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Mobile Device-Related Neck Pain as a Limiting Factor for Sport Participation in Young Adults

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ABSTRACT

Background

Regular physical activity plays an important role in maintaining health among young adults. Nevertheless, musculoskeletal symptoms affecting the cervical region may limit engagement in sport and exercise. The growing use of smartphones is associated with prolonged static postures that can contribute to cervical discomfort and functional limitations. Such symptoms may influence training quality, range of motion and the overall level of sport participation.

Aim

The aim of this review was to evaluate the potential relationship between cervical musculoskeletal pain associated with prolonged mobile device use and sport participation among young adults.

Material and methods

This study is based on a narrative review of literature examining the association between mobile device use, neck pain and participation in physical activity. The literature search included databases such as PubMed, Scopus and Google Scholar. Studies published between 2017 and 2025 addressing posture-related issues, cervical discomfort and physical activity participation were included in the analysis.

Results

The analyzed studies indicate that prolonged smartphone use is commonly associated with forward head posture, cervical muscle fatigue and reduced neuromuscular efficiency. These factors may contribute to discomfort during sport activities and may discourage regular training.

Conclusions

Cervical discomfort related to prolonged mobile device use may represent a modifiable factor influencing sport participation. Preventive strategies including ergonomic education, postural awareness and cervical strengthening exercises may help support sustained engagement in physical activity.

Keywords: neck pain, physical activity, athletic performance, musculoskeletal diseases, young adult

1. INTRODUCTION

Regular participation in physical training and sport is widely recognized as an essential component of maintaining physical fitness, musculoskeletal health and functional capacity in young adults. Despite well-established health benefits, a significant proportion of individuals within this population demonstrate insufficient levels of training involvement. Among the factors potentially contributing to reduced sport participation are musculoskeletal complaints affecting the cervical region, which may limit the ability to engage in exercise requiring upper body stabilization, postural control, or sustained upright positioning.

Neck pain is one of the most prevalent musculoskeletal disorders worldwide and represents a growing public health concern, particularly among young adults. According to recent Global Burden of Disease estimates, neck pain ranks among the leading causes of disability and contributes significantly to reduced functional capacity and decreased quality of life across various populations [1]. The prevalence of non-specific neck pain has increased substantially in recent years, particularly among individuals exposed to prolonged static cervical loading associated with handheld device use [2].

In recent years, the widespread use of smartphones has emerged as a potential lifestyle-related factor influencing musculoskeletal health. Prolonged use of handheld devices often involves sustained neck flexion and forward head posture, which may contribute to the development of cervical discomfort and fatigue. These symptoms may impair the ability of young adults to tolerate training loads during resistance exercise, running, or team sport participation requiring sustained head stabilization and upper body coordination.

The rapid development of digital technologies has resulted in widespread adoption of mobile devices, with smartphones becoming an integral part of daily functioning in academic and recreational contexts. Young adults are currently among the most active users of handheld electronic devices, frequently engaging in prolonged smartphone use throughout the day [3, 4]. Sustained use of mobile devices is commonly associated with non-neutral postures involving cervical flexion and forward head positioning, which may increase mechanical load on the cervical spine and surrounding musculoskeletal structures [1, 5].

Biomechanical studies suggest that increased cervical flexion angles during mobile device use may significantly elevate compressive forces acting on the cervical spine, contributing to muscle fatigue, ligament strain and postural imbalance over time[6]. These factors may promote the development of musculoskeletal discomfort and functional limitations within the cervical region, particularly in populations exposed to repetitive or prolonged static loading conditions[7].

Importantly, musculoskeletal pain related to mobile device usage may negatively influence on engagement in structured exercise by contributing to movement avoidance and reduced exercise tolerance. Pain associated functional limitations have been identified as potential barriers to engagement in structured training sessions or sport participation, thereby increasing the risk of sedentary behaviour and long term musculoskeletal dysfunction and impaired athletic performance [6, 7]. As physical inactivity is a well-established risk factor for

chronic disease development, understanding the relationship between smartphone related neck pain and reduced movement behaviour is of increasing importance from both clinical and public health perspectives.

Given the growing reliance on digital technologies among young adults, further investigation into the impact of lifestyle related postural strain on cervical spine health is warranted. Therefore, the aim of this narrative review is to examine the influence of smartphone-related cervical musculoskeletal strain on training tolerance, sport-specific motor control and exercise performance in young adults, with particular emphasis on biomechanical consequences and potential preventive strategies[8, 9].

1.1 Epidemiology of Mobile Device Usage in Young Adults

The widespread adoption of smartphones has substantially altered daily movement exposure among young adults. Mobile device usage is currently integrated into academic and recreational routines, resulting in prolonged periods of sustained static posture that may influence musculoskeletal readiness for physical training including the ability to maintain cervical stabilization during dynamic sport-specific tasks such as sprinting, resistance training or change-of-direction movements. Epidemiological evidence suggests that university students frequently engage in handheld device use for several hours per day without maintaining appropriate cervical alignment, which may contribute to cumulative mechanical loading of structures involved in sport-specific movement [10].

Prolonged smartphone usage is commonly associated with sustained cervical flexion and forward head positioning, which may contribute to increased mechanical stress on the cervical spine and surrounding musculoskeletal structures. Cross-sectional studies conducted among young adult populations have demonstrated a significant relationship between increased duration of handheld device use and the prevalence of neck pain symptoms [11, 12]

Furthermore, recent investigations indicate that prolonged screen exposure is associated with a higher prevalence of musculoskeletal discomfort within the cervical region among university students and young working adults. Individuals engaging in prolonged daily mobile device use have been reported to demonstrate significantly higher levels of neck pain compared to those with shorter daily exposure [13]

Excessive smartphone exposure may contribute to suboptimal neuromuscular readiness prior to physical training by promoting prolonged low-load static positioning of the cervical spine [14].

The increasing reliance on digital technologies has also been associated with reduced tolerance to mechanical loading during sport training and exercise conditioning, which may further contribute to cervical musculoskeletal disorders. As screen-based exposure increasingly replaces time allocated to spontaneous physical activity and structured training, smartphone-related cervical strain may represent an emerging risk factor for reduced sport participation and impaired exercise performance among young adults [15, 16].

1.2 Biomechanical Consequences of Forward Head Posture

Forward head posture is commonly observed among young adults engaging in prolonged screen exposure and is considered a significant postural deviation affecting cervical spine alignment. This posture is typically characterized by anterior displacement of the head relative to the trunk, resulting in increased cervical flexion and altered distribution of mechanical loads across the cervical spine [17, 18].

Sustained maintenance of forward head posture during smartphone use may lead to increased mechanical stress acting on musculoskeletal structures within the cervical region. Biomechanical analyses indicate that prolonged cervical flexion may elevate compressive forces exerted on cervical intervertebral discs and surrounding soft tissues, potentially contributing to muscular fatigue and ligament strain over time [19].

Furthermore, abnormal head posture has been associated with altered muscle activation patterns involving both superficial and deep cervical musculature. Increased activity of cervical extensor muscles has been observed during smartphone use, which may result in muscle imbalance and reduced endurance capacity [20].

Forward head positioning may also influence joint kinematics and spinal stability. Changes in head alignment have been shown to alter the distribution of forces across cervical facet joints and intervertebral discs, thereby increasing the risk of microtrauma and degenerative changes within the cervical region [21].

Additionally, sustained non-neutral alignment of the cervical spine may impair proprioceptive function and neuromuscular control, potentially impairing head–trunk

coordination, upper limb force transfer and movement efficiency during sport-specific motor tasks [22]. In athletic populations, these alterations may negatively affect movement economy, visual tracking during dynamic tasks and load distribution during resistance exercise.

Taken together, these biomechanical adaptations may contribute to the development and persistence of neck pain symptoms among young adults engaging in prolonged mobile device use. Understanding these biomechanical adaptations is essential for identifying movement-related risk factors that may impair exercise tolerance and sport-specific motor performance [23, 24].

From a sport performance perspective, these biomechanical adaptations may influence movement efficiency during activities requiring upper limb coordination, trunk stabilization, or sustained visual tracking. Impaired cervical proprioception and reduced neuromuscular control may compromise head–trunk coordination during dynamic tasks such as running, ball sports, or resistance training, potentially increasing fatigue and decreasing exercise tolerance.

2. FUNCTIONAL LIMITATIONS ASSOCIATED WITH SMARTPHONE-RELATED NECK PAIN

Smartphone-related neck pain may contribute to functional limitations that directly affect participation in sport and exercise among young adults. Prolonged engagement in screen-based tasks requiring sustained cervical flexion has been associated with reduced cervical range of motion and decreased muscular endurance within the neck region, which may impair performance during activities requiring upper body stabilization, dynamic movement, or sustained upright posture [25].

Functional impairments related to neck discomfort may include reduced ability to maintain upright posture during static activities, as well as increased fatigue during tasks requiring prolonged head positioning. Individuals reporting smartphone-related neck pain have been shown to demonstrate decreased tolerance for sustained postural demands, which may negatively influence performance during sport training sessions or structured exercise tasks [10].

Furthermore, altered cervical alignment associated with forward head posture may contribute to deficits in neuromuscular control and proprioceptive function. These impairments may affect postural stability and movement coordination, potentially limiting an individual's ability to engage in regular sport-specific activity [2, 26].

Functional limitations related to neck discomfort may extend to sport-specific activities requiring upper limb force generation, trunk stabilization and cervical alignment during overhead or contact-based movement patterns. Individuals reporting smartphone-related neck pain may demonstrate reduced tolerance for training sessions involving resistance exercises, overhead movements, running, or cycling due to increased fatigue within the cervical musculature. These impairments may negatively influence sport-specific motor control, movement efficiency and exercise performance [27].

Additionally, persistent neck pain may contribute to movement avoidance behaviours, which may further reduce participation in structured sport training and impair exercise tolerance [28]. Reduced engagement in physical training may in turn exacerbate musculoskeletal dysfunction and contribute to the persistence of pain symptoms over time.

Taken together, these findings suggest that smartphone-related neck pain may significantly influence exercise performance among young adults, potentially limiting their ability to participate in structured training sessions and sport-specific activities [5, 29].

3. IMPACT OF SMARTPHONE-RELATED NECK PAIN ON PHYSICAL ACTIVITY PARTICIPATION

Smartphone-related neck pain may negatively influence performance during training sessions among young adults by contributing to discomfort during movement and reduced exercise tolerance including decreased ability to sustain training intensity and maintain technical execution during repetitive sport movements. Individuals experiencing persistent neck pain associated with prolonged mobile device usage may demonstrate decreased willingness to engage in recreational or competitive sport participation due to perceived discomfort during head and upper body movements[29].

Musculoskeletal symptoms affecting the cervical region have been associated with functional impairments that may limit participation in activities requiring postural control or sustained movement. Reduced muscular endurance and increased fatigue within the cervical musculature may impair an individual's ability to perform exercises involving upper body stabilization or prolonged upright posture, such as resistance training, team sports including volleyball or football, as well as running or cycling that require sustained head positioning [26].

Furthermore, habitual forward head posture associated with smartphone use may contribute to altered movement patterns and decreased neuromuscular efficiency. These

biomechanical adaptations may increase the likelihood of discomfort during physical exertion, potentially discouraging regular engagement in athletic tasks, including participation in sport training sessions, gym-based conditioning, or recreational competitive activities [17].

Pain-related movement avoidance behaviours may also play a role in reducing activity levels among individuals experiencing smartphone-related neck discomfort. Individuals reporting musculoskeletal symptoms associated with prolonged mobile device use may demonstrate reduced participation in structured training sessions and organized sport activities requiring cervical stabilization or dynamic upper body engagement [10, 16].

Reduced engagement in physical activity may in turn contribute to further musculoskeletal dysfunction, thereby creating a cycle of inactivity and persistent pain. As physical inactivity has been identified as a risk factor for chronic musculoskeletal disorders, the relationship between smartphone-related neck pain and reduced movement behaviour warrants further attention [11].

Taken together, smartphone-related neck pain may represent a potential barrier to regular structured exercise participation among young adults, thereby influencing overall functional capacity and long-term musculoskeletal health [21].

4. PREVENTION STRATEGIES FOR SMARTPHONE-RELATED NECK PAIN

Given the increasing prevalence of smartphone-related neck pain among young adults, the implementation of preventive strategies aimed at reducing musculoskeletal strain is of considerable importance. Prolonged engagement in mobile device use has been associated with sustained cervical flexion and altered head alignment, which may increase mechanical stress acting on the cervical spine [30].

Ergonomic interventions aimed at promoting neutral head posture during smartphone use may contribute to a reduction in cervical loading and associated musculoskeletal discomfort. Maintaining appropriate viewing angles and minimizing prolonged static postures during mobile device use have been identified as potential strategies for reducing strain within cervical musculature [31].

Targeted conditioning of cervical and upper thoracic musculature may enhance tolerance to sport-specific loading patterns and improve postural stability during training [32].

Furthermore, postural education programs focusing on awareness of head alignment during mobile device use may contribute to improved movement patterns and reduced

biomechanical stress acting on the cervical spine. Such interventions may support the maintenance of functional capacity and promote healthier behavioural habits among young adults [33].

Early identification of musculoskeletal discomfort associated with prolonged mobile device usage may also facilitate timely implementation of preventive measures. Addressing ergonomic and lifestyle related risk factors may reduce the likelihood of developing persistent neck pain and associated functional limitations [34].

Taken together, preventive strategies incorporating ergonomic adjustments, postural awareness and regular physical activity may contribute to maintaining sport participation and training capacity among young adults. Implementation of targeted exercise programs aimed at improving cervical muscle endurance and postural control may support continued engagement in both recreational and competitive physical activity despite lifestyle-related postural strain. A summary of preventive strategies for smartphone-related neck pain is presented in Table 1.

Table 1. Summary of preventive strategies for smartphone-related neck pain

(based on [5,13,19,21,30–35]).

Intervention Type	Description	Sport-related Outcome	Expected Result
Ergonomic adjustment	Maintaining neutral head posture during smartphone use	Reduced cervical muscle strain	Decreased neck discomfort

Postural education	Increasing awareness of head alignment during screen-based activities	Improved postural control	Lower risk of musculoskeletal fatigue
Strengthening exercises	Targeted cervical and upper thoracic muscle training	Increased muscular endurance	Improved functional capacity
Regular physical activity	Incorporating daily movement and exercise routines	Enhanced postural stability	Reduced susceptibility to fatigue
Screen time management	Limiting prolonged smartphone usage duration	Decreased cumulative cervical loading	Reduced risk of persistent neck pain
Movement breaks	Introducing frequent posture changes during device use	Improved circulation and muscle recovery	Prevention of static muscle fatigue
Stretching exercises	Cervical and upper trapezius stretching routines	Increased range of motion	Reduced stiffness in cervical region

Workplace ergonomics	Adjusting workstation and device positioning	Improved spinal alignment	Reduced biomechanical stress
Postural correction programs	Structured posture training interventions	Improved neuromuscular control	Enhanced movement efficiency

5. DISCUSSION

The present review highlights the potential role of prolonged smartphone use as a contributing factor to cervical musculoskeletal strain among young adults. While the epidemiological evidence suggests a relationship between mobile device usage and neck pain prevalence, the underlying mechanisms appear to be multifactorial and related to both biomechanical and behavioural adaptations associated with sustained static cervical loading associated with prolonged handheld device use. Forward head posture, commonly adopted during mobile device use, may alter load distribution across cervical spine structures and increase the activation demands placed on cervical extensor muscles [29].

In addition to mechanical loading, habitual engagement in prolonged static postures may influence neuromuscular control and postural stability. Altered muscle activation patterns observed in individuals using handheld devices may compromise cervical stabilization required for efficient force transmission between the upper and lower kinetic chain during sport-specific movement, thereby increasing susceptibility to fatigue and discomfort during training sessions or exercise performance [11]. These adaptations may become particularly relevant in populations characterized by limited movement variability and extended exposure to sedentary behaviours.

Text neck pain may contribute to functional limitations that directly affect participation in sport and exercise among young adults. Prolonged engagement in screen-based tasks requiring sustained cervical flexion has been associated with reduced cervical range of motion and decreased muscular endurance within the neck region, which may impair performance during activities requiring upper body stabilization, dynamic movement, or sustained upright

posture [21]. Over time, such behavioural adaptations may contribute to decreased muscular endurance and impaired functional performance.

Reduced engagement in structured training sessions may limit opportunities for maintaining muscular strength and endurance required for sport performance. In physically active populations, decreased training frequency associated with pain-related movement avoidance may contribute to progressive deconditioning, thereby impairing movement efficiency and overall exercise tolerance [15].

From a sport science perspective, cervical musculoskeletal pain may act as a functional barrier to participation in physical activity among young adults. Individuals experiencing neck discomfort may be less likely to engage in structured exercise programs, resistance training sessions, or recreational sports requiring dynamic upper body involvement. This avoidance behaviour may contribute to decreased physical fitness and increased sedentary time, potentially leading to further musculoskeletal dysfunction and reduced long-term sport participation.

Preventive strategies such as ergonomic education, regular posture correction and strengthening exercises for the cervical and upper back muscles may help reduce the risk of neck pain associated with prolonged mobile device use.

6. CONCLUSIONS

Cervical musculoskeletal pain associated with prolonged screen exposure may represent an important and potentially modifiable barrier to effective participation in structured sport training and conditioning programs among young adults. Sustained cervical flexion and forward head posture may contribute to functional impairments affecting postural control, movement efficiency and muscular endurance during sport and exercise [10].

Epidemiological evidence suggests that prolonged smartphone use may be associated with a higher prevalence of neck pain symptoms and reduced cervical muscle endurance in young adult populations. These functional limitations may negatively influence participation in structured sport training and exercise programs by contributing to discomfort during movement and reduced ability to tolerate sport-specific training loads [13].

Furthermore, habitual forward head motor control associated with handheld device use may lead to altered neuromuscular control and decreased postural stability, potentially limiting an individual's ability to tolerate sport-specific training loads [29]. Reduced participation in

physical activity may in turn contribute to further musculoskeletal dysfunction, thereby creating a cycle of inactivity and persistent pain.

Preventive strategies incorporating postural education, ergonomic awareness and targeted strengthening exercises may support continued participation in sport despite lifestyle-related postural strain associated with mobile device use [28]. Early identification of lifestyle-related risk factors associated with prolonged mobile device use may also support the implementation of targeted interventions aimed at improving functional capacity and maintaining musculoskeletal health.

These limitations may negatively influence engagement in structured training programs, resistance exercises and recreational sports requiring dynamic upper body involvement or sustained upright positioning. Reduced athletic performance may, in turn, contribute to decreased physical fitness and increased sedentary behaviour, potentially exacerbating musculoskeletal dysfunction over time.

Taken together, smartphone-related neck pain may represent a potential barrier to regular participation in sport and structured exercise among young adults, highlighting the importance of targeted training interventions aimed at maintaining cervical muscular endurance and movement efficiency.

Disclosure

The authors declare that they have no relevant financial or non-financial interests to disclose.

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Data sharing is not applicable to this article as no new data were created or analyzed in this study.

Conflict of interest

The authors declare no conflict of interest.

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During the preparation of this work, the authors used ChatGPT (OpenAI 5.2) to improve language clarity, grammar and readability of the manuscript. After using this tool, the authors carefully reviewed and edited all generated material as needed and take full responsibility for the final content of the publication.

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