

EFFECT OF STERNOCLEIDOMASTOID STRETCHING AND UPPER TRAPEZIUS COUNTERSTRAIN TECHNIQUE ON CERVICAL PAIN, EYE-HAND COORDINATION AND ATTENTION AMONG SMARTPHONE USERS: A RANDOMISED CLINICAL TRIAL

MISS. VISHWESHWARI PRAKASH RAMAPURE

Department of Physiotherapy, Miraj Medical Centre's College of Physiotherapy, Wanless Hospital, Miraj, Maharashtra, India

Guided by: Dr. Vrushali Bhore, MPT

Co-guided by: Dr. B. S. Jebasingh Rajan, MPT

ABSTRACT

Background: Smartphones are widely used for communication, education, entertainment and accessing information. Prolonged smartphone use commonly involves forward-flexed neck and sustained shoulder postures, increasing stress and fatigue in cervical and shoulder muscles. This may contribute to cervical pain and may affect eye-hand coordination, attention and scapular endurance.

Aim: To study the effectiveness of sternocleidomastoid (SCM) stretching and upper trapezius counterstrain technique on cervical pain, eye-hand coordination, attention, scapular endurance and smartphone-related problems among smartphone users.

Material and Method: A randomized clinical trial was conducted among 32 smartphone users aged 18–26 years. Participants received SCM stretching and upper trapezius counterstrain techniques for two weeks. Upper trapezius counterstrain was performed three times per week, while SCM stretching was performed regularly during the intervention period. Pre- and post-intervention assessments were carried out using the Visual Analogue Scale (VAS), Wall Ball Bounce Test (WBBT), Attention Stroop Test, Scapular Endurance Test (SET) and Smartphone Addiction Scale (SAS). Normality was assessed using the Shapiro–Wilk test and within-group changes were analysed using the paired-sample Wilcoxon test.

Results: VAS decreased from 7.28 ± 0.81 to 3.59 ± 0.61 ; WBBT increased from 13.13 ± 2.17 to 32.00 ± 1.72 ; Stroop Test scores decreased from 54.31 ± 2.51 to 39.75 ± 5.05 ; SET increased from 21.13 ± 1.39 to 31.63 ± 1.41 ; and SAS decreased from 48.13 ± 4.96 to 32.66 ± 1.26 . All reported within-group comparisons were statistically significant ($p = 0.001$), with reported effect sizes of approximately $r = 0.87$ – 0.88 .

Conclusion: The two-week programme combining SCM stretching and upper trapezius counterstrain was associated with reduced cervical pain and improved eye-hand coordination, attention, scapular endurance and smartphone-related outcome scores among the studied smartphone users.

Index Terms: Smartphone use, cervical pain, sternocleidomastoid stretching, upper trapezius, counterstrain, eye-hand coordination, attention, scapular endurance.

I. INTRODUCTION

INTRODUCTION

Prolonged smartphone use causes continued mechanical stress on the tendons, muscles and surrounding tissues. Additionally, maintaining the same postures can cause musculoskeletal disorders [1]. The smartphone has become a necessity for most people [4]. Smartphones are used for both communication and entertainment, including messaging, music, media, internet access, photos and games (Arsalan). Straker et al found that using a small video terminal with a smaller screen than a regular desktop computer increased the activity of the muscles surrounding the neck and shoulders, whereas Park et al found that prolonged smartphone use induces fatigue in the cervical erector spinae and upper trapezius muscles. Lee et al. also reported that smartphone use increased pain and muscle fatigue in upper trapezius muscles. Neck pain is a common problem in the general population. [3]

The source of pain may originate from many structures of the cervical spine and can develop into chronic pain. Neck pain is reported to affect between 22%–30% of the population. It is regarded as one of the most common pain problems. The viewing angle of a smaller screen is lower than that of a larger screen. As a result, the person has to bend his/her neck a lot more. The neck was more flexed and the neck extensor muscle activity was noticeably higher at low heights. Excessive smartphone use can cause upper back pain in addicts, which can range from persistent, nagging pain to acute, excruciating pain. The epidemiology of neck pain is significant for several reasons. More information about the size and scope of this issue would facilitate accurate predictions of the need for medical. {Hakkinen A, Salo P}. An adult head weighs 10–12 pounds in its neutral position.[4]. When the head tilts forward,

the forces on the neck increases to 27 pounds at 15 degrees, 40 pounds at 30 degrees, 49 pounds at 45 degrees, and 60 pounds at 90 degrees. At 90 degrees, the model prediction was unreliable. Good posture is defined as keeping one's ears aligned with the shoulder and retracting the angel wings or shoulder blade. Proper alignment reduces spinal stress and is the most efficient position for the spine. . Mechanical and muscular loading occurs with prolonged neck flexion, along with the lack of support for the arms and the repetitive movement of the fingers, especially using one hand only.46% experienced wrist and finger pain using the smartphone's visual display terminal for an extended period of time.

The condition is exacerbated by the use of Smartphone in the room that is not enough lighting then it can cause the eye to do extra work [Power accommodation] which is aggravated by a long time period will cause the eyes easily tired so it can cause pain. An eye coordination is the ability to use motor and visual skills to produce a coordinated movement. Hand eye coordination is the ability to do activities which require the simultaneous use of hand and eyes. The influence of head neck position on the hand grip it was also noted that highest hand grip seen when the patient head neck rotation to left side and similarly the grip is more in rotation than in neutral head position. An eye coordination is the ability to use motor and visual skills to produce a coordinated movement. [5,16]

As professional it is important to prioritize the development of attention skills in children and the negative impact of the mobile phone use within educational environment.is a precious commodity with a fixed central source. All activities compete for access to it, and the concurrent execution of multiple tasks can cause overload on the limited capacity attention. Human processing is divided into two channels: auditory / verbal, which process auditory inputs and verbal visualizations, and visual which process visual inputs and visualizations[6,7,18]

Prolonged smartphone use will likely contribute to increased strain on the upper trapezius muscle, leading to discomfort and musculoskeletal issues. As individual continue to maintain forward head posture and elevated shoulders upper trapezius will become more susceptible to the development of tender points and muscular tightness. [20,12,9]

The upper trapezius counterstrain technique is a gentle manual therapy technique that helps to relieve pain, muscle tenderness, and abnormal muscle tension. Lawrence Jones developed the strain-counterstrain (SCS) positional release technique, which is the foundation of this method. The technique entails locating a tender point in the affected muscle and passively positioning the body in a position of maximum comfort, thereby shortening the involved muscle. This position is held for a set period of time before gradually returning the muscle to its neutral position.[14,1]

An essential postural muscle, the upper trapezius helps move the cervical spine and elevates and rotates the scapula. Long-term smartphone use frequently results in shoulder elevation, cervical flexion, and forward-head posture, all of which can put more strain on the upper trapezius muscles.[12,10]

Persistent exposure to these positions can exacerbate cervical discomfort, weariness, muscle tightness, and tenderness[20]

By putting the muscle in a shortened and comfortable position, the counterstrain technique is suggested to reduce excessive muscle activity and tender point sensitivity. This could lessen pain sensitivity, enhance local circulation, and lessen protective muscle spasm. It is a low-load, non-thrust manual technique that can be used to treat postural neck pain in patients receiving physiotherapy[2,3,4,14]

Stretching is widely recognized as an important component. Stretching is a type of physical exercise in which a specific muscle or tendon is deliberately flexed or stretched to improve the muscle's felt elasticity and achieve comfortable muscle tone. Stretching is widely recognized as an important component. Stretching is a type of physical exercise in which a specific muscle or tendon is deliberately flexed or stretched to improve the muscle's fe It elasticity and achieve comfortable muscle tone. Stretching is widely recognized as an important component. Stretching is a type of physical exercise in which a specific muscle or tendon is deliberately flexed or stretched to improve the muscle's felt elasticity and achieve comfortable muscle tone. [15,20,1]

II. AIM AND OBJECTIVES

Aim: To study the effectiveness of sternocleidomastoid stretching and upper trapezius counterstrain technique on smartphone users.

- To evaluate the effectiveness of sternocleidomastoid muscle stretch on neck pain among smartphone users.
- To analyze the relationship between smartphone-use duration and fine motor coordination using the Wall Ball Bounce Test.
- To analyse the effects of mobile phone overuse on cognitive attention using the Attention Stroop Test.
- To evaluate the effect of SCM stretching and upper trapezius counterstrain technique on cervical pain using the Visual Analogue Scale.
- To evaluate the effect of the intervention on scapular endurance using the Scapular Endurance Test.
- To evaluate the level of smartphone addiction using the Smartphone Addiction Scale.

MATERIAL AND METHOD

The study was a randomized clinical trial conducted over a period of 6 months to evaluate the effect of sternocleidomastoid stretching and upper trapezius counterstrain technique among smartphone users.

The study included 32 smartphone users aged 18–26 years from Sangli district. Participants were selected using convenience sampling according to the predetermined inclusion and exclusion criteria

Participants were included if they were 18–28 years old, of either gender, had a history of neck pain related to prolonged smartphone use and used a smartphone for more than six hours. Participants with recent surgery around the neck or shoulder, fracture around the shoulder or neck region, or a history of neurological disease were excluded.

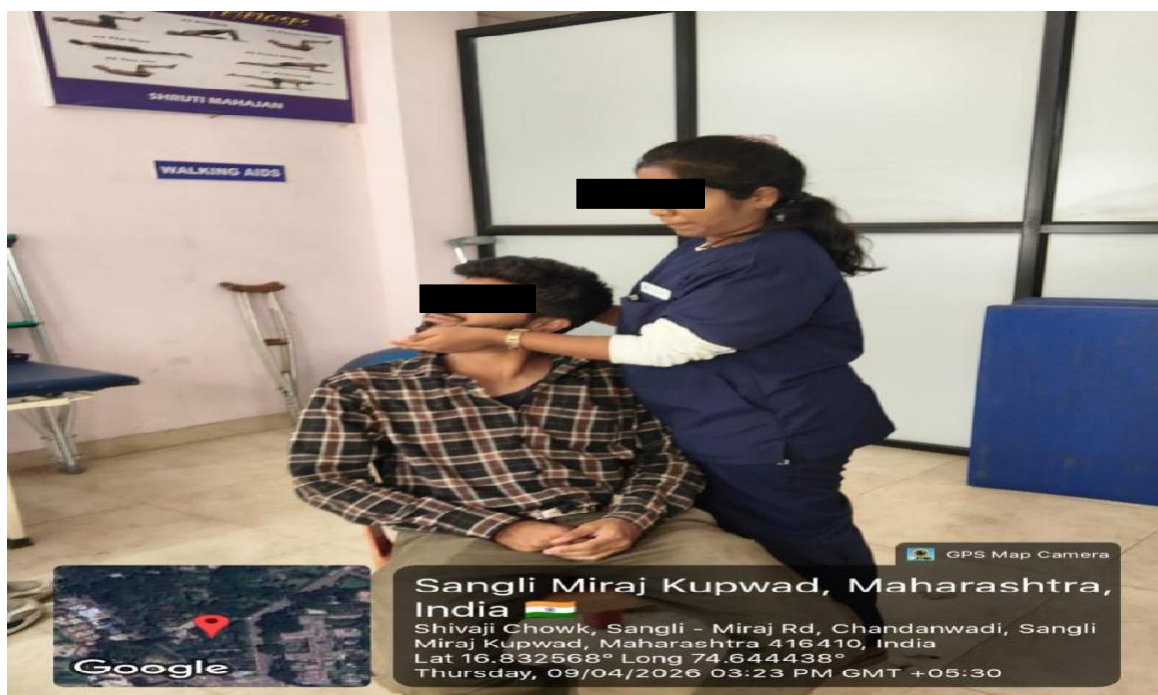
Ethical committee clearance was obtained. The procedure was explained to participants in their vernacular language and written informed consent was obtained before assessment. Pre-intervention assessment was followed by the intervention and post-intervention assessment.

III. A. INTERVENTION PROTOCOL

Upper Trapezius Counterstrain: The participant was positioned supine. The ipsilateral arm was positioned in flexion, abduction and external rotation to reduce reported tender-point pain. Once a position of ease was identified, pressure was applied to the tender point. The technique was performed for two weeks, three times per week, with a 30-second hold followed by 10 seconds of rest.[2]



Sternocleidomastoid Stretching: SCM stretching was performed during the two-week, twice per day and five times per week.[15]



III.B. OUTCOME MEASURES AND STATISTICAL ANALYSIS

Visual Analogue Scale (VAS): A 10-cm scale used to assess pain intensity, ranging from no pain to worst pain.

Wall Ball Bounce Test (WBBT): The participant stood 2 m from a smooth wall and alternately threw a tennis ball with one hand and caught it with the opposite hand for 30 seconds. The test was used to assess eye-hand coordination.[5]

Attention Stroop Test: The assessment included word reading, colour naming and colour-word interference components to assess attention and cognitive interference control.[6]

Scapular Endurance Test (SET): The participant maintained the standardized shoulder position while sustaining a 1-kg load measured using a spring balance. The test assessed scapular endurance.[8]

Smartphone Addiction Scale (SAS): Used to assess problematic or excessive smartphone use.

Descriptive statistics were reported as mean and standard deviation for continuous variables and frequency and percentage for categorical variables. Normality was assessed using the Shapiro–Wilk test. Because the variables did not meet the normality assumption, the paired-sample Wilcoxon test was used for pre- and post-intervention comparisons. Effect size was calculated using the standard correlation coefficient. A p-value <0.05 was considered statistically significant; alpha was set at 5%, confidence interval at 95%, and study power was considered at 80% and above.

IV. RESULTS

A total of 32 smartphone users participated in the study. The participants were aged 18–26 years. The mean age was 21.06 ± 2.16 years. There were 21 females (65.6% when calculated from $n=32$) and 11 males (34.4%). As per reports the gender distribution as 21 females (66%) and 11 males (34%).

Gender	Frequency	Percentage
Female	21	66%
Male	11	34%
Total	32	100%

Table no 1- Gender Distribution

Outcome	Pre-intervention Mean $\pm$ SD	Post-intervention Mean $\pm$ SD	Mean change	p-value	Effect size (r)
VAS	7.28 ± 0.81	3.59 ± 0.61	-3.69	0.001	0.88
WBBT	13.13 ± 2.17	32.00 ± 1.72	+18.88	0.001	0.87
Attention Stroop Test	54.31 ± 2.51	39.75 ± 5.05	-14.56	0.001	0.87
SET	21.13 ± 1.39	31.63 ± 1.41	+10.50	0.001	0.88
SAS	48.13 ± 4.96	32.66 ± 1.26	-15.47	0.001	0.87

Table no 2- Age

All five reported outcomes demonstrated statistically significant pre- to post-intervention changes according to the Wilcoxon analysis reported ($p = 0.001$). The reported effect sizes were approximately $r = 0.87$ – 0.88 .

V. DISCUSSION

In the present study, cervical pain was assessed using the Visual Analogue Scale (VAS). A reduction in VAS score following the intervention suggests that SCM stretching combined with upper trapezius counterstrain help to reduce cervical phone use is frequently associated with forward-head and cervical-flexion postures, which increase the load placed on the cervical and upper trapezius muscles. Increase in the fatigue of cervical and upper trapezius prolonged use smartphone posture³ demonstrated that cervical flexion angle during smartphone use can influence upper trapezius muscle fatigue and pain.⁴ A recent systematic review and meta-analysis further reported that smartphone overuse was associated with a significantly higher risk of neck pain.⁵

The reduction in cervical pain associated with the therapeutic stretching effect on the sternocleidomastoid (SCM) muscle. Tightness of the SCM can contribute to altered cervical alignment and increased mechanical stress on the surrounding musculature. SCM stretching helps improve muscle extensibility, reduce excessive muscular tension, and facilitate pain-free cervical mobility. By decreasing muscular tightness, the intervention helped reduce mechanical loading on the cervical structures, thereby contributing to the observed reduction in cervical pain following treatment.⁶

The upper trapezius is frequently involved during prolonged smartphone use because the muscle contributes to positioning and stabilization of the shoulder girdle. Counterstrain is a gentle manual therapy technique intended to reduce abnormal muscle tension and tenderness. Reduction in upper trapezius tension may decrease local mechanical stress and improve comfort during cervical and shoulder movements. Previous research has demonstrated increased upper trapezius activity and fatigue during smartphone use, particularly when the neck is maintained in a flexed position.^{3,4} Therefore, addressing the upper trapezius together with the SCM have contributed to the reduction in cervical symptoms.^{3,4}

The improvement in cervical symptoms can also be explained by the effect of SCM stretching on soft-tissue flexibility and cervical mobility. Increased SCM tightness can restrict cervical movement and contribute to altered biomechanical loading of the neck. Stretching promotes muscle extensibility, reduction of excessive muscle tone, and improved cervical range of motion, thereby contributing to alleviation of pain and functional discomfort. Previous evidence has demonstrated that SCM stretching combined with massage can produce significant improvements in pain intensity, disability, cervical range of motion, and muscle endurance in individuals with chronic neck pain.⁷

In the present study, eye-hand coordination was assessed using the Wall Ball Bounce Test. Improvement in test performance may indicate better coordination between visual input and upper-limb movement. Smartphone users frequently perform repetitive visual and hand movements, while simultaneously maintaining a relatively static cervical and shoulder posture. Reduction in neck and shoulder discomfort may allow participants to perform the coordination task with less muscular distraction and greater task efficiency. However, improvement in the Wall Ball Bounce Test should not be interpreted as evidence of a direct neurological effect of the intervention. Reduced pain, reduced fatigue and improved attention may also have contributed to improved performance.^{8,9}

Excessive smartphone use has been investigated in relation to upper-extremity function and fatigue. Prolonged smartphone use can influence muscle activity of the upper limb and shoulder and may contribute to discomfort during functional tasks.⁸ Therefore, improvement in eye-hand coordination after treatment may be partly related to improved comfort and reduced muscular fatigue rather than a direct change in visual-motor processing. Further research using standardized coordination measures is required to establish this relationship more clearly.⁸

Attention was assessed using the Stroop Test, which evaluates selective attention, cognitive inhibition, and the ability to manage interference between competing stimuli. Improvement in Stroop performance following the intervention indicates better attentional control and cognitive processing. The test requires participants to focus on the relevant stimulus while suppressing an automatic or habitual response. Smartphone overuse is associated with changes in cognitive control, and individuals with a tendency toward smartphone addiction can show differences in Stroop performance, particularly during tasks involving cognitive interference.¹⁰

The improvement in attention observed after the intervention can be associated with a reduction in cervical discomfort and musculoskeletal pain. Pain and muscular discomfort can act as distracting stimuli and interfere with the ability to maintain concentration during cognitive tasks. Reduction in pain intensity can decrease this physical distraction and allow participants to allocate greater attentional resources toward the task.^{10,11}

Scapular endurance was assessed because smartphone use frequently requires prolonged positioning of the upper limb and shoulder girdle. Maintaining a static posture for a long duration can increase the demand placed on the upper trapezius and other scapular stabilizing muscles. Studies have demonstrated increased muscular fatigue during smartphone use, particularly involving the upper trapezius and cervical muscles.^{3,4}

Improvement in scapular endurance following the intervention may be explained by reduction in excessive muscular tension and fatigue. Although the intervention directly targeted the SCM and upper trapezius, these muscles are functionally related to cervical and scapular posture. Reduction in abnormal muscle tension may allow more efficient shoulder-girdle stabilization. Kim et al. reported that stretching and stabilization exercises reduced muscle fatigue in mobile phone users, particularly in the upper trapezius.¹² This supports the possibility that reducing muscular fatigue can improve functional endurance.¹²

The Smartphone Addiction Scale was used to assess problematic smartphone use. Smartphone addiction is not only a behavioral concern but may also be associated with prolonged exposure to poor postures and musculoskeletal symptoms. A systematic review reported that smartphone use is associated with increased muscle activity, forward-head positioning and musculoskeletal discomfort.^{2,13}

^{2,13}The relationship between smartphone use and neck pain is important when interpreting the present findings. A recent systematic review and meta-analysis involving more than 10,000 participants found that smartphone overuse was associated with a higher risk of neck pain, with a pooled adjusted odds ratio of 2.34.⁵ This supports the concept that prolonged or excessive smartphone use can contribute to cervical musculoskeletal problems.⁵

Longer periods of smartphone use may increase muscular fatigue and pain. A study of adults with forward-head posture found that pain and muscle fatigue increased with longer smartphone-use duration.¹⁴ The authors recommended appropriate posture and breaks during smartphone use. These findings are relevant to the present study because reducing prolonged static posture help prevent recurrence of cervical symptoms.¹⁴

The possible mechanism of improvement following SCM stretching and upper trapezius counterstrain include reduction in muscle tightness, reduction in tenderness, improved soft-tissue mobility and decreased mechanical stress on the cervical region. Treatment of the SCM may also influence upper trapezius symptoms because both muscles contribute to head and neck posture.⁶ Stretching may improve muscle flexibility, while counterstrain reduce excessive muscle tension and tenderness.^{6,7}

Reduction in cervical pain may have influenced the secondary outcomes. When participants experience less pain, they may be able to perform upper-limb activities with greater comfort, maintain better posture and concentrate more effectively during cognitive tasks. Therefore, improvements in eye-hand coordination, attention and scapular endurance may partly reflect the reduction in cervical discomfort rather than a direct effect of the manual techniques on each outcome.^{3,4,10}

VI. LIMITATIONS AND FUTURE RECOMMENDATIONS

- Long-term follow-up could not be performed to determine persistence of mechanical and postural changes.
- Generalized ergonomic training may have reduced adherence or affinity toward postural and muscular adaptation.
- A control group can be included in future studies to determine the specific impact of the intervention.
- Additional pain-perception outcomes may help clarify patterns of nociception and their relationship with reported pain.

VII. CONCLUSION

The present study found statistically significant pre- to post-intervention changes following a two-week programme of sternocleidomastoid stretching and upper trapezius counterstrain among smartphone users. Cervical pain decreased, while Wall Ball Bounce Test performance and scapular endurance increased; Stroop Test and Smartphone Addiction Scale scores also decreased. Overall, the findings suggest that the combined physiotherapy programme was associated with improvement in the selected cervical, functional and smartphone-related outcomes in the studied participants.

VIII. CLINICAL IMPLICATIONS

The findings indicate that SCM stretching and upper trapezius counterstrain may be incorporated into physiotherapy management

for smartphone users presenting with cervical discomfort and muscular fatigue. Clinicians may combine gentle soft-tissue and stretching approaches with education regarding prolonged smartphone posture, appropriate positioning and regular breaks. Further controlled research is needed to clarify the contribution of each treatment component.

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REFERENCES

- Kim SJ, Lee JH. Effect of sternocleidomastoid muscle and suboccipital muscle soft tissue release on muscle hardness and pressure pain of the sternocleidomastoid muscle and upper trapezius muscle in smartphone users with latent trigger points. *Medicine*. 2018;97(36).
- Albert Atienza Meseguer, et al. Immediate effects of the strain/counterstrain technique in local pain evoked by tender points in the upper trapezius muscle. *Clinical Chiropractic*. 2006;6(3):112–118.
- Jagad BH, Jagad KB. Effects of ischaemic compression on the trigger points in upper trapezius muscle. *Indian Journal of Physiotherapy and Occupational Therapy*. 2013;7(1):99–104.
- Nimbi GS, Ronak R, Dipika I, Apeksha V, Urmi B. Difference between ischaemic compression and muscle energy technique on upper trapezius myofascial trigger points: a comparative study. *International Journal of Health and Allied Sciences*. 2013;2(1):17–22.
- Senthil KB, Subbaiah S, Arun B, Alagesan J. Comparison of hand-eye coordination on individuals with and without cervical radiating pain. *Biomedicine*. 2022;42(2):359–625.
- Sadoughi M. The relationship between problematic mobile usage and academic performance among students. *Education Strategies in Medical Sciences*. 2017;10(2):123–132.
- Felisoni DD, Godoi AD. Cell phone usage and academic performance: an experiment. *Computers & Education*. 2018;117:175–187.
- Fischer HA, Holentunder KA, Lemanski AL, Morelli ME. The negative aspects of cell phone: interpersonal communication, effects on youth and academics, health risks, and driving. University of Wisconsin–Whitewater; 2011.
- Choi JH, Jung MH, Yoo KT. An analysis of the activity and muscle fatigue of the muscles around the neck under the three most frequent postures while using a smartphone. *Journal of Physical Therapy Science*. 2016.
- Xie Y, Szeto G, Dai J. A comparison of muscle activity in using touchscreen smartphone among young people with and without chronic neck-shoulder pain. *Ergonomics*. 2016.
- Choi JH, Jung MH, Yoo KT. Smartphone posture and cervical/upper trapezius muscle fatigue. *Journal of Physical Therapy Science*. 2016.
- Lee S, Choi YH, Kim J. Effects of the cervical flexion angle during smartphone use on muscle fatigue and pain in the cervical erector spinae and upper trapezius in normal adults in their 20s. *Journal of Physical Therapy Science*. 2017.
- Chen YJ, Hu CY, Wu WT, et al. Association of smartphone overuse and neck pain: a systematic review and meta-analysis. *Postgraduate Medical Journal*. 2025.
- Kim SJ, Lee JH. Effects of sternocleidomastoid muscle and suboccipital muscle soft tissue release on muscle hardness and pressure pain of the sternocleidomastoid muscle and upper trapezius muscle in smartphone users with latent trigger points. *Medicine (Baltimore)*. 2018;97(36).
- Büyükturan B, Şaş S, Karartı C, Büyükturan Ö. The effects of combined sternocleidomastoid muscle stretching and massage on pain, disability, endurance, kinesiophobia, and range of motion in individuals with chronic neck pain: a randomized, single-blind study. *Musculoskeletal Science and Practice*.
- Xie Y, Szeto GPY, Dai J. Prevalence and risk factors associated with musculoskeletal complaints among users of mobile handheld devices: a systematic review. *Applied Ergonomics*. 2017.
- Xie Y, Szeto GPY, Dai J, Madeleine P. A comparison of muscle activity in using touchscreen smartphone among young people with and without chronic neck-shoulder pain. *Ergonomics*. 2016;59(1).
- Zhang T, Gong N, Jia R, Li H, Ni X. Stroop effect in smartphone addiction among college students. *Medicine (Baltimore)*. 2021;100(30):e26741.
- Jiang Z, Zhao X, Li C. Self-control predicts attentional bias assessed by online shopping-related Stroop in high online shopping addiction tendency college students. *Comprehensive Psychiatry*. 2017.
- Kim HY, Yeun YR, Kim SJ. Preventive effects of stretching and stabilization exercises on muscle fatigue in mobile phone users. *Journal of Physical Therapy Science*. 2016;28(9).
- Musculoskeletal disorder and pain associated with smartphone use: a systematic review of biomechanical evidence. *Journal of Medical and Biological Engineering*. 2019.
- Effect of duration of smartphone use on muscle fatigue and pain caused by forward head posture in adults. *Journal of Physical Therapy Science*. 2016;28(6).

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