Manual Therapy xxx (2015) 1–6

Contents lists available at ScienceDirect

Manual Therapy

journal homepage: www.elsevier.com/math

Case report

Computer-aided combined movement examination of the lumbar spine and manual therapy implications: Case report

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ARTICLE INFO

Article history:
Received 13 November 2014
Received in revised form
7 May 2015
Accepted 19 May 2015

Keywords:
Lumbar spine
Low back pain
Combined movement examination
Lumbar movement
Manual therapy

ABSTRACT

Combined movement examination (CME) of the lumbar spine has been recommended for clinical examination as it confers information about mechanical pain patterns. However, little quantitative study has been undertaken to validate its use in manual therapy practice.

This study used computer aided CME to develop a normal reference range, and to guide provisional diagnosis and management. Two cases were assessed, before and after manual therapy using CME, a pain Visual Analogue Scale, the Roland Morris Low Back Pain and Disability Questionnaire and the Short Form (SF-12) Health Survey. Diagnosis and management were guided by comparing each CME pattern with the age and gender matched reference range. Self-reports data and CME total change scores were markedly improved for both cases, particularly for the most painful and restricted CME directions.

This report describes how computer-aided CME and a normal reference range may be used objectively to inform a diagnosis and as an outcome measure in cases of mechanical LBP. Future investigations of cases with specific lumbar pathologies are required to validate this concept.

1. Introduction

Assessing lumbar spine movement in the clinical setting to investigate dysfunction and to monitor changes in a patient's spinal movement characteristics over time is routine clinical practice (Maitland, 1997; Ha et al., 2013; Laird et al., 2014). This is used, along with other assessment findings, to develop a provisional diagnosis, treatment and management plan.

According to Pearcy and Hindle (1989) single plane lumbar movements are often unrepresentative of the lumbar spine function, and as such have limited value in clinical assessment. The combined movement examination (CME), originally described by Edwards (1979), examines the patient's ability to perform a planar movement examination as well as actively combined side-flexion of the lumbar spine while in flexed, neutral and extended positions.

Edwards (1979) originally proposed that the CME may be more informative than the standard planar assessment. This approach was subsequently confirmed by Barrett et al. (1999) who reported acceptable CME intra-examiner reliability, as well as preliminary evidence concerning the effectiveness of CME in identifying reduced lumbar movement in LBP cases. To the authors' knowledge, no study has reported the objective use of computer-aided CME to inform clinical practice.

Validation of the MotionStar™ 3-D motion tracking system (Ascension Technology, VT, USA), establishing the reliability of computer-aided CME, the development of a CME normal reference range (NRR) and proof of concept with clinical cases has previously been reported (Monie et al., 2015). This paper is to first report the use of computer-aided CME as a tool to objectively assess intra- and inter-session lumbar movement in two cases with different (non-specific) LBP presentations. Second, to report how an individual's CME 'signature' (Fig. 1) may be used to guide manual therapy (MT) intervention. Finally, a comparison is made between each case's CME data and an age and gender matched CME NRR.

1.1. Presenting concerns

Two symptomatic individuals were recruited from a convenience sample of clients at a local Physiotherapy private practice. Case A, was a 35 year old female house-wife (BMI 22) who complained of an

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http://dx.doi.org/10.1016/j.math.2015.05.004
1356-689X/

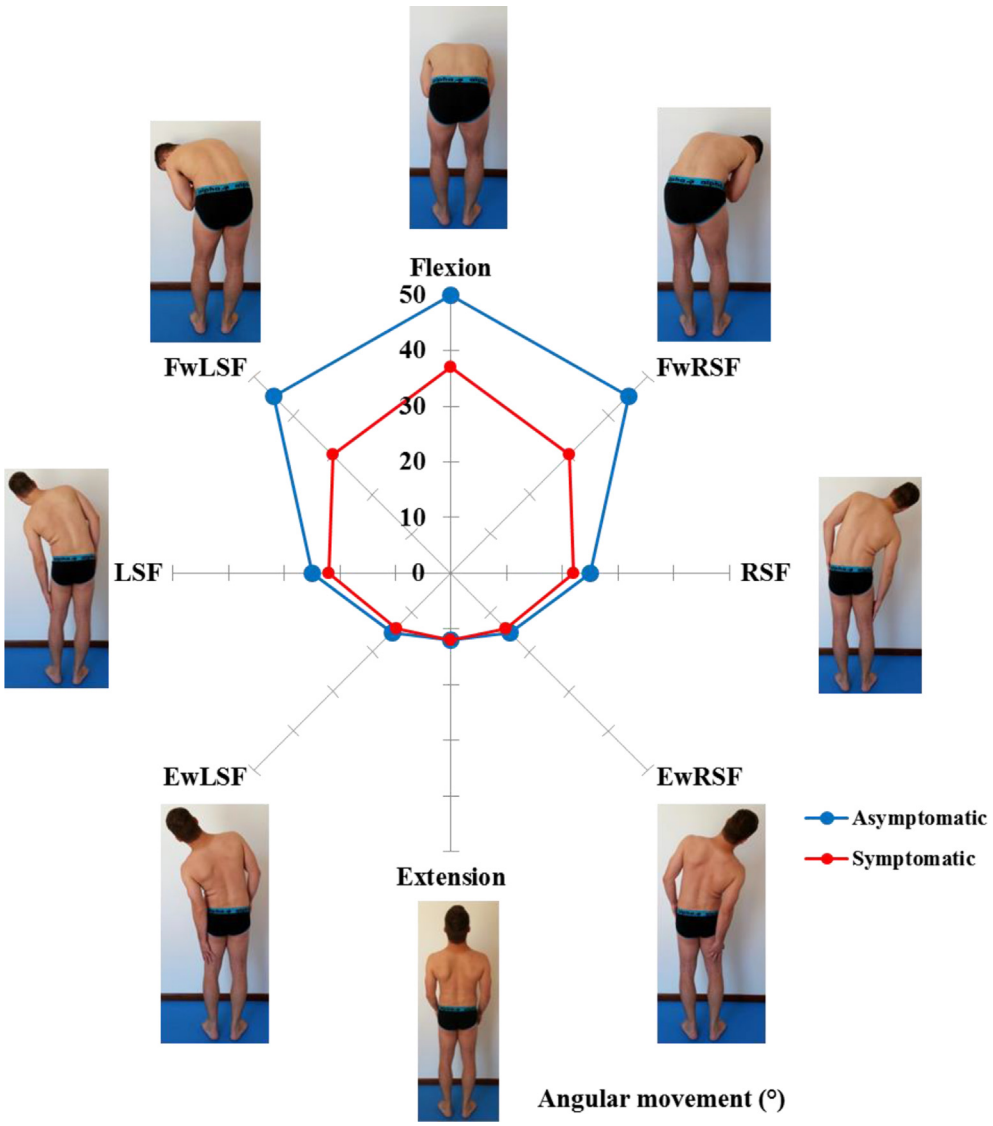

Fig. 1. Example of an asymptomatic volunteer's CME radial plot (blue) in degrees of angular movement. The inset plot (red) shows a case with reduced available range particularly in flexion. Photographs illustrate the movement directions and end-points, namely: Flexion with Left Side-Flexion (FwLSF), Flexion with Right Side-Flexion (FwRSF), Left Side-Flexion (LSF), Right Side-Flexion (RSF), Extension with Left Side-Flexion (EwLSF) and Extension with Right Side-Flexion (EwRSF). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

acute exacerbation of central, constant lumbar stiffness and intermittent pain with movement. This patient attended for CME examination and MT on two consecutive days. Case B, was a 57 year old female, school principal, (BMI 23) who presented with an acute exacerbation of right sided, intermittent, mechanical LBP. This patient attended four sessions (days 1, 4, 5 and 8).

1.2. Clinical findings

Both cases considered themselves in very good health (SF-12) with no complaint of dominant psychosocial factors, systemic disease, trauma or co-morbidities. Both individuals stated that they had experienced mild low back discomfort or tightness 1-2 times per year. However, neither had experienced the same pain location or intensity as their presenting complaint.

1.3. Diagnostic focus and assessment

Both cases were screened for 'red flags', questioned for symptoms of neurological involvement and assessed for myotomal strength, deep tendon reflexes and altered sensation. There was no indication of neural pathology in either patient, thus both cases were classified as predominantly mechanical musculoskeletal pathologies.

After obtaining informed written consent and familiarisation of equipment and testing sequence, both cases were examined using computer-aided CME. Skin mounted MotionStar™ sensors were placed over the volunteer's S1 level and L1 spinous process (Fig. 2A and B). In a relaxed standing position, participants had their lumbar lordosis (angle between L1 and S1) recorded using the MotionStar™ system (Fig. 2A). This became the 'zeroed' starting position (centre of radial plot) (Fig. 1).

The patient was instructed to move within their comfortable limits and then cued through the eight CME positions by the examiner. Maximum data values for each CME direction were recorded according to a pre-defined sequence: Flexion, Flexion with Left Side-Flexion (FwLSF), Flexion with Right Side-Flexion (FwRSF), Left Side-Flexion (LSF), Right Side-Flexion (RSF), Extension, Extension with Left Side-Flexion (EwLSF) and Extension with Right Side-Flexion (EwRSF). Position data were acquired by the

Please cite this article in press as: Monie AP, et al., Computer-aided combined movement examination of the lumbar spine and manual therapy implications: Case report, Manual Therapy (2015), http://dx.doi.org/10.1016/j.math.2015.05.004