



ORIGINAL RESEARCH

# Effect of remote after-effects of resistive static contraction of the pelvic depressors on improvement of restricted wrist flexion range of motion in patients with restricted wrist flexion range of motion



Mitsuo Arai, PhD <sup>a,\*</sup>, Tomoko Shiratani, PhD <sup>b</sup>

<sup>a</sup> Division of Physical Therapy, Tokyo Metropolitan University, Japan

<sup>b</sup> Division of Physical Therapy, Sonoda Hospital, Japan

Received 31 July 2014; received in revised form 22 October 2014; accepted 2 November 2014

## KEYWORDS

PNF;  
Pain;  
Remote after-effect;  
Active range of motion;  
Resistive static contraction;  
Pelvic depressors

**Summary** The objective of the study was to compare the effects of remote after-effects of resistive static contraction of the pelvic depressors (RSCPD) with after-effects of static contraction of upper extremity muscles (SCUE) on improvement of the maximal active range of motion (MAROM) for patients with restricted wrist flexion range of motion (ROM) due to upper limb pain and dysfunction. The participants were 10 outpatients with restricted wrist joints. The mean (SD) age was 53.7 (4.4) years (range, 34–81). The subjects performed two exercise protocols (SCUE and RSCPD) in random order. One-way repeated measures ANOVA showed significant main effects in evaluation of the change in MAROM and IEMG activities for different conditions (after rest, after SCUE, and after RSCPD). The remote after-effects of RSCPD, but not those of SCUE, caused significant improvement in MAROM for restricted wrist flexion ROM.

© 2014 Elsevier Ltd. All rights reserved.

## Introduction

Deficits in maximal active range of motion (MAROM) may be caused by several factors, including muscle weakness, pain,

muscle spasm, and soft-tissue tightness, all of which have been reported following injury and in association with osteoarthritis (Bearne et al., 2002; Povlsen and Rose, 2008). After injury, muscles that cross multiple joints or have

\* Corresponding author. Division of Physical Therapy, Faculty of Health Sciences, Tokyo Metropolitan University, 7-2-10, Higashioku, Arakawa-ku, Tokyo 116-8551, Japan. Tel.: +81 3 3819 1211; fax: +81 3 3819 1406.

E-mail address: [arai-mitsuo@tmu.ac.jp](mailto:arai-mitsuo@tmu.ac.jp) (M. Arai).

complex architectures are weaker and at risk for further injury (Garrett, 1996). If direct approaches to improve MAROM and strengthen the agonist muscles of restricted joints are difficult because of pain or weakness of agonist or antagonist muscles, indirect therapy may also be useful to improve the restricted joint in an indirect neuro-rehabilitation procedure (Arai and Shiratani, 2012a; Arai et al., 2012).

Wilson et al. (1995) found that the after-effect of a static contraction (SC) on the mean afferent spindle discharge rate was 65% higher than the mean pre-contraction discharge rate. In the cat, monosynaptic excitation by muscle spindle Ia afferents from a given muscle is not distributed exclusively to the  $\alpha$ -motoneurons of the muscle (homonymous projections), but also reaches the pools of motoneurons of other muscles (heteronymous projections) acting synergistically at the same joint or at different joints (Marchand-Pauvert et al., 2000). The heteronymous connections described to date in the human upper limb involve wrist-to-elbow muscles (Cavallari and Katz, 1989; Mazevet and Pierrot-Deseilligny, 1994) and might help provide proximal support for distal movements. The mechanical contributions of these sources of stiffness vary under different functional conditions, such as joint position and voluntary contraction level (Mirbagheri et al., 2001).

Muscle activity is also not restricted to the target muscle, with activity observed in both ipsilateral and contralateral (non-target) muscles during strong unilateral contractions (Post et al., 2008). The ascending effects of resistive exercises on remote muscle activities may depend on the type of exercise (Borroni et al., 2004; Cerri et al., 2003). Compared with the after-effect of a weak SC with a neutral shoulder joint position, the after-effect of an SC of an upper extremity (SCUE), such as a strong SC of the intrinsic hand muscles performed with a diagonal shoulder joint position, significantly influenced improvement in MAROM of wrist flexion in normal volunteers, and this after-effect correlated with wrist agonist/antagonist surface integrated electromyographic (IEMG) activities (Arai et al., 2012).

Facilitation of trunk control is also used to influence extremities (Knott and Voss, 1969). One proprioceptive neuromuscular facilitation (PNF) activity used during treatment is manual resistance to directed pelvic motion of posterior depression (Trueblood et al., 1989). In particular, a remote after-effect of resistive static contraction of the pelvic depressors (RSCPD) in the mid-range of pelvic motion while lying on the side increases the flexibility of remote body parts, such as the upper shoulder (Arai et al., 2012). Compared with the static stretch group, the RSCPD group showed a significant improvement in AROM of the shoulder joint in patients with rotator cuff tears (Arai et al., 2012). Application of this technique may be effective for indirect treatment of extremities that cannot be directly exercised because of pain.

The effect of the RSCPD technique for patients with restricted wrist flexion ROM due to upper limb pain and dysfunction has not been reported. Thus, the objective of this study was to examine the difference in remote after-effects of RSCPD compared to SCUE for improvement of MAROM for restricted wrist flexion ROM.

## Methods

### Participants

The participants were 10 outpatients (2 males, 8 females) with restricted wrist joints and no history of upper motoneuron diseases who were referred by an orthopedist for improvement of ROM of the upper extremity, including the wrist joints. The patients were randomly selected from 25 outpatients. The mean age (standard deviation, SD) was 53.7 (4.4) years (range, 34–81 years). The exclusion criteria included any other orthopedic disorders and any neurological disorder within the last year that required medical attention. All patients gave written informed consent.

All patients had pain during movement and restricted wrist motion relative to that of the unaffected side. The MAROM may be restricted by upper limb pain and dysfunction. The time since onset of impairment varied from 9 weeks to 10 years. The patients had primary diagnoses of fractures of the radius and ulna, fracture of the radius, surgical neck fracture of the humerus, rheumatoid arthritis, carpal tunnel syndrome, and tenosynovitis of the flexor-tendon sheath of the index finger. MAROM of wrist flexion was measured on the more affected side (left, 9; right, 1). At the beginning of the study, the patients presented with stiff and mildly swollen wrists. No patient had knowledge of which exercise pattern might be more effective for improving MAROM of the wrist joint.

### Experimental design

Each subject learned each SC method sufficiently well before the start of the study to allow performance of the activity alone. Because experienced therapists may have a bias toward certain therapeutic methods that may influence the outcome, the experiments were performed by two well-trained physical therapy students. The two students who performed the assessment had been in our program for 4 weeks and received training in the specific experiments for 2 weeks.

The effects of order were controlled by randomly assigning numbers taken from a table of random numbers for the order of the SC conditions (SCUE, RSCPD) for each patient. Prior to data collection, subjects sat for 5 min to relax. After resting, the subject performed each exercise for 2 s (Figure 1). The forearm attachment was supported during each SC by a researcher. Each SC condition was separated by a 60-s rest period.

SCUE involved performing strong SCs of the intrinsic hand muscles with a diagonal shoulder joint position (shoulder flexion = 135°, adduction = 45°; Figure 1(a)). The pinch-force target strengths spanned a range of 70–80% for maximal voluntary contractions (strong pinch), as measured by a pinch meter.

RSCPD for inducing SCs of the lower trunk was applied by the researcher. With elbows locked in extension, the researcher placed hands over the subject's upper ischial tuberosity while standing behind the subject (Figure 1(b)). The researcher then applied manual resistance over the upper ischial tuberosity in the direction toward the medial sacral crest. The amount of resistance provided by the

Download English Version:

<https://daneshyari.com/en/article/2618663>

Download Persian Version:

<https://daneshyari.com/article/2618663>

[Daneshyari.com](https://daneshyari.com)