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Scientific/Clinical Article

The short-term effects of hot packs vs therapeutic whirlpool on active wrist range of motion for patients with distal radius fracture: A randomized controlled trial

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ABSTRACT

Study Design: Blinded randomized controlled trial.
Introduction: It is generally accepted that heat is beneficial for improving range of motion (ROM). However, the mechanism of action is not clearly understood, and the optimal method of heat application has not been established.
Purpose of the Study: To investigate the immediate effects of using a moist hot pack (MHP) vs therapeutic whirlpool bath (WB) for improving wrist ROM during a therapy session for patients with distal radius fracture.
Methods: About 60 adult patients, with a mean age of 54 years in the MHP group and 53 years in the WB group, with healed distal radius fracture were randomized into 2 groups of 30. Patients in group 1 were placed in an MHP for 15 minutes during therapy. Patients in group 2 had their arm placed in a WB and were asked to perform active wrist ROM exercises for the same period. This occurred for 3 consecutive therapy visits, with wrist and forearm ROM being measured before and after heat during each visit.
Results: The multivariate analysis of variance demonstrated that the canonical variate for ROM was significantly different between groups ($F[6,53] = 6.01$; $P < .05$), indicating that patients in the WB group had a significantly larger increase in ROM than patients receiving MHP application.
Discussion: Both WB and MHP improved wrist ROM during therapy sessions in this study, making both these acceptable options for clinical use when the goal is to precondition a patient for other treatments.
Conclusions: Individuals who received WB showed a statistically greater increase in wrist ROM than those receiving MHP during a therapy session, although the difference between groups may or may not be clinically important considering the small changes in ROM observed in this study.
Level of Evidence: Level II.

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Introduction

Although distal radius fractures (DRFs) are among the most common fractures treated by hand therapists, a recent Cochrane review indicated that the available evidence from randomized controlled trials is insufficient to establish the relative effectiveness of the various interventions used in the rehabilitation of adults with fractures of the distal radius.[1] Practice patterns vary widely in rehabilitation of DRF[2] and commonly include the use of superficial heat before stretching and exercise as a means of maximizing recovery of joint motion in fracture rehabilitation. The use of superficial heat can often take nearly half of the therapy visit time, although the level of benefit derived from their use for improving range of motion (ROM) after injury has never been quantified for the upper extremity.

Superficial heat modalities are commonly used for pre-conditioning joints to increase joint ROM during the mobilization stage after wrist fracture.[2] A recent systematic review concluded

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that superficial heat immediately increased ROM at a variety of joints and that a combination of heat and stretching is more effective than just stretching alone.[3] However, most studies in this systematic review focused on the knee, ankle, hip, and shoulder. Although it is generally accepted that heat is beneficial for improving ROM of joints, the mechanism of action is not clearly understood, and the optimal method and actual benefit of heat application have not been established, especially for the upper extremity.

There are several methods of superficial heat application used for the upper extremity, including moist hot packs, whirlpool baths (WBs), paraffin wax baths, and Fluidotherapy (Chattanooga Group Inc., Hixson, Tennessee). Of these, hot pack application is likely the most common as it is inexpensive and can be repeated in the home environment. Therapeutic whirlpool has traditionally not been recommended for upper extremity use due to concerns about increasing edema[4]; however, recent work has shown that this may be a transient effect.[5] Whirlpool may have an advantage over hot pack for increasing ROM due to the ability to perform motion during the heating process while still allowing for an even distribution of heat. The purpose of this study was to investigate the immediate short-term effects of using a hot pack vs therapeutic whirlpool for improving wrist ROM during a therapy session for patients with DRF. A secondary purpose of this study was to determine if there were any group differences in ROM change after 3 repeated therapy visits.

Methods

Participants

Ethics approval was received for this study by the local institutional ethics review board. Patients who had recently sustained a DRF and were treated at a large tertiary Hand Therapy Center between 2011 and 2014 were eligible for enrollment in this study. Patients were included in the study if they had been cleared by a hand surgeon to begin ROM exercises for the wrist and forearm, were older than 18 years, and were able to attend weekly follow-up visits. Exclusion criteria consisted of a concurrent diagnosis of complex regional pain syndrome, gross swelling, or sensory limitations of the hand that precluded the use of superficial heat during therapy, open wounds, and a predetermined inability to attend follow-up sessions. Patients were seen immediately after clearance for wrist ROM by the referring hand surgeon. Relevant demographics, including time of immobilization before study enrollment, age, sex, AO fracture classification, and surgical intervention, are reported in Table 1. Volar locking plates were used for all patients who required surgery to obtain fracture reduction.

Interventions

On enrollment, patients were randomized into 2 groups using a random number sequence by a therapist not involved in data collection. All patients had active ROM of their wrist measured before and immediately after heat application for 3 consecutive therapy visits. Patient flow through the study is reported in Figure 1. The therapist measuring ROM was blinded to group allocation. To ensure successful blinding, heat application occurred in a separate room, and all patients were required to wash their hands before and after heat application to prevent moist skin from being a clue to group allocation once heating was complete.

Patients in group 1 were placed in a moist hot pack. The hot pack came from a hydrocollator with a water temperature of 73°C (163°F) and wrapped with a cover and 2 towels as shown in Figure 2. The hand and wrist were placed in the hot pack for exactly 15 minutes using a minute timer. Patients in group 2 had their arm placed in a WB at 40°C (104°F). The arm was submersed to the level of the midhumerus, with the elbow flexed and the hand held at the surface of the water to maximize forearm rotation without compensation (Fig. 3). These patients were asked to perform active wrist flexion, extension, radial deviation, ulnar deviation, pronation, and supination exercises while in the bath. Exercises were completed in the order outlined previously, repeated 10 times for each direction, with each stretch held for 10 seconds. A 1-minute rest period occurred

Table 1
Demographics

Group characteristics	Hot pack group	Whirlpool group
Days immobilized (from fracture to enrolment) (d)	39.3 (13.2)	40.0 (11.8)
Age (y)	54.4 (11.3)	52.7 (16.1)
Gender (Female/male)	23/7	26/4
Number having ORIF with volar plate	7	5
AO fracture type		
A	18	18
B	5	3
C	7	9
Dominance		
Right	28	27
Left[a]	2	3
Fractured side		
Right	15	19
Left	15	11

ORIF = open reduction internal fixation.
[a] All patients who fractured the left wrist were also left handed.

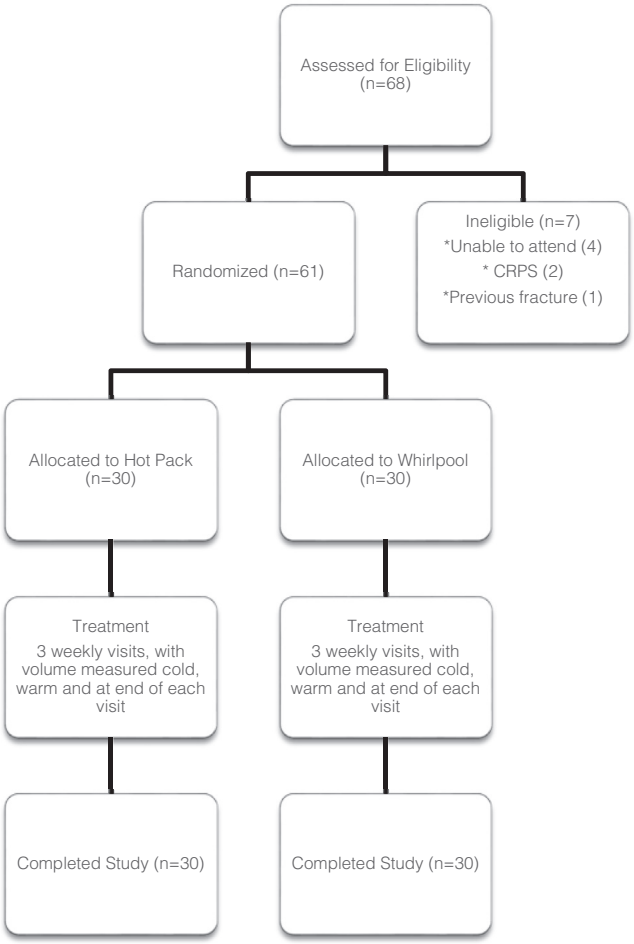

Fig. 1. Patient flow through the study.

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