness of the deep neck flexor and scapular stabilisers. Also, there is overactivation and shortening of deep upper cervical extensor muscles, shoulder protractors, and elevators.[5] The cervical extensors work less than the upper trapezius (UT) to support the head in a neutral position.[3] This leads to the overactivation of the UT muscle as compared to the cervical extensor muscle. In a previous article, it was found that the higher activity of the UT causes a change in the cervical vertebra.[6] So, the overactivation of the UT increases the possibility of increasing the FHP and compensates for the reduced activity of the cervical extensor muscles. Further, the weakness of the serratus anterior (SA) muscle exacerbates the muscle imbalance.[7] These atypical changes occur due to the protective reaction of hyperactivity and inhibition of muscle, to compensate and suppress further damage to the body.[8]

To resolve this problem, it is important to align the body properly by working on the affected muscle mainly by strengthening the deep cervical flexors and correcting the thoracic spine.[9,10] Scapular stabilisation exercises have proved to be effective in regaining the balance of muscle as well as improving posture.[11] This exercise, by synchronised movement and couple motion of the scapula, has proven to be effective in the rehabilitation process. The main contribution of this exercise is to enhance the activation of the lower trapezius and the SA muscle and decrease the activation of the UT.[12] The activation of the lower trapezius aligns the scapula by creating a tilt in the scapula and decreasing the upper rotation angle.[13] Similarly, with the activation of the SA, the activation of the UT decreases and further helps to raise the scapula and stretch the neck.[14] Therefore, it is necessary to activate the SA to assist with better posture. Previous studies show that there is not only activation but also strengthening of the SA and trapezius muscle during contraction of the abdominal muscle while performing dynamic shoulder exercises as these muscles are linked through the thoracolumbar fascia.[14,15] Also, the SA and external oblique muscles have a few common sites of origin so they work in synergy and help in strengthening the SA. The muscle tension created during trunk control exercises is transferred to the proximal tendon of the SA, thus leading to an increase in fibre recruitment in the scapulothoracic muscle.[16] This study aims to determine the effect of trunk control and scapular stabilisation exercises on the improvement of posture among IT professionals and to compare this effect with that of scapular stabilisation exercises alone.

Subjects and Methods

A comparative study was designed to identify the effectiveness of trunk control and scapular stabilisation among IT professionals with FHP. This study was approved by the Research Ethics Committee of Krishna Vishwa Vidyapeeth (deemed to be University). This study was conducted from August 2022 to January 2023 at Krishna Vishwa Vidyapeeth, Karad.

IT professionals, both male and female, 25–35 years of age, and with a CVA (craniovertebral angle) less than 50°, were chosen by random sampling method for this interventional study. A sample size of 34 subjects was determined using a formula approved by the research department. Subjects with a previous history of neck or back injury, any neurological signs, current use of a muscle relaxer, and those carrying out regular physical activity were excluded from the intervention. The participants were informed about the study procedure and consent was taken before being enrolled in the study. The demographic data of the subjects which included name, age, gender, and years of experience were collected, and the following assessment was done.

Outcome Measures

For Craniovertebral Angle

The CVA is the angle between one horizontal line passing through the C7 spinous process and a second line extending from the tragus of the ear to the C7 vertebra. The CVA for the forward head was assessed with the help of ImageJ image analysis software.[17] The angle was measured by taking a lateral photograph of the subject in a seated position without back support and in a straight posture. Markers were attached to the C7 spinous process and tragus of the ear of the subjects. The subjects with an angle less than 50° were considered to have FHP, as a smaller CVA indicates a greater FHP.[18]

For Endurance Test

Deep cervical neck flexor endurance test: The subjects were asked to lie down in a hook lying position and were asked

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to tuck their chin, lift off their neck 1 inch from the plinth, and hold the position for as long as they could without losing the chin tuck. The duration was noted.[14]

Cervical neck extensor endurance test: The subjects were asked to lie down in a prone position, with their head and neck past the edge of the table. The ability of the subject to sustain a chin tuck in neutral was noted, considering the normal time to hold this position to be 20 sec. An inability to hold the chin tuck and head up indicates weakness of both deep and superficial neck extensor muscles.[14]

Thereafter, the participants were randomised into two groups (with 17 participants each) and the following exercises were performed:

Intervention

Scapular Stabilisation Exercises

This group received the following exercises for 3 weeks, with 6 sessions per week while increasing the sets each week.

- **Chin tuck:** Pull your chin towards the chest and hold this position for 10 seconds, while relaxing stretch from your neck to the base of your skull.
- **Horizontal Pull Apart:** Flex the shoulder up to your chest level then supinate your forearm and externally rotate the shoulder, pulling away the resistance band from the midline of the body.
- **Serratus Anterior:** Attain a lying position and flex your shoulder up to 90°. Stretch your hand as far out as you can in front of you. Relax and bring the stretched hand to the neutral position. This is done simultaneously on both hands using a resistance band.
- **Scapular Retraction and external rotation:** Keeping your arms adducted and your elbow at 90° from the midline, pull away from your body assuming the elbow as a pivot point. Use a resistance band during this exercise.
- **TYW exercises:** Attain a prone position and fully extend your elbows and fingers, facing your palm inwards. Depress and retract your scapula and mimic the shapes of T, Y, and W with the arms.

Trunk Control and Scapular Stabilisation Exercises

This group received the intervention for 3 weeks, with 6 sessions per week. They were given scapular stabilisation and trunk control exercises on alternate days, and the sets of exercises were increased each week.

- **Wall Press:** Keep your shoulder and elbows flexed at 90° while your palm faces the wall. Take a deep breath and press your body towards the wall as if doing a push-up. Exhale and push back to the original position.
- **Knee Push-Ups:** Attain the prone position, placing the hands slightly greater than shoulder-width apart, with the knees flexed and comfortably apart. Bend the elbows slowly and lower the chest until the chin touches the ground, then slowly return to the starting position.
- **Wall Slides:** Stand straight with your back against a wall where your shoulder and elbow are at 90°. While lifting the arm, press and slide down the shoulder blades into the wall, then bend your knees slowly up to 45°. While bending your knees, straighten your elbows until your arms are up over your head. Hold this position for 5 seconds, then straighten your knees and bend your elbows.
- **Inferior Glide:** Sit beside a table with the arm abducted and elbow extended and kept on a ball over a table. Apply pressure adducting the shoulder and depressing the scapula while contracting the abdominal muscles.
- **Isometric Low Row:** Stand straight with elbows extended and pronated against a table. Extend the shoulder behind and try to push the table depressing the scapula. Hold this position for 5 seconds while contracting the abdomen and then return to normal position.
- **Full Can Exercise:** Stand straight with arms at the side of the body, raise the arms in the scapular plane to a maximum range of motion and then return to normal position.

Statistical Analysis

The data obtained were entered, compared and analysed using the InStat app. The statistical analysis within a group (pre-test and post-test) was done using the paired t test, whereas the comparison between both groups was done using the unpaired t test.

Results

Represented below are the data findings of Group A (scapular stabilisation exercise) and Group B (both trunk control and scapular stabilisation exercises).

Table 1.Pre-test and Post-test Values of Mean and Standard Deviation for Craniovertebral Angle

Craniovertebral Angle	Pre-test	Post-test	p Value	Inference
Group A	46.37 ± 2.61	47.32 ± 2.25	0.0122	Significant
Group B	47.02 ± 1.64	49.78 ± 1.44	< 0.001	Extremely significant

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Inference	Not significant	Extremely significant	-	-
p value	0.391	0.0006	-	-

Table 2.Pre-test and Post-test Values of Mean and Standard Deviation for Cervical Flexor Endurance Test

Cervical Flexor Endurance	Pre-test	Post-test	p Value	Inference
Group A	14.0 ± 2.20	15.5 ± 2.12	0.0019	Very significant
Group B	15.4 ± 2.69	21.7 ± 2.41	< 0.001	Extremely significant
Inference	Not significant	Significant	-	-
p value	0.104	< 0.001	-	-

Table 3.Pre-test and Post-test Values of Mean and Standard Deviation for Cervical Extensor Endurance Test

Cervical Extensor Endurance	Pre-test	Post-test	p Value	Inference
Group A	19.58 ± 3.80	21.35 ± 2.93	0.032	Significant
Group B	20.23 ± 3.71	24.47 ± 3.24	< 0.001	Extremely significant
Inference	Not significant	Very significant	-	-
p value	0.619	0.0061	-	-

Overall, it was seen that there were significant differences in both groups (Group A and Group B), as has been shown in Tables 1–3 with the data representation in terms of pre-test and post-test values of CVA, cervical flexor, and extensor endurance test. In particular, more improvement was seen in Group B in which trunk control and scapular stabilisation exercises were performed as the p values were less than 0.001 for all outcome measures, whereas the p values in the case of Group A for CVA, cervical flexor, and extensor test were 0.0122, 0.0019, and 0.032 respectively. Hence, we concluded that the exercises performed by Group B were more effective than those performed by Group A.

Discussion

IT professionals work on computers for a long period and if proper posture is not maintained, it can lead to FHP due to muscle imbalance, thus inducing pain, decreasing CVA, strength and endurance of cervical muscles, and causing postural malalignment. External factors acting upon the joint such as gravity and ground reaction forces create an external moment which is countered by the internal moment produced by various muscles and other soft tissue structures around the joint. Greater internal forces will be required in FHP to balance the forces that occurred due to postural malalignment, owing to the altered location of the line of gravity as well as an increased load to some cervical segments.[4,19] The head links to the cervical spine and all other joints through the kinematic chain by various muscles and contributes about 6% of the total body weight.[20] When the head moves forward, for every 2.5 cm, there is an increase of 0.45 kg of weight in consideration of the upper back and neck muscles because they tolerate maximum strain to support the position of the head.[21] Thus, stress is created not only on the neck but on the whole body, thereby affecting the posture. Therefore, it was necessary to conduct this study. In this study, the addition of trunk control to a conventional protocol of scapular stabilisation exercises has led to greater improvements in increasing the CVA and endurance of the cervical flexor and extensor muscles.

Trunk control exercise causes the contraction of trunk muscles to activate them. The trunk muscles are connected to scapular muscles thus, assisting in posture correction. The link between the trunk and scapulothoracic muscles is the SA muscle. SA is an important muscle for maintaining the biomechanics and proper position of the scapula. It is estimated that there is an increase in the activity of the SA during the contraction of trunk muscles.[22] Additionally, the thoracolumbar fascia also acts as a link between the trunk

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and the scapulothoracic muscles. The trunk control exercise showed great enhancement not only in the endurance of the cervical flexors and extensors but also in increasing the CVA.

Moreover, the scapular stabilisation protocol alone was also found to be effective to some extent. Scapular stabilisation exercises are used to correct the position of the scapula while strengthening the scapular muscles.[23] These exercises have shown a considerable effect on increasing the endurance of flexor cervical muscles and extensor cervical muscles. Unfortunately, the effect of the scapular stabilisation exercise alone on the CVA was found to be considerably less than that of both the exercises combined.

A previous study on the effect of scapular stabilisation exercises with abdominal control feedback on FHP depicted a decrease in neck pain and an increase in the endurance of muscles. These results support our observation that trunk control exercises, in addition to scapular stabilisation exercises, have a greater impact on increasing the endurance of cervical muscles.[9,22] Additionally, in our study, an improvement in the CVA can also be seen. It is important to know that trunk and pelvis stability are required to transmit force and energy to the upper limbs during functional activities.[16] Thus, trunk control exercise and scapular stabilisation exercises are beneficial to decrease pain, increase endurance and CVA, and improve posture by correcting muscle imbalance.

This study is beneficial for the improvement of FHP, but the limitation of the study is that the participant's age range could have influenced the outcome of this study. This study was conducted among participants of a limited age group, therefore the sample size was quite small. Moreover, further research is needed to determine the long-term effectiveness of these exercises and their potential for preventing the development of FHP.

Conclusion

Looking from an overall perspective, it is readily apparent that trunk control and scapular stabilisation exercises are more effective than scapular stabilisation exercises alone in increasing the endurance of cervical muscles as well as CVA in IT professionals. These exercises can be incorporated into rehabilitation programmes for individuals with FHP.

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Conflicts of Interest: No conflicts of interest

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