The Efficacy of 95-Hz Topical Vibration in Pain Reduction for Trigger Finger Injection: A Placebo-Controlled, Prospective, Randomized Trial

Kevin W. Park, BA, Martin I. Boyer, MD, Ryan P. Calfee, MD, MSc, Charles A. Goldfarb, MD, Daniel A. Osei, MD

Purpose To determine whether vibratory stimulation would decrease pain experienced by patients during corticosteroid injection for trigger finger.

Methods A total of 90 trigger finger injections were randomized to 1 of 3 cohorts. With the injection, patients received no vibration (control group), ultrasound vibration (sham control group), or vibration (experimental group). We used a commercial handheld massaging device to provide a vibratory stimulus for the experimental group. We obtained visual analog scale (VAS) pain scores before and after injection to assess anticipated pain and actual pain experienced.

Results Anticipated pain and actual pain did not differ significantly among groups. Anticipated VAS pain scores were 45, 48, and 50 and actual VAS pain scores were 56, 56, and 63 for the vibration, control, and sham control groups, respectively. When normalized using anchoring VAS pain scores for "stubbing a toe" or "paper cut," no between-group differences remained in injection pain scores.

Conclusions Concomitant vibratory stimulation does not reduce pain experienced during corticosteroid injections for trigger finger. *(J Hand Surg Am. 2014;39(11):2203–2207.*

Type of study/level of evidence Therapeutic I.

Key words Injection, pain, steroid, trigger finger, vibration anesthesia.

Corticosteroid injections remain a primary treatment option for a number of painful conditions of the hand including de Quervain tenosynovitis and trigger finger.[1] As a result, 90% of orthopedists report using corticosteroid injections in their practice, each administering an average of over 300 injections annually.[2]

The pain associated with corticosteroid injections can cause substantial discomfort and anxiety. Excessive fear of injections is reported by approximately 10% of patients, and needle phobia, characterized by an intense and persistent fear of injections, affects approximately 2% of the general population.[3,4] This fear is not reliably alleviated by the use of local anesthetics that require injections themselves, because the injection of the anesthetic agent may become the most painful portion of the procedure.[5] In part, this has motivated research into alternative methods to reduce the pain and anxiety associated with injections, including distraction techniques, verbal reassurance, vapo-coolant sprays, and anesthetic creams.[6–9]

From the Department of Orthopedic Surgery, Washington University School of Medicine; and the Washington University Institute of Clinical and Translational Sciences, St. Louis, MO.

Received for publication April 14, 2014; accepted in revised form July 23, 2014.

Supported by Washington University Institute of Clinical and Translational Sciences Grant UL1 TR000448 from the National Center for Advancing Translational Sciences.

No benefits in any form have been received or will be received related directly or indirectly to the subject of this article.

Corresponding author: Daniel A. Osei, MD, Department of Orthopedic Surgery, Washington University School of Medicine, Suite 5505, 660 South Euclid Avenue, Campus Box 8233, St. Louis, MO 63110; e-mail: oseid@wustl.edu.

0363-5023/14/3911-0009$36.00/0
http://dx.doi.org/10.1016/j.jhsa.2014.07.047

Recent studies in the dentistry and cosmetic surgery literature reported that vibratory stimulation reduced pain experienced during injections of local anesthesia and botulinum toxin.[10–12] The mechanism of this vibration analgesia has been explained by the gate control theory, which purports that signals from large-diameter Aβ fibers (encoding pressure and vibration) stimulate inhibitory interneurons in the spinal cord that impede signals from Aδ and C fibers (encoding pain).[13]

The purpose of this study was to determine whether vibratory stimulation would affect pain experienced during corticosteroid injections for trigger finger. Our working hypothesis was that vibratory stimulation would decrease pain experienced by patients during corticosteroid injections for trigger finger.

MATERIALS AND METHODS

After we obtained approval from our institutional review board, 90 patients (90 trigger finger injections) consented to participate in this randomized trial—a total of 40 men and 50 women with an average age of 59 years (SD, 12 y). All subjects were recruited from the clinics of 4 fellowship-trained hand surgeons at our tertiary institution. Patients with the diagnosis of trigger finger who were advised by their surgeon to receive corticosteroid injections were eligible for inclusion. The diagnosis of trigger finger was made by the attending physician based on a history of painful finger flexion and extension, symptomatic clicking or locking of the finger at the proximal interphalangeal joint, and the presence of tenderness over the A1 pulley. The choice to proceed with corticosteroid injection was made through a shared decision-making process after discussion of risks and benefits of injection. After patients agreed to proceed with injection, but before the injection was administered, they were offered study enrollment. Patients were excluded if they were under the age of 18 years, had peripheral neuropathy, or were pregnant or nursing.

We assigned consecutive trigger finger injections to 1 of 3 cohorts using a random number generator (Fig. 1). Injections were accompanied by no vibration (control group), ultrasonic vibration (sham control group), or vibration (experimental group). A commercial handheld massaging device (AcuVibe Soft-Touch, Human Touch, Long Beach, CA) was used to provide a 95-Hz vibratory stimulus for the experimental group. The device was placed on the palm 2 to 3 cm proximal to the site of injection so as to be adjacent to the injection site without interfering with injection administration. The vibration was provided 3 to 5 seconds before the initial 30-g needle stick and throughout the entire injection (consisting of 1.0 mL of 40 mg/mL methylprednisolone acetate with either 1.0 mL 1% lidocaine or 0.5 mL 0.5% bupivacaine and 0.5 mL 1% lidocaine).[14] In all patients, the injection site was prepared using a povidone-iodine swab and device sterility was ensured by covering the contact point of the device with a sterile latex surgical glove. Consistent with previously published studies investigating vibration analgesia, no gel or cream was applied to the device or the site of injection.[10,11] In the sham control group, patients were informed that they would receive an ultrasonic vibration that would be neither heard nor felt. The same device and protocol used in the experimental group was used with the exception that the device was turned off. In the control group, no device was used.

Pain scores were measured using a 10-cm (100-point) visual analog scale (VAS) ranging from "no pain" to "most pain." Scores were obtained before the injection to assess anticipated pain (how painful patients imagined the injection would be) and between 2 and 5 minutes after the injection to assess actual pain experienced. In addition, patients rated the pain associated with "stubbing a toe" and "paper cut." These were chosen to provide common experiences with both a blunt and a sharp pain stimulus. The average of these anchoring pain scores for each subject was used to normalize the injection pain scores.[15]

Statistical analysis

An a priori power analysis indicated that 26 injections per group would be required to detect a 20-point change in VAS (20% effect size) with an SD of 25 points. Analysis of variance was used for the between-group comparison of parametric data and chi-square for categorical data.

RESULTS

There were no differences between cohorts in terms of age, sex, location of injection, or whether a previous trigger finger injection was received (Table 1). In 46 of 90 injections (51%), the patient had never received an injection for treatment of trigger finger. The middle finger was the most commonly affected finger (49%).

Anticipated pain and actual pain did not differ significantly among groups ($P = .66$ and .48, respectively) (Fig. 2).