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COMPARE THE EFFECTS OF DEEP NECK FLEXOR STRENGTHENING EXERCISES VERSES ELECTROTHERAPY MODALITIES ON HEAD FORWARD POSTURES RESULTING FROM THE USE OF SMARTPHONES

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ABSTRACT

Background: Forward head posture is very common nowadays. Just look at anyone who works at a desk, students, or anyone who spends the majority of their day looking at some electronic device. Most of the time their head is looking down, their shoulders are rounded forward and their chest is tight. Over time this causes neck pain, upper back pain and tension headaches. ***Objective:*** to compare the effects of deep neck flexor strengthening exercises verses Electrotherapy modalities on head forward postures resulting from the use of smartphones. ***Methodology:*** Thirty participants were divided into three groups; first group **G1** (vehicle group, *n* = 10), second group **G2** (*n* = 10) who given deep neck flexor strengthening exercises and the third group **G3** (*n* = 10) given Electrotherapy Modalities (Ultra sound and IFT). **G1** using Pressure Biofeedback Unit (PBU); these exercises were performed on a hard therapy table to measure changes in the pressure gage accurately. The subjects maintained static contraction for ten seconds, and then took a rest for five seconds, which was defined as a one-time exercise. One set of exercises consisted of ten-time exercises, and a total of five sets were performed each day. The subjected performed the exercises three times each week for a four-week period. **G2** exposed to Ultrasound for 10 min. and IFT for 10 min., three sessions per a week for four weeks. ***Results:*** Before treatment, the scores of PF, GH, BP and VT showed no statistical difference between treatment groups and control group ($p > 0.05$). After treatment at 4th week the scores of PF, GH, BP and VT in treatment group all improved significantly compared with those before treatment ($p < 0.05$, Table 1). But in control group, no significant differences were observed

(p > 0.05). The scores of PF, GH, BP and VT in treatment group were significantly higher than those in control group. ***Conclusion:*** Deep cervical flexor training with a pressure biofeedback unit is a useful method for maintaining neck mobility and muscular endurance in people with forward head posture.

KEYWORDS: *head posture, neck flexor, strengthening exercises, Electrotherapy modalities.*

1. INTRODUCTION

Forward head posture (FHP) occurs when the head is anterior to a vertical line through the individual's center of gravity. FHP can include both an upper cervical extension and a lower cervical flexion2) and it can induce lengthening and weakness of the anterior cervical muscles and shortening of the posterior region. If this abnormal change in the muscles and joints of the cervical region is prolonged, it may cause to restrict cervical mobility and decreased muscular performance.

In general, forward head posture refers to the posture that accompanies forward bending of the lower cervical vertebrae and excessive extension of the upper cervical vertebrae.

Forward head posture is very common nowadays. Just look at anyone who works at a desk, students, or anyone who spends the majority of their day looking at some electronic device. Most of the time their head is looking down, their shoulders are rounded forward and their chest is tight. Over time this causes neck pain, upper back pain and tension headaches.

Forward Head Posture (FHP) is the anterior positioning of the cervical spine. It is a posture problem that is caused by several factors including sleeping with the head elevated too high, extended use of computers, lack of developed back muscle strength and lack of nutrients such as calcium.

One of the most common postural deviations in the cervical region is Forward Head Posture (FHP), which is defined by Hertling et al. as follows: "When the head is held anteriorly, the line of vision will extend downward if the normal angle at which the head and neck meets is maintained. To correct for visual needs there is a tilting of the head backwards (posterior cranial rotation [PCR]), flexion of the neck over the thorax and posterior migration of the mandible."p636. In a study conducted on patients with neck pain, greater levels of disability were seen in patients with a more severe FHP.

According to Nemmers, there is an age- associated effect on FHP in elderly women with the older women reflecting a more severe FHP. Also, Quek et al. found out that greater FHP in older adults was associated with decreased cervical flexion and general cervical rotation. In a recent study, conducted by Silva et al., induced forward head posture had no effect on postural control in healthy subjects; in their study, healthy volunteers were asked to perform a 6° anterior translation of their head to have exaggerated FHP.

As the above examples indicate, previous studies have mainly focused on factors affecting proprioception. Nonetheless, to the authors' knowledge, no specific study has thus far been formulated to investigate the possible effect of true FHP on neck position sense.

Factors causing this posture in modern people include occupations and habits and most cases except the occupational factor are largely influenced by the habit of using electronic devices such as computers and smartphones. The use of visual display terminals such as smartphones for long hours can cause improper postures such as forward head posture and the subsequent increases in cervical lordosis and thoracic or lumbar kyphosis cause round shoulders and decreases in vital capacity and thoracic cavity.

Moreover, the continuous maintenance of forward head and slouched postures can cause damage not only to structures around the cervical and lumbar vertebrae, but also to ligaments around the region. In controlling cervical postures and maintaining the stability of cervical vertebrae, the role of deep neck flexors is considered important.

To maintain a correct posture in the cervical region, deep neck flexors contribute to maintaining a balance between the head and the neck in the upper part and between the back and the waist in the lower part. In addition, to support the head's weight during its movement in various directions, deep neck flexors work together and play the role of providing stability by supporting and fixing the cervical region by using low levels of static muscle endurance rather than generating high levels of motility.

Patients with acute cervical pain mostly show changes in the cervical Range of Motion (ROM), muscle enduranc and proprioception. To manage this condition effectively, it is important to improve its symptoms, but it may be more important to prevent the recurrence of the symptoms and chronic in acute cervical pain patients. As an active exercise method that can recover such damage.

Patient is kept in a supine position, a Pressure Biofeedback Unit (PBU) is placed behind the patient's cervical region and the patient pushes his/her head toward the floor while drawing the chin inward. In this method, the strength of deep cervical flexors is indicated as the pressure applied to the PBU. Fewer studies on Electrotherapy modalities are done.

The purpose of the present study was to compare the effects of deep neck flexor strengthening exercises verses Electrotherapy modalities on head forward postures resulting from the use of smartphones. In order to do so, we used Revel et al.'s method in measuring the accuracy of joint position sense, according to which patients were to relocate the cervicocephalic junction to the neutral head position after they actively rotated the head to the right and left sides.

Aim of the Study

Aim of the present study is to compare the effects of deep neck flexor strengthening exercises verses Electrotherapy modalities on head forward postures resulting from the use of smartphones.

Hypothesis

It is Hypostatized That Deep neck flexor strengthening exercises is effective than that of Electrotherapy modalities on head forward postures resulting from the use of smartphones.

Null Hypothesis

It is Hypostatized That Deep neck flexor strengthening exercises is not effective than that of Electrotherapy modalities on head forward postures resulting from the use of smartphones.

2. MATERIALS AND METHODOLOGY

2.1. Study population

Thirty adult males, who are students of Hail University, were using smartphone for at least three hours per day.

2.2. Inclusion criteria

Subjects with Forward Head Posture (FHP) and the mean age of 23/5±3/26 years and BMI= 22/27±2/66, together with 15 male healthy subjects with mean age of 23/94±2/68 years and BMI of 21/22±2, voluntarily participated in the experiment. An informed consent, designed and approved by the ethics committee of Hail University of medical sciences, was signed by all participants.

2.3. Exclusion criteria

Those with chronic and acute neck pain, headache, vertigo, history of trauma to the neck, neck vertebra fracture, history of surgery in the cervical region and cardiac and neurological disorders were supposed to be excluded from the study.

2.4. Study design

Thirty participants were divided into three groups; first group **G1** (vehicle group, n = 10), second group **G2** (n = 10) who given deep neck flexor strengthening exercises and the third group **G3** (n = 10) given Electrotherapy Modalities (Ultra sound and IFT).

2.5. Procedures

G1 using Pressure Biofeedback Unit (PBU); these exercises were performed on a hard therapy table to measure changes in the pressure gage accurately. The subjects maintained static contraction for ten seconds and then took a rest for five seconds, which was defined as a one-time exercise. One set of exercises consisted of ten-time exercises, and a total of five sets were performed each day. The subjected performed the exercises three times each week for a four-week period.

G2 exposed to Ultrasound for 10 min. and IFT for 10 min., three sessions per a week for four weeks.

2.6. Outcome measurements

The Neck Pain and Disability Scale (NDAP), the visual analogue scale (VAS), the neck disability index (NDI), general health (GH), bodily pain (BP) and vitality (VT) were recorded for each group.

2.7. Data analysis

Obtained data were analyzed by SPSS 22 software test to compare the data before and after treatment within groups. The significant threshold set at $p < 0.05$, or non-significant set at $p > 0.05$.

3. RESULTS

The three groups were homogenous in age, weight, height and gender. As there was no significant difference between the three groups in age, weight, height and gender.

The differences in craniovertebral angle, cervical ROM, and muscular endurance between the different stages of the study were compared within each group. The experimental group showed significant improvements in cervical ROM, and muscular endurance but not in craniovertebral angle at post-training and after the four-week detraining period, compared to pre-training ($p < 0.05$).

In the control group, there were significant differences in cervical extension and both cervical rotations in post-training compared to pre-training ($p < 0.05$). The changes in the three factors that occurred between pre-training and post-training, and between post-training and after the four-week detraining period, were compared between the two groups.

The experimental groups showed a significantly greater increase in cervical ROM between post-training and the four-week detraining period, compared to the control group ($p < 0.05$, $p < 0.001$).

Within subject's comparison by using paired t-test showed that, there was a significant difference between pre and post treatment pain pressure threshold values for the 3 groups as P-value was (0.0001), (0.0001) and (0.0001) respectively. And between pre and post treatment Neck disability index for group the three groups as P-value was (0.0001), (0.0001) and (0.0001) respectively. And finally between pre and post treatment forward head posture the 3 groups as the P-value was (0.02), (0.0001) and (0.0001) respectively.

Between subjects comparison by using analysis of variance test revealed that there was no significant difference among the three groups for the pretreatment pain pressure threshold, Neck disability index and forward head posture as P value was (0.61), (0.91) and (0.76) respectively.

While there was a significant difference for the post treatment pain pressure threshold, Neck disability index and forward head posture as P value was (0.0001), (0.0001) and (0.0001) respectively.

For pain pressure threshold there was a significant difference between traditional treatment group and low power laser group as P value was (0.0001) and between low power laser group and kinesio taping group as P value was (0.0001) and finally between traditional treatment group and kinesio taping group as P value was (0.0001).

For Neck disability index there was a significant difference between groups traditional treatment group and low power laser group as P value was (0.0001), traditional treatment group and kinesio taping group as P value was (0.0001) and Finally, between groups low power laser group and kinesio taping group as P value was (0.005).

Finally for forward head posture there was no significant difference between groups traditional treatment group and low power laser group P value was (0.73), while there was a significant difference between groups traditional treatment group and kinesio taping group as the P value was (0.0001) and between low power laser group and kinesio taping group as P value was (0.0001).

Before treatment, the VAS and NDI scores of participants in three groups corresponded to normal distribution. There was no statistical difference between treatment groups and control group ($p > 0.05$) (Table 1).

After treatment, the VAS score and NDI score showed significant differences in treatment groups at the 4^{th} week, compared with that at 0 week ($p < 0.05$). In contrast, differences were not identified in control group ($p > 0.05$).

Before treatment, the scores of PF, GH, BP and VT showed no statistical difference between treatment groups and control group ($p > 0.05$).

After treatment at 4^{th} week the scores of PF, GH, BP and VT in treatment group all improved significantly compared with those before treatment ($p < 0.05$, Table 1). But in control group, no significant differences were observed ($p > 0.05$). The scores of PF, GH, BP and VT in treatment group were significantly higher than those in control group (**Table. 1and Fig. 4**).

Table (1): Showing the obtained data.

	G1	G2	G3
VAS	**45.02 ± 12.21**	**42± 7.17**	**41.08** ± 5.03**
NDI	**15.12 ± 3.01**	**14.15* ± 2.33**	**12.23 ±2.01**
PF	**25.39 ± 11.29**	**24.37* ± 10.41**	**24.25 ± 8.94**
GH	**32.38 ± 22.32**	**39.21** ± 22.40**	**42.19** ± 22.53**
BP	**36.67 ± 14.14**	**35.00* ± 14.58**	**34..8 ± 14.6**
VT	**38.81 ± 19.61**	**44.38* ± 17.56**	**46.01** ± 19.85**

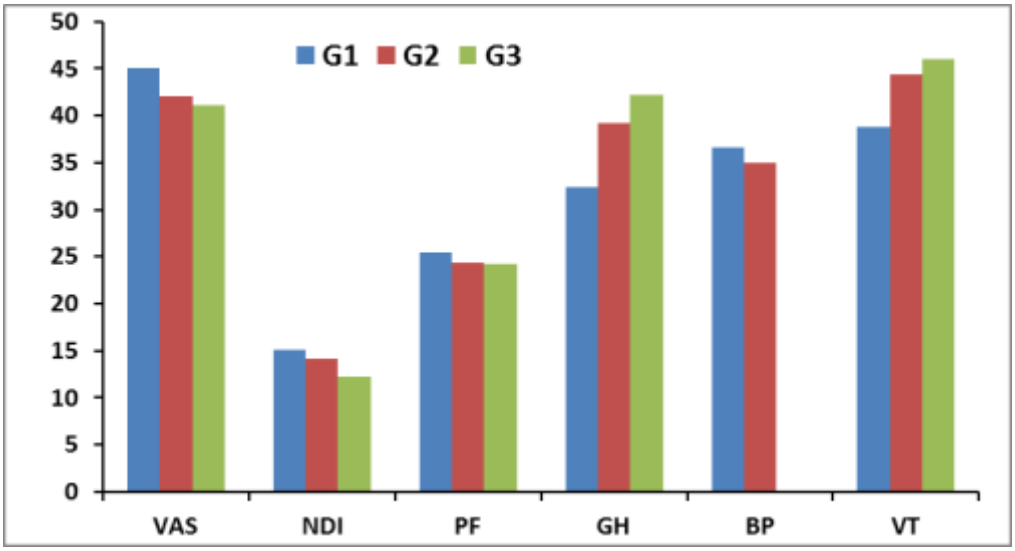

Fig. 1: Histogram showing the recorded results.

4. DISCUSSION

FHP generally results in shortening of cervical extensors such as the splenii, upper trapezius and SCM muscle and in lengthening and weakening of the cervical flexors. An earlier research has suggested that when performance is impaired, the balance between the stabilizers on the posterior region of the neck and the DCF is damaged, resulting in a loss of proper alignment and posture. This loss of alignment can then induce cervical impairment.

Therefore, using DCF training as a rehabilitation program for FHP is based on the rationale that DCF plays a major role in the stabilization of the head and on neck posture. This study was designed to investigate whether the angular degrees of FHP, muscular endurance and cervical mobility are affected by DCF training. It also aimed to find the effectiveness of DCF training with a PBU in comparison to conventional DCF training.

The results of our study confirmed that four weeks of DCF training with a PBU improves the cervical mobility and muscular endurance of DCF in subjects with FHP even after four weeks of detraining. Moreover, DCF training with a PBU was more effective than DCF training without a PBU. As mentioned previously, until now, there has been little research regarding the ability of people with FHP to maintain the benefits of DCF training and there are insufficient data to suggest how much these benefits decrease over time. The lack of research in this area limited the possibility for direct comparison with other studies.

Therefore, only a partial discussion of the comparisons of our work with other studies was possible. The results of this study suggest that DCF training with a PBU improves muscular

endurance by facilitating DCF contraction and that stretching exercises induce increases mobility of shortened muscles in subjects with FHP. Consequently, the beneficial effects of this training lasted for up to four weeks following a six-week training program.

Muscular performance can also be increased with the use of PBU training. Craniocervical flexion is the basic action of DCF and craniocervical flexion exercises using a PBU aim to train the longus capitus and colli. The results of our study are similar to earlier studies, which examined the direct application of massage to the longus colli and the results of this on increases of cervical ROM.

In these studies, stretching seemed to improve cervical mobility. Stretching, was conducted with a conventional DCF exercise and consisted of stretches in the neck muscles, shoulders and scapular region. PBU training and stretching are beneficial because stretching the shortened muscles and strengthening the weak muscles are required to achieve these optimal length and strength of those muscles thereby improving muscular performance. In this sense, the results of this study seems logical, as it is generally true that PBU training facilitates effective contraction of the longus colli and flattening of the cervical curve.

The results of this study have some potential limitations. As the endurance of the DCF increase, the degree of cervical lodorsis decreases. Therefore, cervical posture is related more closely to muscular endurance than to muscular strength of the DCF. Unfortunately, no significant changes in craniovertebral angle were shown in this study following DCF training, even though the muscular endurance of the DCF increased significantly. This may have been influenced by musculoskeletal problems in the study's subjects. Additionally, the duration of the follow-up period was too short. Future studies should be designed to address these factors. In conclusion, six weeks of DCF training with a PBU is a useful method for maintaining neck mobility and muscular endurance in people with FHP.

This study demonstrated that there was significant improvement in pressure pain threshold and functional outcome measured by neck disability index in both experimental groups as compared to the control group. Although there are numerous studies that have there are numerous studies that have addressed the issue of manual therapy in neck pain, but no studies have utilized kinesio taping as intervention study in neck pain and so it compliments with previous studies that investigated the effect of progressive pressure release on cervical, thoracic and lumbar range of motion.

The percentage improvement in pressure pain threshold was more in the both experimental groups as compared to the control group. These findings are comparable to the research of (Wilson and Payton, 2003) which showed that low power laser therapy decreases disability and improves function, range of motion in patients with mechanical cervical pain (Wilson, and Payton, 2003).

This improvement in experimental groups possibly may be due to rapid hypo analgesic effects of ultrasound and IF therapy induced analgesia and is generally consistent with the proposed mechanisms of action and is used to treat somatic dysfunctions that result in cervical motion restriction.

5. CONCLUSION

Deep cervical flexor training with a pressure biofeedback unit is a useful method for maintaining neck mobility and muscular endurance in people with forward head posture.

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