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Review article

Effect of lumbopelvic myofascial force transmission on glenohumeral kinematics – A myo-fascia-biomechanical hypothesis

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ABSTRACT

Introduction: The clinical management of shoulder disorders do not commonly includes the myo-fascial–skeletal contributions from the lumbopelvic (LP) region. Nevertheless, a notable myofascial–biomechanical connection exists between LP and shoulder regions.
Aim: The current paper proposes a quantifiable medical hypothesis that there will be an increased anterior humeral head translation (ATHH) in the glenohumeral joint (GHJ) due to altered myofascial force transmission that results from LP dysfunction.
Material and methods: A literature search was conducted in Science Direct and PubMed databases for articles published from January 1990 to December 2015. Medical Subject Headings and other keywords for search were myofascial continuity, force transmission, muscle slings, lumbopelvic-glenohumeral joint and biomechanics.
Results and discussion: The hypothesis suggests a clinical reasoning that impaired myofascial force transmission from LP region as one of the contributing factors for shoulder pathogenesis. The hypothesis is proposed based on the anatomical and biomechanical relationship between the LP region and the contralateral GHJ. Evidences of myofascial continuity between the LP and GHJ, myofascial force transmission and integrated energy transfer theory are explained to strengthen the proposed hypothesis. An experimental method to test the proposed hypothesis is recommended for researchers and clinicians. A theoretical understanding of the pre stressed spring system via the myofascial chains is applied to strengthen the reasoning on the current hypothetical connection between LP and contralateral GHJ.
Conclusions: The implication of the new medical hypothesis may substantiate the understanding of the clinicians on the connections between the LP and the contralateral GHJ to consider a global myo-fascial–skeletal management of shoulder disorders.

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1. Introduction

Fascia is a dense irregular connective tissue that surrounds and connects every muscle forming a true myofascial continuity throughout our whole body.[1] The role of fascia in the musculoskeletal dynamics is crucial and gains attention in clinical practice.[2] In traditional clinical practice, the management of glenohumeral (GH) pathologies generally does not view the myo-fascial–skeletal contributions from the lumbopelvic (LP) region. The role of myofascial tissue that exists between the GH and LP region is rarely considered as one of the structures that contributes to the passive stability of GH joint (GHJ). In this paper, a biomechanical medical hypothesis which suggests an excessive anterior translation of the humeral head (ATHH) in GHJ is proposed which may be contributed by dysfunction of LP region. In normal clinical practice, the clinicians evaluate the stability of the GHJ through active and passive restraints. In current script, we postulate a hypothetical concept based on the myo-fascial–skeletal system by deriving empirical models and theories that may enhance a fresh understanding of the musculoskeletal control and stability of the GHJ. With excessive ATHH suggested to be one of the contributing factors for shoulder pathologies, the posed hypothesis on the myo-fascial–skeletal model provides clinicians a global and detailed clinical perspective toward the evaluation of GH disorders.

2. Aim

The purpose of this article is to present a myo-fascial–biomechanical hypothesis based on myofascial force transmission from global muscle connections between the pelvis and contralateral shoulder toward the regulation of the ATHH in GHJ.

3. Material and methods

3.1. Data sources

A literature search of published articles from January 1990 to December 2015 was conducted in the ScienceDirect and PubMed databases. The medical subject headings (MeSH) terminologies and other keywords for search were [(myofascial continuity) OR (myofascial lines) OR (anatomic continuity)] AND/OR [(force transmission) OR (myofascial force transmission) OR (transmission of forces in myofascial)] AND/OR [(anatomy train) OR (muscle slings) OR (myofascial slings) OR (oblique muscle chain)] AND/OR [(lumbopelvic) OR (sacroiliac) OR (hip-lumbopelvic complex)] AND/OR [(biomechanics) OR (biomechanical models) OR (biomechanical theories)]. The search strategy retrieved all articles in a conventional review manner.

3.2. Article selection

The articles were selected for the review if they had reported on the study search terminologies. First, the articles were included if the studies were presented on the myofascial force transmission. Secondly, the studies that presented on the muscle trains and anatomy of the myofascial slings were considered. Thirdly, any studies that presented a biomechanical model and theories were incorporated. Only those articles which were published in the English language were considered for the hypothetical review.

3.3. Data extraction

All the studies were examined for the reference lists to identify if any further literatures existed. Similarly, the titles and abstracts of all the identified studies were examined. A full article was identified when the literature was relevant to the study. The identified literatures were examined and used in the hypothetical review.

4. Results

4.1. Theoretical framework and evidence

4.1.1. Anatomical relationship between the LP and contralateral shoulder joint

The anatomical evidence between the LP and the contralateral GHJ exists through two integrated myofascial sling systems, namely posterior and anterior oblique sling, which serves as an anatomical connection between the LP region and contralateral GHJ.[3–5] The posterior oblique muscle sling that lies in the posterior aspect of the trunk involves muscles such as biceps femoris, gluteus maximus, thoracolumbar fascia, latissimus dorsi and upper trapezius. It runs from the LP region via the gluteus maximus spans up into the superficial and deep lamina of the posterior thoracolumbar fascia, crossing the mid body segment connecting up with latissimus dorsi and ending up in the contralateral GHJ. The anterior oblique sling which consists of hip adductors, transverse abdominis, internal and external oblique, the anterior fascia of the trunk and pectoralis major runs from hip-lumbopelvic region to contralateral GHJ.[3–5] Fig. 1 indicates the anatomical relationship between the LP region and contralateral GHJ. The transfer of forces across anterior and posterior oblique sling muscles may assist to maintain the tensegrity of the GHJ.[3] On the other hand, any impairment of the two muscle slings may result in alteration of the accessory movement pattern and joint kinematics of GHJ.[6]

4.1.2. Biomechanical relationship between LP and contralateral shoulder joint

Human walking involves specific coordination patterns between upper and lower body segments.[7] Pelvic angular momentum is counterbalanced, either directly by counter-rotating the thorax or indirectly by swinging an arm.[8] During human locomotion, there is a reciprocal movement of upper extremity and lower extremity and it is cross-patterned, with alternating arm swing and leg movement to achieve biomechanical efficiency.[9,10] Pelvic rotates from right to left around a vertical axis and two innominate bones alternately rotates forward and backward synchronously with activation of gluteaus maximus, while the shoulder girdle rotating in the

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