Journal of Bodywork & Movement Therapies (2017) 21, 386–400

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/jbmt

REVIEW: SYSTEMATIC REVIEW

The role of scapular kinematics in patients with different shoulder musculoskeletal disorders: A systematic review approach

Roshanak Keshavarz, PT, MSc, DPT [a],
Siamak Bashardoust Tajali, PT, MSc, PhD [a,*],
Seyed Mohsen Mir, PT, MSc, PhD [a],
H. Ashrafi, MSc, PhD [b]

[a] *Department of Physical Therapy, School of Rehabilitation, Tehran University of Medical Sciences, Tehran, Iran*
[b] *Department of Applied Design, Faculty of Mechanical Engineering, University of Kashan, Kashan, Iran*

Received 11 May 2016; received in revised form 10 August 2016; accepted 2 September 2016

KEYWORDS
Scapular Kinematics;
Shoulder Musculoskeletal Disorders;
Scapulothoracic Muscles;
Shoulder;
Pain;
Disability

Summary This study aimed to identify the role of the scapula in shoulder musculoskeletal disorders (SMDs) and provided a systematic review of available studies in the field of scapular three-dimensional kinematics. We systematically searched 5 international databases, including Scopus, EMBASE, PubMed, CINAHL, PEDro, and Cochrane Library from June to September 2015. Twenty studies met the inclusion criteria and were retrieved in full paper. The selected studies were critically appraised independently by two researchers. The patients with shoulder impingement syndrome (SIS) and shoulder instability had an increased protraction, lesser upward rotation (UR), and increased internal rotation (IR) during scapular plane elevation, whereas the patients with frozen shoulders had lesser protraction. Moreover, the patients with SIS had a greater scapular posterior tilt (PT) and external rotation during shoulder abduction. Increased scapular UR and PT with decreased scapular IR was seen in patients with stiffness of Latissimus Dorsi and fibromyalgia without any changes in the scapular IR.

The results of this systematic review help the clinicians to have an insight about scapular kinematics as a predictive index for SMDs.

* Corresponding author. Fax: +98 21 77533939.
E-mail address: s_bashardoust@yahoo.com (S. Bashardoust Tajali).

http://dx.doi.org/10.1016/j.jbmt.2016.09.002
1360-8592/

Introduction

Shoulder pain is one of most common musculoskeletal complaints in modern societies. Up to 40% of the population experiences shoulder pain in their life which includes 20.9% of musculoskeletal disorders (SMDs) in the general population (Lawrence et al., 2014). Proper scapula position and orientation are necessary for improving shoulder strength, stability, range of motion, and premium functional ability (Kibler et al., 2006). Through recent decades, researchers have focused on the role of scapular control in SMDs (Ludewig and Reynolds, 2009). The scapula is a key link between the upper extremity and axial skeleton during daily activities. The muscles attached to the scapula provide proximal stability for the upper extremity activities (Kibler and McMullen, 2003). When the scapular musculature cannot stabilize the scapula, neuromuscular performances might be affected leading to shoulder malfunction (Voight and Thomson, 2000).

Numerous studies have found that scapulothoracic motions are different between patients with various SMDs and asymptomatic individuals (De Baets et al., 2013; Timmons et al., 2012). Scapular dyskinesis has been found in 32% of the patients with shoulder instability (SI) and 57% of the patients with shoulder impingement syndrome (SIS) (Warner et al., 1992). Furthermore, these comparisons were provided using surface electromagnetic sensors. However, skin-motion artifacts related to surface electromagnetic sensors may create the differences among the groups (Hamming et al., 2012; Karduna et al., 2001).

There is a clear controversy in SMD studies which have reported scapular-kinematics alterations in patients with the SMDs. The main role of scapular kinematics in the upper extremity function helps the practitioners to recover the scapular pattern movement for all shoulder dysfunctions and/or pathologies. Our systematic review study helps the clinicians to have an insight about scapular kinematics as a predictive index for SMDs (Green et al., 2013; Ludewig and Reynolds, 2009).

There is little evidence to provide systematic information on scapular kinematics in specific shoulder pathologies such as SIS (Timmons et al., 2012), stroke (De Baets et al., 2013), SI (Struyf et al., 2011), and unimpaired shoulders (Borsa et al., 2003). We aimed to present a systematic method to summarize the results of studies on different types of shoulder disorders in the field of scapular kinematics. The aim of this systematic review was to identify abnormal kinematic patterns and their role in the diagnosis of SMDs based on scapular kinematics. We searched for scapular kinematics alterations from the normal pattern in various types of musculoskeletal shoulder disorders. The hypothesis of our study was abnormal kinematics might have a considerable role in different types of SMDs (Ludewig and Reynolds, 2009). This study may help the clinicians with the diagnosis of SMDs type and/or abnormal scapular kinematics as a simple guide.

Method

Eligibility criteria

We included published studies in English language to compare scapular kinematics in five groups of the most common SMDs (SIS, Frozen Shoulder (FS), SI, Rotator Cuff Tear (RCT) and Scapulothoracic Muscles Problems (STMPs)). The inclusion criteria were professional and clinical confirmation of the SMD by various clinical examinations, and the use of a motion analyzer and similar kinematic methods (Euler angle) to calculate 3-D scapular kinematics, during the active humerothoracic elevation as clearly stated in the paper. Three scapular kinematic variables (scapular upward rotation, external rotation, and posterior tilt) were present in the included papers. Differences between five mentioned SMDs and controls was not be accredited to the kinematic motion-capture methods.

The studies were excluded if they were not published in English language. Studies conducted on non-specific shoulder pain, non-adult age groups, animals, cadaver, as well as single-subject case reports were excluded.

Search strategy

We searched the Cochrane Database Library, MEDLINE (1968—2014), EMBASE, CINAHL (1974—2014), PubMed, Scopus, and PEDro from June to September 2015 using MeSH and indexing terms. The full search strategy is depicted in Fig. 1. We also searched the ProQuest and SIGLE from June to September 2015 to find the unpublished and/or gray literature. Reference lists of systematic reviews were searched to find more related studies. Excluded studies and their reasons for exclusion are listed in Index 1.

Study selection

Two investigators (RK and SBT) searched and assessed all distinguished titles and abstracts to identify the studies. The full text of the eligible studies was retrieved and reviewed independently by two researchers (RK and SBT). The data were extracted separately by the researchers. In case of any disagreement, the researchers reached a consensus by exchanging ideas.

The studies were also excluded if the subjects had a history of shoulder surgery or dislocation and shoulder-girdle fracture or shoulder pain produced by neck motion. The use of 3-D scapular kinematics during reaching or grasping tasks also resulted in the exclusion of the study.

Each selected study was screened and entered into a data extraction form by two investigators independently (RK and SBT). All data, including the authors' names, publication date, characteristics of the study population, sample size, diagnosis, age, gender, dominant hand, and the kinematic measurement method, were entered into tables (Table 1). Scapular kinematics measurement methods included task, motion capture system, scapular kinematic techniques, Euler decomposition, scapular landmark, and range of humerothoracic elevation (Table 2).

In general, there were twenty studies that reported 3-D scapular kinematics in patients with the SMDs (Tables 1 and 2). Eleven studies provided a comparison between healthy participants and patients with SIS, and six studies reviewed RCTs, FS, and SMPTs systematically. Three studies stated the differences in scapular kinematics between healthy people and patients with SI.