Laodikya Rehabilitasyon Bilimleri Dergisi/Journal of Laodikeia Rehabilitation Sciences

İletilme Tarihi (Submitted Date): 19.02.2025 Kabul Tarihi (Accepted Date): 19.03.2025
Makale Türü (Article Type): Araştırma Makalesi/ Research Article
2025;3(1):10-17 doi: 10.5281/zenodo.15277916

Forward Head Posture: Examination from Biomechanical, Postural, and Therapeutic Perspectives – Current Literature and Rehabilitation Methods

Baş Önde Postür: Biyomekanik, Postüral ve Terapötik Yaklaşımlar Açısından İncelenmesi Güncel Literatür ve Rehabilitasyon Yöntemleri

Gürkan DEMİRTAŞ 1, Nevin A. GÜZEL 2
[1]Department of Physiotherapy and Rehabilitation, Nigde Omer Halisdemir University, Faculty of Bor Health Sciences, Nigde, Türkiye
[2]Department of Physiotherapy and Rehabilitation, Gazi University, Faculty of Health Sciences, Ankara, Türkiye

Öz

Baş Önde Postür (BÖP), başın öne doğru yer değiştirdiği bir postüral bozukluk olup servikal-torasik-omuz bölgesini etkileyen en yaygın postüral anormalliklerden biridir. Bu yer değişikliği ile birlikte, C0-C2 segmentlerinde ekstansiyon ve lordoz artışı gözlemlenirken, C2-C7 segmentlerinde fleksiyon artışı ve lordoz azalması meydana gelir. Meydana gelen bu postüral değişikliklere çevre kaslar, uzayarak veya kısalarak uyum sağlamaktadır. Omurganın birbirine bağlı kinetik bir zincir olarak çalıştığı göz önünde bulundurulduğunda, nötral spinal hizadan sapma diğer omurga eğrilerinde de telafi edici değişikliklere neden olmaktadır. Bu bağlamda, BÖP; torasik kifoz, yuvarlak omuzlar ve skapular diskinezi gibi postüral anormalliklerle yakından ilişkilidir.

BÖP'ün tedavi planlamasında bireyin duruş özellikleri, ağrı kaynakları ve kas dengesizliklerinin detaylı değerlendirilmesi esastır. Tedavide germe, güçlendirme, stabilizasyon, düzeltici egzersizler, kas enerji teknikleri ve manuel terapi gibi fizyoterapi yöntemleri kullanılmaktadır. Çalışmalar, çok yönlü tedavi yaklaşımlarının daha etkili olduğunu göstermektedir. Egzersiz programlarının etkinliği değişkenlik göstermekle birlikte, en yaygın kullanılan yaklaşımlar, kas dengesini sağlamak amacıyla zayıflamış kasları güçlendirme ve kısalmış kasları esnetme üzerine odaklanmaktadır.

Derin boyun fleksörleri ve skapular kasların güçlendirilmesi, BÖP'ün düzeltilmesinde kritik bir rol oynar.Sternokleidomastoid(SCM)kasının aktivasyonunun azaltılması, derin boyun fleksörlerinin aktivasyonunu artırarak postürün düzeltilmesine katkı sağlar. Çeşitli tedavi yaklaşımları etkili olmakla birlikte, çok yönlü bir yaklaşım en kapsamlı sonuçları sağlamaktadır

Anahtar kelimeler: Baş önde postür, Biyomekanik, Çok yönlü tedavi, Egzersiz, Terapötik

Abstract

Forward Head Posture (FHP) is a postural disorder in which the head shifts forward, making it one of the most common postural abnormalities affecting the cervical-thoracic-shoulder region. This displacement is accompanied by an increase in extension and lordosis in the C0-C2 segments, whereas the C2-C7 segments experience increased flexion and reduced lordosis. The surrounding muscles adapt to these postural changes by either lengthening or shortening. Considering that the spine functions as a connected kinetic chain, any deviation from the neutral spinal alignment leads to compensatory changes in other spinal curves. In this context, FHP is closely associated with postural abnormalities such as thoracic kyphosis, rounded shoulders, and scapular dyskinesis.

A detailed assessment of an individual's posture, pain sources, and muscle imbalances is essential in planning the treatment of FHP. Physiotherapy methods such as stretching, strengthening, stabilization, corrective exercises, muscle energy techniques and manual therapy are used in treatment. Studies indicate that multimodal treatment approaches are more effective. While the effectiveness of exercise programs varies, the most commonly used approaches focus on strengthening weakened muscles and stretching shortened muscles to restore muscle balance.

Strengthening deep neck flexors and scapular muscles plays a crucial role in correcting FHP. Reducing the activation of the sternocleidomastoid (SCM) muscle enhances the activation of deep neck flexors, contributing to postural correction. Although various treatment approaches are effective, a multimodal approach provides the most comprehensive results.

Key Words: Forward head posture, Biomechanics, Multimodal treatment, Exercise, Therapeutics.

Corresponding Author: Gürkan Demirtaş
E-mail: gdemirtas255@gmail.com
ORCID: 0000-0002-0741-4519

Laodikya Rehabilitasyon Bilimleri Dergisi/Journal of Laodikeia Rehabilitation Sciences

İletilme Tarihi (Submitted Date): 19.02.2025 Kabul Tarihi (Accepted Date): 19.03.2025
Makale Türü (Article Type): Araştırma Makalesi/ Research Article
2025;3(1):10-17 doi: 10.5281/zenodo.15277916

1. Introduction

Forward Head Posture (FHP) is a postural deviation in which the head is positioned anterior to its normal alignment. It is one of the most prevalent postural abnormalities affecting the cervical-thoracic-shoulder region. It has become increasingly common due to modern lifestyle factors, particularly excessive computer and smartphone use (1). If FHP is maintained for an extended period, the functional resting length of the cranio-cervical muscles may change, and over time, FHP can become the individual's "natural" posture (2,3).

The pathomechanics of FHP are typically not attributed to a single specific cause but rather result from the combination of multiple contributing factors. This interplay of factors can disrupt postural balance, triggering the development of FHP. Consequently, the imbalance between agonist and antagonist muscles leads to an uneven distribution of loads in the cervical and occipital regions, causing excessive tension or weakness in the muscles, ligaments, and joint structures of these areas. This condition not only predisposes individuals to postural pain and dysfunction but also restricts head and neck movements, potentially leading to chronic postural issues over time (3). Therefore, this review aims to contribute to the literature by providing a comprehensive investigation of the biomechanical and postural changes associated with FHP alongside therapeutic approaches, offering a holistic perspective that integrates both mechanical alterations and evidence-based treatment strategies.

2. Biomechanical and postural changes

FHP induces various alterations in the segmental alignment of the cervical vertebrae. In FHP, an anterior sagittal displacement is observed in all segments from the occiput to C7, progressively increasing from T1 towards the occiput (4–6). Along with this displacement, an increase in extension and lordosis is noted in the C0-C2 segments, whereas in the C2-C7 segments, an increase in flexion is accompanied by a reduction in lordosis (5). These alterations also lead to various adaptations in the surrounding soft tissues. In general, cervical extensors and occipital flexors elongate, whereas cervical flexors and occipital extensors shorten. Unlike other muscles, the splenius capitis, one of the occipital extensor muscles, elongates because it originates from the spinous processes of the lower cervical and upper thoracic vertebrae and inserts onto the mastoid process. During FHP, as the lower cervical vertebrae undergo flexion, the mastoid process moves anteriorly, resulting in the elongation of the muscle (4).

In the misalignment caused by FHP, the most pronounced flexion in the lower cervical vertebrae is observed at the C4-5 and C5-6 segments. The muscles spanning these segments include the semispinalis cervicis, superficial multifidus muscles (T1-C4 and T1-C5), and deep multifidus muscles (C5/6-C3 and C6/7-C4), which are the most elongated muscles in the cervical region, proportionally to the severity of flexion. In contrast, the extension occurring in the C0-C2 segment leads to the shortening of the suboccipital muscles. The muscles exhibiting the most remarkable percentage change in length are the rectus capitis posterior major and rectus capitis posterior minor in the suboccipital region. In contrast, among the occipital muscles, only the obliquus capitis inferior remains unaffected by the sagittal positional change (4–6) (Table 1).

In a normal posture, the gravity line aligns along a path passing through the external auditory meatus, cervical vertebral bodies, and the acromion (7). In this state, the external moments generated by gravitational and ground reaction forces on the joints are counterbalanced by the internal moments produced by surrounding muscles and other soft tissue structures. However, when this balance is disrupted, a misalignment occurs between the center of mass and the gravity line. This misalignment imposes additional loads on the surrounding tissues, prompting the body to develop various compensatory mechanisms to accommodate the increased mechanical demands (1).

A deviation from the neutral spinal alignment can lead to compensatory changes in other spinal curves, considering that the spine functions as a connected kinetic chain. In this context, FHP is closely associated with postural abnormalities such as thoracic kyphosis, rounded shoulders, and scapular dyskinesis (8). The deep neck flexors, upper back extensors, and shoulder adductors weaken compared to their antagonists, leading to muscle imbalances in the upper quarter of the body. This

Corresponding Author: Gürkan Demirtaş
E-mail: gdemirtas255@gmail.com
ORCID: 0000-0002-0741-4519

Laodikya Rehabilitasyon Bilimleri Dergisi/Journal of Laodikeia Rehabilitation Sciences

İletilme Tarihi (Submitted Date): 19.02.2025 Kabul Tarihi (Accepted Date): 19.03.2025
Makale Türü (Article Type): Araştırma Makalesi/ Research Article
2025;3(1):10-17 doi: 10.5281/zenodo.15277916

Table 1. Alterations in Cervical Muscle Length in Forward Head Posture (2, 3)

Elongated Muscles	Shortened Muscles	Unaffected Muscles
Occipital flexors	*Occipital extensors*	*Cervical flexors*
○ Rectus capitis anterior	○ Longissimus capitis	○ Posterior scalene
○ Rectus capitis lateralis	○ Semispinalis capitis	
○ Longus capitis	○ Sternocleidomastoid	*Occipital extensors*
	○ Rectus capitis posterior major	○ Obliquus capitis inferior
Cervical extensors	○ Rectus capitis posterior minor	
○ Longissimus cervicis	○ Obliquus capitis superior	
○ Ilıocostalis cervicis	○ Upper trapezius	
○ Levator scapulae		
○ Multifidus, deep	*Cervical Flexors*	
○ Mulitifidus, superficial	○ Longus colli	
○ Semispinalis cervicis	○ Anterior scalene	
○ Splenius Cervicis	○ Middle scalene	
Occipital extensors		
○ Splenius capitis		

* Changes in Muscle Lengths After Inducing FHP by Increasing Occiput-T1 Sagittal Vertical Alignment by 26 mm (ΔSVA = 26 mm) from Neutral Posture (2, 3)

imbalance results in FHP, abnormal protraction, and increased thoracic kyphosis (9). An increased upper thoracic kyphosis is a significant risk factor for developing FHP (10). Although there is a consensus that FHP, rounded shoulders, and thoracic kyphosis frequently coexist, it remains unclear whether these conditions are causative factors for one another or merely consequences of a common underlying issue.

The FHP results in various regional and systemic consequences. One of the primary effects is the alteration in muscle length due to postural imbalances, which disrupt the interaction between actin and myosin filaments, ultimately reducing muscle strength and endurance (11). The activation of deep neck muscles decreases due to FHP, while the activity of superficial neck muscles increases (12). The increased activation of superficial muscles leads to more significant muscle fatigue. The fatigue of these superficial muscles further weakens the deep cervical muscles, exacerbating muscle fatigue and creating a vicious cycle (13). Secondly, the disruption of normal vertebral alignment increases the load on surrounding joint capsules and ligaments, leading to microtrauma. These microtraumas cause elongation of capsular ligaments, abnormal ligament-muscle reflexes, and excessive movement in the facet joints, eventually contributing to cervical instability. Instability is characterized by abnormal mobility in spinal segments, posing a long-term threat to spinal health (13). Thirdly, the cervical region plays a central role in balance and proprioceptive control. The suboccipital muscles provide essential proprioceptive information for coordinating head position and eye and head movements due to their higher spindle density per gram compared to other neck muscles (14,15). In FHP, the shortening of the suboccipital muscles and alterations in their activation can lead to proprioceptive deficits, negatively impacting head and neck muscle function, reaction time, postural stability, and postural control (16).

The dysfunctions caused by FHP highlight the necessity of treatment. The primary goals of treatment include restoring biomechanical balance, reducing the load on the musculoskeletal system, and preventing long-term complications. This process is essential for achieving

Corresponding Author: Gürkan Demirtaş
E-mail: gdemirtas255@gmail.com
ORCID: 0000-0002-0741-4519

Laodikya Rehabilitasyon Bilimleri Dergisi/Journal of Laodikeia Rehabilitation Sciences

İletilme Tarihi (Submitted Date): 19.02.2025 Kabul Tarihi (Accepted Date): 19.03.2025
Makale Türü (Article Type): Araştırma Makalesi/ Research Article
2025;3(1):10-17 doi: 10.5281/zenodo.15277916

proper posture, alleviating neck pain and headaches, enhancing cervical mobility, and improving balance and overall quality of life.

3. Materials and Methods

In this narrative review, a literature search was conducted using the PubMed database to identify studies reporting on the efficacy of various therapeutic approaches to FHP. The search was narrowed to randomized controlled trials between 2015 and 2025 covering the last 10 years (17-24, 26-29). The interventions were compared with a control group, no treatment or sham treatment. The following search terms were used: forward head posture, upper crossed syndrome, exercise, and treatment. Additional study was found by analyzing the reference lists of the articles (25). Outcome measures were the craniovertebral angle measured to determine FHP.

4. Therapeutic Approaches

Various physiotherapeutic methods and exercises are utilized in treating FHP and managing its associated symptoms. Karimian et al. reported that a group receiving a self-myofascial release, stretching, and strengthening exercises in combination with ergonomic education showed improvements in FHP, kyphosis, and rounded shoulder angles (17). Similarly, Nitayarak et al. found that a scapular stabilization exercise program, conducted over 12 sessions within four weeks, improved FHP and rounded shoulder angles while increasing the flexibility of the pectoralis minor muscle. Additionally, scapular stabilization exercises alone have increased the craniovertebral angle (18). Additionally, when scapular stabilization exercises are combined with postural correction exercises, they have been found to be more effective in managing forward head posture (FHP) than postural correction exercises alone (19). Yaghoubitajani examined the effects of strengthening exercises for cervical and scapular muscles, instructing one group to perform them under online home-based supervision and another group to execute them unsupervised at their workplace. Both intervention groups reported improvements in neck-shoulder pain, FHP, rounded shoulders, and kyphosis (20).

In a study by Lee et al., one group performed Pilates-based stretching and strengthening exercises while the other group engaged in traditional stretching and strengthening exercises. Although both groups improved pain levels, only the Pilates-based exercise group significantly improved FHP measurements (21). Ruivo et al. reported that a 32-week traditional cervical, thoracic, and shoulder muscle stretching and strengthening exercise program significantly improved the craniovertebral angle (CVA) and sagittal head angle (22). In a study by Shih, both Kinesio taping and therapeutic exercises improved FHP immediately after the intervention and at the two-week follow-up. However, therapeutic exercises were reported to be more effective than taping (23). Another study reported that while eye exercises, when added to cervical manual therapy and stabilization exercises, did not affect the CVA, they contributed to relieving nerve compression and promoting muscle relaxation in the neck (24). Unlike other studies, Mulet et al. reported that the four-week Racabados 6x6 exercise program, which includes exercises such as tongue resting position, cranio-cervical flexion, chin-tuck, and shoulder retraction, was insufficient for correcting FHP (25).

Considering the relationship between the T1 slope and the C2-C7 lordotic angle, reducing the T1 slope may help decrease hyperextension in the C2-C7 segments. Therefore, upper and mid-thoracic spinal manipulation has been suggested as a potential treatment approach for patients with FHP (6). A study comparing a group receiving upper thoracic vertebra mobilization in addition to exercise with a group receiving upper cervical vertebra mobilization alongside exercise reported that the group undergoing upper thoracic vertebra mobilization exhibited a more significant increase in the CVA (26). This result suggests that reducing the degree of kyphosis plays a critical role in managing FHP.

In a study by Gillani comparing eccentric muscle energy technique and static stretching, cervical segmental mobilization, TENS, and infrared therapy were additionally applied to both groups. The findings indicated improvements in postural angles in both groups, with no significant difference in effectiveness between the two treatment combinations (27). Similarly, Aneis et al. compared a four-week multimodal treatment program including muscle energy technique (MET), cervical and

Corresponding Author: Gürkan Demirtaş
E-mail: gdemirtas255@gmail.com
ORCID: 0000-0002-0741-4519

İletilme Tarihi (Submitted Date): 19.02.2025 Kabul Tarihi (Accepted Date): 19.03.2025
Makale Türü (Article Type): Araştırma Makalesi/ Research Article
2025;3(1):10-17 doi: 10.5281/zenodo.15277916

scapulothoracic stabilization exercises, ergonomic recommendations, and postural correction education with MET alone. They found significant improvements in FHP, rounded shoulders, pain intensity, and functional disability, concluding that a multimodal treatment approach is more efficacious (28). Additionally, myofascial rolling was more effective in dental students suffering from upper crossed syndrome than MET techniques in reducing pain intensity and correcting postural deviations (29).

5. Discussion

A recent systematic review and meta-analysis indicates that exercise therapy has very low to strong evidence in improving FHP (30–32). Stretching, strengthening, stabilization, corrective exercises, muscle energy techniques, manual therapies, and myofascial release are the treatment options for correcting FHP and managing its associated symptoms. However, there is no conclusive evidence regarding which exercise is the most effective or whether any particular exercise is superior to others (30–32). It has been suggested that a multimodal approach, incorporating not only stretching and strengthening but also proprioception, active correction, and neuromuscular training, can enhance the effectiveness of treatment (30,31,33). A meta-analysis demonstrated that exercise training increased the CVA by 4.5 degrees in individuals with neck pain and by 4.58 degrees in those without neck pain (32). However, studies have reported considerable variability in these angular changes. While Nitayarak et al. found a mean increase of 3.26 degrees in the CVA to be statistically significant (18), Aneis et al. reported a statistically significant increase of 9.73 degrees (28). The exact degree to which an increase in CVA can be considered clinically significant remains unknown.

A literature review indicates that the most commonly used approach for postural abnormalities focuses on restoring the balance between agonist and antagonist muscles by strengthening weakened, elongated, and stretching shortened muscles (31,34). These exercises target the cervical region and involve the upper thoracic and periscapular muscles. In this context, therapeutic exercises for FHP aim to stretch shortened neck and back muscles, such as the sternocleidomastoid, levator scapulae, scalene muscle group, and pectoralis major and minor, while strengthening deep neck flexors, including the longus colli, longus capitis, and anterior scalene. A recent study reported that the most frequently included stretching and strengthening exercises in FHP intervention programs are sternocleidomastoid, pectoral muscle, chin-tuck, and scapular retraction exercises (34). This result indicates that the most effective treatment approach for FHP involves addressing the muscles of the cervical-thoracic-shoulder complex as an integrated unit.

Scapular muscles play a crucial role in neck and shoulder stability and mobility. The rhomboids, trapezius, and serratus anterior are the primary stabilizers of the scapula, contributing significantly to maintaining its proper position and ensuring an optimal scapulothoracic rhythm (35). However, these muscles tend to elongate and weaken in response to increased thoracic kyphosis and rounded shoulder posture commonly associated with FHP. This imbalance disrupts the relationship between the humerus and the glenoid cavity, leading to increased internal rotation of the arm. Consequently, this condition may result in weakness and elongation of the external rotator muscles while causing shortening of the internal rotator muscles (9). Scapular stabilization exercises have been shown to play a significant role in correcting FHP by effectively addressing scapular muscle strength imbalances and activation patterns (18,19).

Deep neck flexors are key in maintaining normal cervical lordosis and correcting alignment. In FHP, these muscles weaken and exhibit reduced activation, leading to decreased cervical stabilization (13). As is well known, the sternocleidomastoid (SCM) plays a key role in FHP (36). With postural changes, the shortening and increased activation of the SCM, along with the elongation and decreased activation of its antagonist muscle group, the cervical flexors, lead to an imbalance in muscle strength and activation. A reduction in SCM activation subsequently increases the activation of the deep neck flexors (37). Therefore, cranio-cervical flexion exercises, such as chin-tuck, are crucial in activating and strengthening the deep neck flexor muscles. Along with retraining the muscle activation patterns, stretching and reducing the activation of the suboccipital and SCM muscles are key factors in cervical stabilization and

Corresponding Author: Gürkan Demirtaş
E-mail: gdemirtas255@gmail.com
ORCID: 0000-0002-0741-4519

Laodikya Rehabilitasyon Bilimleri Dergisi/Journal of Laodikeia Rehabilitation Sciences

İletilme Tarihi (Submitted Date): 19.02.2025 Kabul Tarihi (Accepted Date): 19.03.2025
Makale Türü (Article Type): Araştırma Makalesi/ Research Article
2025;3(1):10-17 doi: 10.5281/zenodo.15277916

treating FHP (13,36,37).

The suboccipital muscles are the most shortened and activated in FHP (4,5). Excessive contraction of these muscles and the over-release of acetylcholine by the neuromuscular junction can lead to tight bands that compress the capillaries supplying the muscle, resulting in muscle ischemia. This condition causes the release of metabolites and inflammatory molecules, which activate nociceptors and sensitize proprioceptors (13). MET is a manual therapy method commonly used to reduce tension in the musculoskeletal system, increase the range of motion, and correct muscle imbalances. (38). In participants with FHP, applying MET to shortened and overactive muscles, such as the suboccipital extensors, can potentially reduce muscle tension and activation, thus minimizing factors such as tension and circulation issues that may lead to trigger point formation. Therefore, MET can play a role in relaxing tense muscles and eliminating trigger points in treating FHP, offering a practical approach to treatment and symptom management (27,28).

Neck pain is closely associated with FHP (5,6). However, it is not fully understood whether FHP causes pain or if pain leads to the development of FHP. An increase in thoracic kyphosis has been associated with a gradual reduction in the neural foramina of the cervical segments. Interestingly, FHP results in the expansion of the neural foramina (10). This situation raises the question: Is the patient adopting a forward head position as a compensatory mechanism to alleviate pain? The answer to this question plays a critical role in treating FHP. Suppose the cause of the pain is pressure on the nerves exiting the neural foramina, and the treatment for FHP is focused solely on correcting cervical muscle imbalances or performing exercises that force the head into a neutral position. In that case, the patient's symptoms are likely to worsen. Therefore, after a thorough anamnesis and evaluation, if it is determined that the pain is due to nerve root compression, the appropriate approach would be first to correct the increased thoracic kyphosis, followed by a holistic treatment of the cervical-thoracic-shoulder complex.

6. Conclusion

The FHP disrupts the biomechanical balance of the cervical, thoracic, and shoulder complex, leading to pain, dysfunction, and postural issues. The literature indicates that various approaches, including stretching, strengthening, stabilization, corrective exercises, and manual therapies, effectively treat FHP. Multimodal treatment approaches provide more comprehensive outcomes by targeting regional and systemic effects. A detailed assessment of an individual's postural characteristics, pain sources, and muscle imbalances is essential in treatment planning. In conclusion, adopting a holistic approach to treating FHP is crucial for long-term recovery and preventing complications.

Disclosure of interest: The authors report there are no competing interests to declare.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors

References

1. Singla D, Vegar Z. Associtian Between Forward Head, Rounded Shoulders, and Increased Thoracic Kyphosis: A Review of the Literature. J Chiropr Med. 2017;16(3):220-9.
2. Lee TH, Liu TY. Postural and muscular responses while viewing different heights of screen. Int J Occup Saf Ergon. 2013;19(2):251–8.
3. Neumann DA. Kinesiology of the Musculoskeletal System, Foundations for Rehabilitation. Third Edition. Elsevier; 2017:391–436.
4. Khayatzadeh S, Kalmanson OA, Schuit D, Havey RM, Voronov LI, Ghanayem AJ, et al. Cervical Spine Muscle-Tendon Unit Length Differences Between Neutral and Forward Head Postures: Biomechanical Study Using Human Cadaveric Specimens. Phys Ther. 2017;97(7):756–66.
5. Patwardhan AG, Khayatzadeh S, Havey RM, Voronov LI, Smith ZA, Kalmanson O, et al. Cervical sagittal balance: a biomechanical perspective can help clinical practice. Eur Spine J. 2018;27(Suppl 1):25–38.
6. Patwardhan AG, Havey RM, Khayatzadeh S, Muriuki

Corresponding Author: Gürkan Demirtaş
E-mail: gdemirtas255@gmail.com
ORCID: 0000-0002-0741-4519

İletilme Tarihi (Submitted Date): 19.02.2025 Kabul Tarihi (Accepted Date): 19.03.2025
Makale Türü (Article Type): Araştırma Makalesi/ Research Article
2025;3(1):10-17 doi: 10.5281/zenodo.15277916

MG, Voronov LI, Carandang G, et al. Postural Consequences of Cervical Sagittal Imbalance: A Novel Laboratory Model. Spine (Phila Pa 1976). 2015;40(11):783–92.

7. Conroy VM., Murray Brian, Alexopulos Quinn, McCreary Jordan, Kendall FP. Kendall's muscles : testing and function with posture and pain. Sixth edition. Lippincott Williams & Wilkins; 2023

8. Lv P, Peng Y, Zhang Y, Ding K, Chen X. Kinematic Causes and Exercise Rehabilitations of Patients with Round Shoulder, Thoracic Kyphosis and Forward Head Posture (FHP). Epidemiology: Open Access. 2016;6(5):1000263.

9. Sepehri S, Sheikhhoseini R, Piri H, Sayyadi P. The effect of various therapeutic exercises on forward head posture, rounded shoulder, and hyperkyphosis among people with upper crossed syndrome: a systematic review and meta-analysis. BMC Musculoskelet Disord. 2024;25(1):105.

10. Smith ZA, Khayatzadeh S, Bakhsheshian J, Harvey M, Havey RM, Voronov LI, et al. Dimensions of the cervical neural foramen in conditions of spinal deformity: an ex vivo biomechanical investigation using specimen-specific CT imaging. Eur Spine J. 2016;25(7):2155–65.

11. Wilson JM, Loenneke JP, Jo E, Wilson GJ, Zourdos MC, Kim JS. The effects of endurance, strength, and power training on muscle fiber type shifting. J Strength Cond Res. 2012;26(6):1724–9.

12. Falla DL, Jull GA, Hodges PW. Patients with neck pain demonstrate reduced electromyographic activity of the deep cervical flexor muscles during performance of the craniocervical flexion test. Spine (Phila Pa 1976). 2004;29(19):2108–14.

13. Sung YH. Suboccipital Muscles, Forward Head Posture, and Cervicogenic Dizziness. Medicina (Kaunas). 2022;58(12):1791.

14. Armstrong B, McNair P, Taylor D. Head and neck position sense. Sports Med. 2008;38(2):101–17.

15. Liu JX, Thornell LE, Pedrosa-Domellöf F. Muscle spindles in the deep muscles of the human neck: A morphological and immunocytochemical study. Journal of Histochemistry and Cytochemistry. 2003;51(2):175–86.

16. Armstrong BS, McNair PJ, Williams M. Head and neck position sense in whiplash patients and healthy individuals and the effect of the cranio-cervical flexion action. Clin Biomech (Bristol, Avon). 2005;20(7):675–84.

17. Karimian R, Rahnama N, Ghasemi G, Lenjannejadian S. Photogrammetric Analysis of Upper Cross Syndrome among Teachers and the Effects of National Academy of Sports Medicine Exercises with Ergonomic Intervention on the Syndrome. J Res Health Sci. 2019;19(3):e00450.

18. Nitayarak H, Charntaraviroj P. Effects of scapular stabilization exercises on posture and muscle imbalances in women with upper crossed syndrome: A randomized controlled trial. J Back Musculoskelet Rehabil. 2021;34(6):1031–40.

19. Abd El-Azeim AS, Mahmoud AG, Mohamed MT, El-Khateeb YS. Impact of adding scapular stabilization to postural correctional exercises on symptomatic forward head posture: a randomized controlled trial. Eur J Phys Rehabil Med. 2022;58(5):757–66.

20. Yaghoubitajani Z, Gheitasi M, Bayattork M, Andersen LL. Corrective exercises administered online vs at the workplace for pain and function in the office workers with upper crossed syndrome: randomized controlled trial. Int Arch Occup Environ Health. 2022;95(8):1703–18.

21. Lee S-M, Lee C-H, O'sullivan D, Jung J-H, Park J-J. Clinical effectiveness of a Pilates treatment for forward head posture. J Phys Ther Sci. 2016;28(7):2009-13.

22. Ruivo RM, Carita AI, Pezarat-Correia P. The effects of training and detraining after an 8 month resistance and stretching training program on forward head and protracted shoulder postures in adolescents: Randomised controlled study. Man Ther. 2016;21:76–82.

23. Shih HS, Chen SS, Cheng SC, Chang HW, Wu PR, Yang JS, et al. Effects of Kinesio taping and exercise on forward head posture. J Back Musculoskelet Rehabil. 2017;30(4):725–33.

24. Park SH, Oh YJ, Lee MM. Improving Function and Quality of Life in Patients with Chronic Neck Pain, Tension-Type Headache, and Forward Head Posture: The Role of Eyeball Exercise and Cervical Stabilization Programs. Med Sci Monit. 2024;30:e944315.

25. Mulet M, Decker KL, Look JO, Lenton PA, Schiffman EL. A randomized clinical trial assessing the efficacy of adding 6 x 6 exercises to self-care for the treatment of masticatory myofascial pain. Volume 21, Issue 4, Pages 318 - 328. 2007;21(4):318–28.

26. Cho J, Lee E, Lee S. Upper thoracic spine mobilization and mobility exercise versus upper cervical spine

Corresponding Author: Gürkan Demirtaş
E-mail: gdemirtas255@gmail.com
ORCID: 0000-0002-0741-4519

İletilme Tarihi (Submitted Date): 19.02.2025 Kabul Tarihi (Accepted Date): 19.03.2025
Makale Türü (Article Type): Araştırma Makalesi/ Research Article
2025;3(1):10-17 doi: 10.5281/zenodo.15277916

mobilization and stabilization exercise in individuals with forward head posture: a randomized clinical trial. BMC Musculoskelet Disord. 2017;18(1):525.

27. Gillani SN, Qurat-Ul-Ain, Rehman SU, Masood T. Effects of eccentric muscle energy technique versus static stretching exercises in the management of cervical dysfunction in upper cross syndrome: a randomized control trial. J Pak Med Assoc. 2020;70(3):394–8.

28. Aneis YM, El-Badrawy NM, El-Ganainy AEA, Atta HK. The effectiveness of a multimodal approach in the treatment of patients with upper crossed syndrome: A randomized controlled trial. J Bodyw Mov Ther. 2022;32:130–6.

29. Sasun AR, Jawade S, Chitale N. Measuring the Efficacy of Myofascial Rollers and Post-isometric Relaxation Technique in Relieving Pain Intensity and Postural Deviation Using Plumb Line Assessment for the Treatment of Upper Cross Syndrome in Dental Undergraduate (UG) Students. Cureus. 2022;14(10):e29831.

30. Chang MC, Choo YJ, Hong K, Boudier-Revéret M, Yang S. Treatment of Upper Crossed Syndrome: A Narrative Systematic Review. Healthcare (Basel). 2023;11(16):2328.

31. Chaudhuri S, Chawla JK, Phadke V. Physiotherapeutic Interventions for Upper Cross Syndrome: A Systematic Review and Meta-Analysis. Cureus. 2023;15(9):e45471.

32. Sheikhhoseini R, Shahrbanian S, Sayyadi P, O'Sullivan K. Effectiveness of Therapeutic Exercise on Forward Head Posture: A Systematic Review and Meta-analysis. J Manipulative Physiol Ther. 2018;41(6):530–9.

33. Porto AB, Nascimento Guimarães A, Alves Okazaki VH. The effect of exercise on postural alignment: A systematic review. J Bodyw Mov Ther. 2024;40:99–108.

34. Titcomb DA, Melton BF, Miyashita T, Bland HW. Evidence-Based Corrective Exercise Intervention for Forward Head Posture in Adolescents and Young Adults Without Musculoskeletal Pathology: A Critically Appraised Topic. J Sport Rehabil. 2022;31(5):640–4.

35. Cools AMJ, Struyf F, De Mey K, Maenhout A, Castelein B, Cagnie B. Rehabilitation of scapular dyskinesis: from the office worker to the elite overhead athlete. Br J Sports Med. 2014;48(8):692–7.

36. Çobanoğlu G, Yusuf Demirkan M, Ecemiş ZB, Güzel NA, Üniversitesi G, Fakültesi SB, et al. Forward Head Posture and Its Effect on Muscle Activation. Gazi Sağlık Bilimleri Dergisi. 2024;9(1):85–93.

37. Arshadi R, Ghasemi GA, Samadi H. Effects of an 8-week selective corrective exercises program on electromyography activity of scapular and neck muscles in persons with upper crossed syndrome: Randomized controlled trial. Phys Ther Sport. 2019;37:113–9.

38. Sbardella S, La Russa C, Bernetti A, Mangone M, Guarnera A, Pezzi L, et al. Muscle Energy Technique in the Rehabilitative Treatment for Acute and Chronic Non-Specific Neck Pain: A Systematic Review. Healthcare (Basel). 2021;9(6):746.

Corresponding Author: Gürkan Demirtaş
E-mail: gdemirtas255@gmail.com
ORCID: 0000-0002-0741-4519