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Original Research Article

Myofascial force transmission in sacroiliac joint dysfunction increases anterior translation of humeral head in contralateral glenohumeral joint

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ABSTRACT

Introduction: Posterior and anterior oblique muscle slings contribute to the force closure mechanisms that provide stability to sacroiliac joint. These global muscle slings consist of myofascial network of fascia, muscles and tendons from global muscles. It links the lumbopelvic region to other joints of musculoskeletal system especially the contralateral glenohumeral joint (GHJ). Any sacroiliac joint dysfunction (SJD) may likely disrupt the force transmission across the oblique slings and it can affect the contralateral GHJ.
Aim: The current study aims to investigate the effects of SJD on the contralateral GHJ.
Material and methods: An experimental study is designed recruiting 20 participants with SJD and 20 healthy participants as matched controls to test the hypothesis that SJD may cause excessive anterior translation of humeral head (ATHH) in contralateral GHJ. Using real time ultrasonography, resting position of humeral head (RPHH), ATHH and posttranslation distance of humeral head (PDHH) are compared between the GHJs among participants with SJD and the matched controls. Paired sample *t*-test and independent sample *t*-test are used to analyze the data.
Results and discussion: The paired sample *t*-test result showed statistically significant increase in ATHH (P = 0.03) and PDHH (P = 0.01) in contralateral GHJs among participants with

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SJD. The independent sample t-test showed a significant increase in RPHH ($P = 0.01$) and PDHH ($P = 0.01$) in SJD participants when compared to matched controls.

Conclusion: SJD contributes to excessive ATHH in the contralateral GHJ. This may occur due to altered myofascial force transmission across oblique sling muscles.

1. Introduction

Sacroiliac joint is one of the common cause for low back and pelvic girdle pain.[1–3] Evidence suggests that the sacroiliac joint dysfunction (SJD) as the primary source of low back pain in 22.5% of patients,[4,5] and one of the potential causes of failed back surgery syndrome among patients with previous spine surgery.[6] SJD refers to any altered or impaired functioning of the somatic framework of sacroiliac joint and its related components such as arthrodial, myofascial, ligamentous, given that the articular surfaces are variable in anatomical position from side to side in an individual.[7] SJD is a musculoskeletal condition where the joint is biomechanically incompetent to transmit load in the absence of a demonstrable pathology.[1] As sacroiliac joint serves as the connecting link between the pelvis and the extremities, it was suggested that any functional SJD may cause secondary disorders in the musculoskeletal system.[8]

Many researchers has explored sacroiliac joint from biomechanical perspective for deeper understanding of joint dysfunction and its consequences to musculoskeletal dynamics.[9–11] Poor sensory motor function of the upper cervical segments and dysfunction of atlanto-occipital-axial joints are reported among patients with SJD.[8,12] Furthermore, the sacroiliac joint is acknowledged to influence the load transfer to lower extremities and foot.[13–15] Some other evidence relate to hamstring tightness and flexibility with SJD.[16,17] All of these studies suggest the biomechanical influence of the sacroiliac joint to structures far away from its presence. Very recently, researchers have started to explore the biomechanical and myofascial connection between lumbopelvic region and the contralateral shoulder region.[18,19] As per the principles of tensegrity that governs tension in tendons, muscles and fasciae, it may be possible that SJD may influence the contralateral glenohumeral joint (GHJ) through altered myofascial force transmission.

The anatomical and myofascial connections between the lumbopelvic region and contralateral glenohumeral region postulates for possibility of altered force transmission from SJD to contralateral GHJ.[20–23] The clinical reasoning for the above biomechanical force transmission lies through global muscle slings termed as posterior and anterior oblique muscular slings.[20,21] Posterior oblique sling is a myofascial muscular sling that runs from gluteus maximus toward the lumbopelvic region ascends up into the deep lamina of the posterior thoracolumbar fascia, crosses the mid body segment and attach to the contralateral humerus via lattisimus dorsi.[20,21,24] Similarly, anterior oblique sling includes structures such as pectoralis fascia, pectoralis major, anterior fascia of trunk, internal and external oblique, transverse abdominis ending up with the contralateral pubic bone.[20,22] It is through these muscle slings with myofascial tissues that the force transmission may occur between the lumbopelvic region and contralateral glenohumeral region by intra and inter-myofascial force transmission.[23,25]

The posterior and anterior oblique muscle slings can be seen as two elastic cables. In GHJ, the neutral position of the humeral head is maintained as long as the net passive elastic moment generated by both of these two muscle slings equals to zero. When the contractile force generated by the muscles of posterior oblique sling muscles is impaired as it may happen in SJD, then the net moment of force generation from anterior myofascial sling may increase which may cause excessive anterior translation of humeral head (ATHH) in the GHJ. Thus the current study proposes a medical hypothesis that there will be excessive ATHH in the contralateral glenohumeral when compared with the ipsilateral joint among participants with SJD and as well as matched controls. The findings of the study may assist the clinicians toward understanding the biomechanical effects of SJD on the musculoskeletal dynamics of the shoulder joint.

2. Aim

The first objective was to compare the amount of ATHH between ipsilateral and contralateral GHJ among subjects with SJD. The second objective was to compare the ATHH in GHJ between participants with SJD and matched controls.

3. Material and methods

3.1. *Subjects*

A total of 40 participants (20 participants with SJD and 20 matched controls) participated in this experimental study. All the subjects with SJD were recruited from outpatient physiotherapy department at a University tertiary hospital using a convenient sampling method. A battery of clinical tests which includes Gillet test, standing flexion test, prone knee flexion test, supine long sitting test and palpation of posterior iliac spine asymmetry on sitting were conducted to diagnose SJD.[24,26,27] All of the clinical tests were conducted by one senior musculoskeletal therapist. The diagnosis was made if a subject showed positive response to at least four of five clinical tests.[24,26,27] The healthy participants were recruited as matched controls from the hospital staffs and primary care givers. The healthy participants were matched in terms of age,