Postural Control and Balance in Ankylosing Spondylitis

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Abstract

Ankylosing spondylitis (AS) is a chronic inflammatory disease characterised by inflammatory back pain and the formation of syndesmophytes which lead to ankylosis. Postural deviation in AS patients is caused by increased thoracic kyphosis and hip flexion which then causes the centre of body weight to shift anteriorally. As a compensation mechanism, knee flexion and plantar flexion develop. Although it has been estimated that the typical deformities which occur may have a negative effect on postural balance, there are very few studies on this subject and contradictory results have been obtained. In this study, it was aimed to evaluate the changes in the musculoskeletal system of AS patients and to examine the effects of these on postural control and balance.

Key Words: Ankylosing spondilitis, postural changes, balance

(Rec.Date: Sept 30, 2014 Accept Date: Oct 05, 2014)

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Introduction

Ankylosing spondylitis is a chronic inflammatory disease of unknown etiology characterised by enthesis with peripheral joint and axial skeletal involvement [1-3]. The general prevalence of AS has been reported as 0.1-1.4% [4]. Although it is seen in white races at 0.5-1%, it is extremely rare in black races [5]. It is most often seen in males aged 20-40 years [6,7]. The general complaints of AS are pain, mechanical stiffness and reduced range of movement in the axial system. Mechanical stiffness is reflected in advanced fusion of the affected joints and adjacent vertebral segments [4]. While the sacroiliac joints are affected in the early stage, peripheral joint involvement can be seen at the advanced stage [8-10]. Clinical findings may be mild stiffness in the morning and peripheral joint involvement may be in the form of severe bilateral hip involvement or entire spine fusion concomitant to non-joint involvement [8]. Non-joint involvement may be seen as acute anterior uveitis, aortic failure, cardiac conduction defects, and fibrosis in the superior lobe of the lungs, neurological involvement and secondary renal amyloidosis [8-10]. AS may show differences in clinical course, sometimes starting insidiously, progressing slowly and relapses and remissions may be seen [11].

The fusions occurring in the spine lead to impairments in spine movements and have further importance in terms of reducing the capabilities of performing daily living activities [12]. In AS patients, continuing posture and movement disorders such as loss of spinal mobility, restricted movement of the peripheral joints and reduction in chest exapansion may develop [11]. Spinal and surrounding joint involvement may lead to physical restrictions and disability. Poor posture and impaired mobility increase the tendency to fall [6]. More than one system is used in achieving postural stability, such as the vestibular, visual, somatosensorial and musculoskeletal systems. In AS, the musculoskeletal system is affected, which is related to the motor responses of postural control and the other systems are intact. Muscle shortness, atrophy and joint restrictions cause reductions in joint range of movement and loss of joint flexibility and together these cause loss of balance and impairments in postural balance [13,14].

Although it can be predicted that the typical deformities in AS patients will have a negative effect on postural balance, there are extremely few studies on this subject and contradictory results have been obtained [15,16]. In the first study in literature examining the relationship of

AS and postural balance, Murray et al showed a higher rate of impaired balance in AS patients compared to healthy individuals [13]. However, in a later study, no impairment could be shown in the postural stability of AS patients [14].

The aim of this study was to evaluate the changes in the musculoskeletal system of AS patients and their effect on postural control and balance.

Postural Control and Balance

Posture is the combination of body postions taken with each movement of the joints. In other words, the optimal position of each part of the body in harmony with adjacent segments and the rest of the body [17-19]. Evaluation of the senses is controlled by sensory input and neuromuscular response. The sensory input includes the vestibular, visual and proprioceptive systems. An effective motor response requires a healthy neuromuscular system and sufficient muscle strength [20]. In this context, a healthy neuromuscular system to provide balance, requires sufficient muscle strength to return to the centre of gravity within the support basis when there is an imbalance between the motor response and balance. As loss of balance usually occurs in situations related to movements such as walking, it has been reported that it is necessary to achieve balance control in both dynamic and static positions [21,22].

Spinal Changes and Posture

In AS, pain, inflammation and increased mechanical locking of the affected joints are known to be contributing factors to changes in the posture [23]. Spinal changes in AS generally start in the early stages and become more evident as the disease progresses [24]. Typical spinal deformities of AS form over a period of 10 years or more [2].

When the disease has advanced to the thoracic spine, there is an evident increase in normal dorsal kyphosis and the patient's shoulders droop forwards. Depending on the severity of cervical and thoracic involvement, protection of the centre of gravity requires that the patient stands in a position with the knees in flexion [1,2]. The abdomen becomes more evident and repiration is primarily by the diaphragmatic route [25]. The characteristic posture of AS is formed with ventral flexion of the head and neck, increased thoracic kyphosis and shortening of the hip and knee flexors [6].

Postures of reduced lumbar lordosis, increased thoracic kyphosis and the head bending forwards may cause restrictions in daily living activities, such as interpersonal communication, driving a car, walking and personal hygiene [26-28].

Changes in Postural Control and Balance

The anatomic changes which occur with the development of vertebral ankylosis in AS may result in kyphosis and lead to decreased movement in the spine [29]. It has been reported that the changes occurring in axial mobility lead to impaired postural control, loss of balance and even increased risk of falls [13].

The spine can become a rigid group of bones as far as the occiput sacrum and the rigidity can even lead to thoracolumbar kyphotic deformity [24]. If kyphotc deformity develops, it causes an anterior shift in the centre of gravity of the body [30]. A previous study determined a significant relationship between a change in the location of the centre of gravity and BASFI. In support of that finding, it was stated that evaluation of postural control could be a valuable procedure in the monitoring of disease status and progression [23].

Literature Review

The results of the first study in literature related to ankylosing spondylitis and balance were reported by Murray et al. It has been suggested that the antalgic position adopted by AS patients (anterior flexion of the trunk) probably starts with postural changes caused by stretching soft tissue and increasing enthesis calcification. In a study of 30 AS patients and 58 control subjects, static balance was compared with the eyes open and closed, using the Modified Schober Test and quantitative measurements of posture such as the occipital wall distance and chest expansion. No relationship was found between these measurements and balance. The conclusion was reached that the reason for lower than normal values of the AS patients with their eyes open and closed could be the loss of proprioception in AS patients. In the same study, the AS patients were separated into 3 groups as mild, moderate and severe AS according to the quantitative measurements of posture. While the balance of those with mild AS was found to be impaired, the AS patients in the moderate and severe AS groups had better balance. These results emphasised that impaired balance cannot be explained by biomechanical changes only [13].

Bot et al determined that AS patients had great difficulty extending their hips when standing and this changed the centre of gravity towards the anterior leading to increased impaired balance. In the biomechanical analyses applied in that study, it was shown that the impaired balance which could occur from thoracic kyphosis was compensated for with hip extension, knee flexion and ankle plantar flexion and the most effective of these was ankle plantar flexion [29].

In a study by Van Royen et al, it was determined that postural changes and balance protection compensations occured in correlation in individuals where vertebral deformation had developed. It was reported that increased hip extension was used to compensate for a change in the centre of gravity and thus the standing posture was protected, but when the deformation continued, the compensatory effect provided by the hip decreased [24].

In a study by Swinkels of postural changes in AS, it was reported that the antalgic position associated with vertebral or sacroiliac joint inflammation could be related to muscle fatigue as a result of the primay denervation process. Characteristic changes were determined such as lumbar lordosis improvement, increased thoracic kyphosis, increased upper cervical extension and lower cervical flexion. In the same study, it was also reported that there may be proprioceptive deficits in AS patients. It was stated to be most likely that proprioceptive losses resulted in spinal enthesis pathological involvement [31].

In a study by Aydoğ et al of 70 AS patients and 35 healthy controls, balance was evaluated with the Biodex Stability System and the relationships were investigated between the duration of the disease and cervical rotation, tragus-wall distance, lumbar side flexion, intermalleolar distance and BASMI. In the results of the study, a positive relationship was only found between the tragus–wall distance and the mediolateral stability index. No other relationship was determined between the BASMI score of other stability indexes and disease duration and it was therefore reported that there was a high probability of dynamic balance loss in AS [14].

Souza et al reported that postural balance was worse in AS patients than in healthy individuals and a positive correlation was determined between pain and balance [32].

In a study by Adams et al, AS patients were compared with healthy individuals and it was determined that there was no difference in terms of impaired posture and impaired balance

developing associated with that. Just as no difference was observed in respect of balance, so no relationship was found between balance and quantitative measurements of posture such as the occiput- wall distance [15].

In studies by Durmus et al, the relationship was examined between mobility and functional status, patient activity and postural stability in AS patients in early and late stages. The balance index values of both groups were found to be high compared to those of a control group. The postural balance impairment test values of patients in the late stages were determined to b higher than those of patients in the early stages [16].

However in a study by Inanir et al, which examined AS patients and a control group in respect of balance index values, no statistically significant difference was determined between the AS patients and the control group in any of the postural stability indexes [33].

Conclusion

Previous studies have suggested that postural control in AS patient's changes in a significant way. Although these changes have been evaluated with different measurement methods, there is no specific scale to evaluate balance in AS patients. There is a need for future studies to address this deficiency.

Postural control measurements are consistent with functional impairment and disease activity measurements. Activities of daily living and quality of life are naturally included in postural control. However, there are very few studies which have examined dynamic and static postural control in AS patients.

Therefore, it would seem to be extremely important to have future studies evaluating postural control, to better understand the factors causing disability in AS and to be able to plan more effective, realistic treatment for the patient.

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