Ultrasound and Joint Mobilizations Restore Range of Motion in a Child with a Hypomobile Elbow Due to Dislocation: An Exploration Clinical Case Report

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Ultrasound at a frequency of 3 MHz, has been shown to raise the tissue temperature \( \sim 4\text{–}5 \text{ °C} \) in 8–10 min at the skin’s surface to 3 cm deep, when used at an intensity of 1 W/cm\(^2\). This is appropriate to increase collagen extensibility, inhibit sympathetic activity, and lead to an increase in the viscoelastic properties of the tissues.\(^3,4\)

When used in conjunction with deep heat, joint mobilizations are capable of increasing collagen extensibility and improving joint physiologic and accessory movements when joint stiffness is present.\(^5\text{–}8\) This increase in temperature of the area to be mobilized increases patient comfort during the treatment and minimizes posttreatment soreness.\(^7,9\)

One of the difficult things to do in physical medicine and rehabilitation is to quantify active range of motion (AROM). This is because it is hard to measure intratester reliability. This varies from person to person and often from author to author. For this paper, I have used range of motion (ROM) suggested relative to entry-level knowledge of goniometric measurement.\(^9\text{–}11\) Thus, in this study, I list normal elbow flexion as being 145° and normal extension as being 0°.\(^9,11,12\)

The purpose of this exploration clinical case report is to describe the treatment protocol used in a 10-year-old child recovering from an elbow dislocation. There are three reasons that this case is unique. First, this case is significant since her prior treatments did not use ultrasound or joint mobilizations. Second, this exploration clinical case report is important to the reader because he or she can implement ultrasound and joint mobilizations to the elbow to restore AROM. Third, it is also important in that it discusses the proper use of low dose (1 W/cm\(^2\)) ultrasound in a child, where this was previously thought to be a contraindication.

**Patient**

In September 2014, a 10-year-old female attempted a flip on the trampoline. She
overshot the trampoline and landed on her right outstretched hand, which resulted in a posterior elbow dislocation. She was treated that day at the local emergency department, where the dislocated elbow was reduced. Other concomitant injuries, such as fracture, were ruled out. She did not need surgery and she was subsequently immobilized in a cast for 4 weeks (Figure 1). Upon completion of the 4 weeks of immobilization, the cast was removed. As a consequence of immobilization, she lacked significant AROM in elbow flexion and extension. Her treating physician prescribed physical therapy, which consisted of warm whirlpool, massage, stretching, and wearing a splint at night. After 3 months of treatment, the patient and her parents were discouraged due to little progress made in restoring AROM to the joint. They expressed their concerns to their neighbor who, incidentally, has his office next door to me. I called the mother and explained the technique I would use and that I would be willing to treat her. The following day, she and her parent reported for treatment at the therapeutic modalities laboratory at my institution.

Upon examination, the patient reported very little pain at rest, but stated that it had been a 7/10 on a numerical rating scale after her physical therapy appointments. I then measured the AROM of the elbow. She had 122° degrees of flexion (23° from normal) and 33° extension (33° from normal) (Figure 2). All AROM measurements were obtained using a 10.16-cm plastic 360° universal goniometer (scale marked in 1° increments) for increased validity of the measurements.13–15 However, when using a goniometer, standard error in the measurement may range from 4° to ~6°.13–15 The ROM was performed as follows:

- **Flexion:** The patient sat on a low stool so that her upper arm laid flat on a table. The axis was placed over the lateral epicondyle of the humerus. The stationary arm was placed along the midline of the humerus in line with the acromion process of the scapula. The moving arm was placed along the lateral midline of the radius in line with the styloid process of the radius.9 The patient performed AROM and then I took her through passive range of motion (PROM).

- **Extension:** The same landmarks and positioning used in flexion were used for extension. The patient performed AROM and then I took her through PROM. The same goniometer was used for all measurements to limit error due to differences between goniometers. No masking of the goniometer was used during the measurements.

**Intervention**

A treatment protocol of ultrasound followed by joint mobilizations and concluding with a crushed ice pack was initiated after the initial examination. During each treatment session, AROM and PROM measurements were obtained before the ultrasound and after the joint mobilizations but before ice pack application. The patient was instructed not to start any new or