REVIEW

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Q-angle and postural stability: a review of the relationship and implications for fall risk

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ABSTRACT

Introduction: One of the condition common types of muscular distortion is retrieved Q-angle and postural stability. The function lower extremities with all the structures assist postural stability in most static postures and dynamic movements or activities. The changes in the Q-angle and postural stability contribute to the development risk of falling. This study aimed to examine the relationship and implications of Q-angle and postural stability for fall risk.

Methods: This study uses a literature review by conducting data through an electronic database such as Pedro, Pubmed, and Google Scholar. They had discussed approximately Q-angle, postural stability, and fall prevention with selection by inclusion and exclusion criteria.

Results: We discovered three research related articles. The studies examined the relationship and implications of Q-angle and postural stability for fall risk. The results of those studies, Q-angle and postural stability had a correlate and implication for fall risk.

Conclusion: Q-angle and postural stability are related to the risk of falling. The risk of falling can be decreased by reducing the Q-angle and improving postural stability. Additionally, it can be achieved through exercise or orthotics to helps reduce the risk of falls, which will eventually avoid injuries.

Keywords: fall risk, postural stability, Q-angle.

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INTRODUCTION

The ability to evenly transfer bending, torsional, shear, and compressive forces should be a property of lower limbs. The unnatural movement might result from an improper distribution of these forces, which would then add additional pressure.[1] Damage to the body's soft tissues and a lack of muscles are potential results of this condition. One of the condition common types of muscular distortion is retrieved Q-angle and postural stability. Alignment of the knee may change as a result of this knee, which disturbs the incoming forces on the knee by moving the line of gravity from its normal position to the inner section of the knee.[2]

A typical incorrect movement pattern in the lower extremities can also be affected the trunk, hip, leg, and foot. The changes in biomechanics and lower extremity morphology caused the variations in the proprioceptive signals feedback thus influencing postural control strategies.[3] People who have increased Q-angle have excessive adduction and international rotation brought on by knee and hip flexion, which decreases the patellofemoral joint contact area. In addition, increasing Q-angle has weaker quadriceps femoris muscle.[4]

The function lower extremities with all the structures assist postural stability in most static postures and dynamic movements or activities. Postural stability is the capacity to maintain balance and adjustment reactions in a gravitational environment. Poor stability can cause poor balance which is linked to a higher risk of injury in a number of populations.[5] A fall is one of the risk injuries that might result from these things. Falls can result in nonfatal injuries such as fractures and brain injuries, and falls are the second greatest cause of unintentional injury-related deaths among individuals[6].

Numerous studies have demonstrated that changes in the lower extremity's alignment and postural stability contribute to the development of injuries.[7-8] The direct impact of lower extremity alignment and postural stability on the risk of falling, however, has not been emphasized. In fact, the position of the knee and postural stability can affect our daily activities. Therefore, the purpose of the current study was to examine the relationship and implications of Q-angle and postural stability for fall risk.

METHODS

The method of this study is a literature review or study of literature articles. The literature was searched through an electronic databases such as Pedro, Pubmed, and Google Scholar. They had been discussed approximately Q-angle, postural

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stability, and fall prevention. The studies included in this study is they were: publish from 2013-2023, in English, and reported about Q-angle and postural stability for fall risk, clinical trial study, experimental study, experimental study, systemic review and meta-analysis, review article, and randomized controlled trial. The studies have been excluded from this study if the result of the study is not reported and they are not mentioned Q-angle, postural stability, and fall risk. For the selected study was conducted in the flow chart below.

RESULTS

Based on the search results, we discovered three research related articles. The studies examined the relationship and implications of Q-angle and postural stability for fall risk. In the sample selection, samples were excluded from the study if had any vestibular and visual problems, neurological or orthopedic disorders, lower limb injury leading to walking difficulty, and those who received medications disrupting the balance control.[9-11]

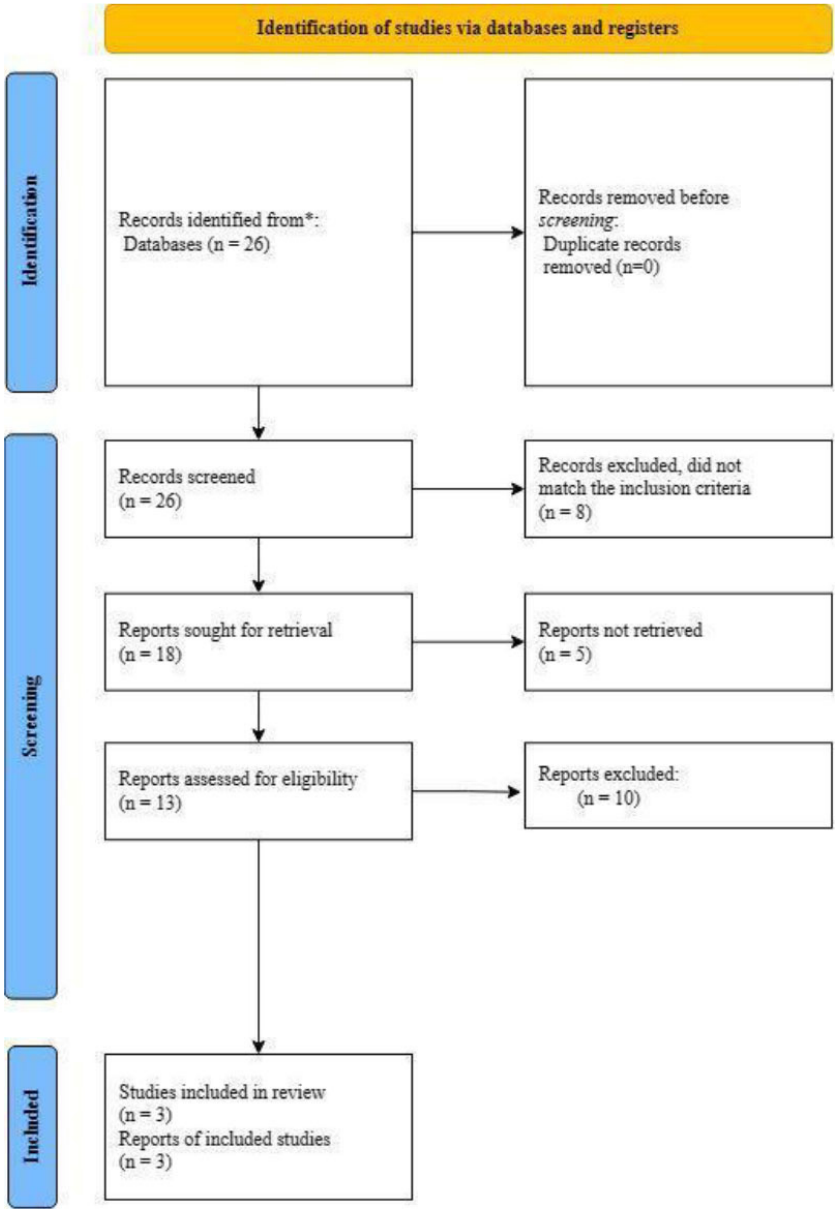

Figure 1. Flow Chart Diagram

Bozbas (2018) found that the fall index and the Q-angle had a moderately positive correlation. Furthermore, the study demonstrated that the fall index was statistically significantly affected by the Q-angle, arch index, and foot position angle by 40%. This study also examined the somatosensory response by the motor function of the lower extremities that measuring by F56. As a result, neuromuscular control is compromised, reflex muscle actions are impractical, and the risk of falling rises when proprioception is compromised. The result showed that the Q-angle was the most useful metric for the F56 and was connected with it in the number of positions. We concluded that one of the causes of a higher fall risk was the Q angle.[9]

Rodrigues (2022) discovered that could increase stability and body control by conducting 45 minutes of muscular strength exercise. The muscular strength group increased postural stability and reduced predicted fall risk by 7.9% relative to baseline after the first training week. This study showed that strength exercise substantially improved postural control that can affect significantly lowered fall risk evaluations. Additionally, with significant improvements in the initial months of exercise, the interventions were able to slow the rate at which postural control deteriorated.[10]

According to Safee (2023), fatigue significantly improves postural stability. This result correlated fatigue to postural sway specifically with the anterior-posterior and mediolateral center pressures. Based on the assessment of fall risk, the result showed that the score percentage increased after fatigue. Additionally, the results found a significant correlation between overall postural stability and fall risk after fatigue. The increased postural sway can indirectly increase the fall risk due to the positive correlation between fall risk and the overall stability index (OSI).[11]

DISCUSSION

Falls are a serious public health concern that has a detrimental impact on physical function and quality of life. The potential of falls can occur if lack of consideration of the factors that lead to the occurrence. Body alignment and postural stability are both directly related to body posture, which can influence the risk of falling.[12] Abnormal body alignments of the lower extremity result in the

musculoskeletal system's adaptation to kinetic and kinematic events during walking or another movement and repetitive mechanical loading that can affect Q-angle.[13] Greater Q-angle in terms of motor control might have various causes, such as the strength of hip muscles, trunk stability, foot pronation, etc.[14]

An essential sign of the lower extremity alignment problem is the Q-angle. The quadriceps muscle's strength is measured by the Q-angle, and an increase in this angle affects the mechanical impact of the power produced by the quadriceps femoris. It has been demonstrated that this increase may also have an impact on the neuromuscular response and the reaction time of the quadriceps reflex.[15] Another explanation for the effect of the increase in Q-angle on the stability index and, thus, on the risk of falls, may be that it is unable to cause adequate muscle responses by affecting quadriceps power. Additionally, it influences the center of pressure control, specifically in the medial-lateral component, which may change the postural stability.[9]

Postural stability is known as maintaining, obtaining, or regaining a condition of balance throughout any posture or activity. Somatosensory, vestibular, and visual signals are sent to motor control centers. Then exert control over the muscles involved in the postural response. Keeping the body's center of mass safely inside the base of support is the primary goal of postural stability.[16] The sensory stimulation information from these systems produces specific circumstances to engage the muscles to resist gravity and to activate the balance system, thus preventing the fall.[17] Another important variable that raises the risk of falling is regarded to be postural stability.[18]

The ability of the senses to adapt balance control in order to prevent negative reactions brought on by internal or external disturbances is crucial for maintaining postural stability, which lowers the risk of falls[19-20]. Sensorimotor control dysfunction can change the neuromuscular system and may result in problematic movement patterns.[21] Besides that, postural stability requires functional neuromuscular control, which refers to the timing of muscles to provide the appropriate force. In order, to reduce the fall risk, adequate neuromuscular control of the body is required.[22]

CONCLUSION

The current studies have shown that Q-angle and postural stability are related to fall risk. An increase in the Q-angle leads to decreased postural control which can also affect the postural stability. Poor postural stability might increase the risk of falling. The risk of falling can be decreased by reducing the Q-angle and improving postural stability. Additionally, correcting Q-angles and enhancing postural stability through exercise or orthotics helps reduce the risk of falls, which will eventually avoid injuries.

CONFLICT OF INTEREST

The authors declare there is no conflict of interest in this study.

AUTHORS CONTRIBUTIONS

KTYW collected, compiled the study design, and drafted the manuscript; AAIAFA and IDGAK reviewed and edited the manuscript.

ETHICAL CONSIDERATION

This study reviewed the previous literature. Thus this study does not need to obtain ethical clearance.

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