

# Validity of an Alternate Hand Behind Back Shoulder Range of Motion Measurement in Patients With Shoulder Pain and Movement Dysfunction

Kiran H. Satpute, MPT,<sup>a</sup> Toby Hall, PhD,<sup>b</sup> and Aditi Adanani, BPT<sup>c</sup>

## ABSTRACT

**Objectives:** The purpose of this study was to determine the criterion-related validity of a novel method of measuring hand behind back (HBB) shoulder range of motion (ROM) for evaluating pain and disability in people with shoulder pain and movement impairment.

**Methods:** This cross-sectional study design evaluated shoulder ROM, pain, fear-avoidance beliefs, and disability in 60 people (aged 35-70 years, 31 male) with chronic unilateral shoulder dysfunction (mean duration 15.73 weeks). Shoulder HBB ROM was measured with a bubble inclinometer in a manner that did not require the patient to disrobe. Correlations were sought between HBB ROM and other shoulder movements, as well as scores recorded on the Shoulder Pain and Disability Index (SPADI), visual analogue scale for pain, Fear Avoidance Beliefs Questionnaire (FABQ), and duration of symptoms.

**Results:** Restriction of HBB movement was significantly correlated with SPADI total disability score ( $r = 0.39, P < .01$ ), flexion ROM ( $r = 0.30, P < .05$ ), abduction ROM ( $r = 0.39, P < .01$ ), and external rotation ROM ( $r = 0.60, P < .01$ ). Other variables were not significantly correlated with HBB ROM. Multiple linear regression analysis indicated that the variance in HBB ROM was explained by the SPADI disability subscore ( $P = .01$ ) but not by visual analogue scale score ( $P = .05$ ), FABQ score ( $P = .65$ ), or duration of symptoms ( $P = .73$ ). The FABQ score was not explained by limitation in HBB ROM and shoulder movements.

**Conclusion:** These findings suggest that this novel method of measuring HBB ROM could be used as a functional outcome measure in the evaluation of patients with shoulder disorders. This method could be considered as an additional or alternative where there are challenges in measuring HBB because of restrictions in undressing a patient, such as for cultural reasons. (*J Manipulative Physiol Ther* 2018;xx:1-10)

**Key Indexing Terms:** *Range of Motion; Shoulder; Pain; Cultural Competency*

## INTRODUCTION

Musculoskeletal problems affecting the shoulder are common in Indian rural as well as urban areas, with lifetime incidence reported as 15.6%.<sup>1-3</sup> The 1-year prevalence of

shoulder complaints in the general population was reported to be as high as 46.7%.<sup>4</sup> Clinically, patients with shoulder pain and movement restriction have an inability to reach overhead or behind their head or their back, all of which interferes with daily activities.<sup>5</sup> Such limitations also affect psychological and social functioning.<sup>6,7</sup>

The functional deficits seen in people with various shoulder pathologic conditions are in part determined by evaluating routinely measured cardinal plane physiological movements, as well as through functional evaluation.<sup>8</sup> These functional assessments commonly use self-reports of functional status<sup>9</sup> and physical measures,<sup>10</sup> which are also used as outcome measures in clinical practice as well as in research. Although self-reports of functional status have been reported to be valid and reliable,<sup>11</sup> it has been suggested that more specific outcome measures are crucial for determining treatment success in management of shoulder problems.<sup>9</sup> The choice of measure should be based on a variety of factors including the patient

<sup>a</sup> Department of Kinesiotherapy and Physical Diagnosis, Smt. Kashibai Navale College of Physiotherapy, Pune, Maharashtra, India.

<sup>b</sup> School of Physiotherapy and Curtin Health Innovation Research, Curtin University, Perth, Australia.

<sup>c</sup> Smt. Kashibai Navale College of Physiotherapy, Pune, Maharashtra, India.

Corresponding author: Kiran H. Satpute, MPT, 393 Navi Peth, near Vithal Mandir, Pune 411030, Maharashtra, India. Tel.: +91 9604515338. (e-mail: [Kiran\\_ptist@yahoo.co.in](mailto:Kiran_ptist@yahoo.co.in)).

Paper submitted July 12, 2016; in revised form July 31, 2017; accepted September 8, 2017.

0161-4754

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<https://doi.org/10.1016/j.jmpt.2017.09.010>

population.<sup>12</sup> Physical measures of shoulder functional impairment include hand behind neck<sup>10</sup> and hand behind back (HBB) measures.<sup>13-18</sup>

Shoulder HBB range of motion (ROM) is reported as an important functional deficit when evaluating activities such as dressing and toileting<sup>19</sup> and has been extensively studied.<sup>16,18,20,21</sup> Satpute et al<sup>22</sup> reported that improving HBB ROM improved shoulder function and pain in patients with nonspecific shoulder pain and movement impairment.

In the past, the movement of HBB has often been used interchangeably with internal rotation, with both thought to measure the same construct. However, previous research indicates a poor relationship between these 2 measures and hence it has been suggested that HBB ROM should be assessed in addition to the more usual physiological measures of shoulder movement in the cardinal planes.<sup>16,23</sup> The various methods proposed to measure HBB ROM usually involve the use a tape measure or a modified standard goniometer.<sup>21</sup> Although the tape measure method for measuring HBB ROM that uses the posterior superior iliac spine as a reference point has been reported to have excellent reliability,<sup>18</sup> this method may not be suitable for patients in some cultures where skin exposure is not allowed. Furthermore, this method cannot be used in patients with severe restriction of HBB movement, when they are unable to even reach the sacrum—for example, in conditions such as adhesive capsulitis.<sup>24</sup> To overcome this issue, a novel method of measuring HBB ROM has been proposed using a bubble inclinometer that should be acceptable in multicultural countries because it does not require skin exposure and also provides ROM in degrees. Although HBB movement usually comprises a combination of shoulder extension, internal rotation/adduction, elbow flexion, forearm pronation, and various scapular movements, the new method, for measurement purposes, measures only elbow flexion as a proxy for HBB ROM. In this measurement method, the humerus is maintained vertical by the participant's side while he or she reaches up behind the back, and elbow flexion ROM is recorded.

For goniometry to provide meaningful information, measurements must be valid and reliable and should represent the true value of the variable of interest.<sup>25</sup> Furthermore, criterion-related validity of the measurement is an important consideration<sup>26</sup> to justify the use of the test in research as well as in clinical practice. In addition, Lentz et al<sup>27</sup> reported that pain-related fear is one of the strong predictors of shoulder disability.

The purpose of this study was to assess the criterion-related validity of a novel method of measuring HBB ROM. The primary hypothesis was that restriction of HBB ROM would correlate with shoulder-related disability and shoulder movement in other planes. The secondary hypothesis was that fear-avoidance behavior would correlate with shoulder disability, pain, and impairment of shoulder ROM.

## METHODS

### Study Design

This single measure, cross-sectional study design investigated the criterion-related validity of a novel method of measuring HBB ROM in patients with shoulder pain and movement impairment. Comparisons of ROM in this new method with traditional tape methods of measuring HBB movement were not carried out because of cultural issues associated with skin exposure.

### Participants

Participants were recruited from the physiotherapy outpatient department of Smt. Kashibai Navale Medical College, Pune, India, between November 2014 and April 2015, referred by orthopedic surgeons with a provisional diagnosis of musculoskeletal shoulder pain disorders based on routine evaluation and investigations that were carried out in a typical Indian orthopedic outpatient department. These participants were evaluated by an experienced physiotherapist and were included if they were aged 18 to 70 years with a history of acute or chronic shoulder pain and associated movement restriction. Participants were excluded if they had elbow, forearm, or wrist joint pathologic conditions; a history of dislocation of the glenohumeral or acromioclavicular joint; recent shoulder surgery or fracture; bilateral shoulder involvement; recent cardiac surgery; chronic regional pain syndrome; malignancy; infection; or upper motor neuron lesion.

A total of 60 participants were enrolled in the study (Fig 1). Medical diagnoses are presented in Table 1. The sample size was based on 8 predictor variables in the regression analysis, with  $\alpha = .05$ , power of 0.8, and effect size of 0.5 requiring a sample size of at least 40.

### Procedure

All participants who fulfilled the inclusion criteria and who volunteered to participate in this study were required to provide written informed consent. Demographic data for age, sex, weight, height, and baseline parameters of pain intensity during maximal HBB movement as evaluated on the 10-cm visual analogue scale (VAS),<sup>28</sup> disability as evaluated on the Shoulder Pain and Disability Index (SPADI),<sup>29</sup> and symptom duration were recorded. Psychological factors were measured with the Fear Avoidance Beliefs Questionnaire (FABQ).<sup>30</sup>

The SPADI is a self-administered questionnaire, developed for use in an outpatient setting with 2 subscales, pain and function.<sup>29</sup> The Numeric Rating Scale (NRS) version of SPADI was used.<sup>31</sup> The SPADI is a responsive and valid tool to measure pain and functional status of the shoulder region for current status and change over time.<sup>11,32,33</sup> The intraclass correlation coefficient (ICC) for the disability subscale ranges from 0.57 to 0.84,<sup>34</sup> indicating moderate reliability. When the SPADI is administered before treatment and then at discharge, the minimum detectable change (MDC) is 18 points.<sup>35</sup>

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