SCIENTIFIC ARTICLE

Effects on the Distal Radioulnar Joint of Ablation of Triangular Fibrocartilage Complex Tears With Radiofrequency Energy

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Purpose This cadaver study investigated the temperature profile in the wrist joint and distal radioulnar joint (DRUJ) during radiofrequency energy (RFE) application for triangular fibrocartilage complex resection.

Methods An arthroscopic partial resection of the triangular fibrocartilage complex using monopolar and bipolar RFE was simulated in 14 cadaver limbs. The temperature was recorded simultaneously in the DRUJ and at 6 other anatomic locations of the wrist during RFE application.

Results The mean temperature in the DRUJ was 43.3 ± 8.2°C for the bipolar system in the ablation mode (60 W) and 30.4 ± 3.4°C for the monopolar system in the cut mode (20 W) after 30 seconds. The highest measured temperature in the DRUJ was 54.3°C for the bipolar system and 68.1°C for the monopolar system.

Conclusions The application of RFE for debridement or resection of the triangular fibrocartilage complex in a clinical setting can induce peak temperatures that might cause damage to the cartilage of the DRUJ. Bipolar systems produce higher mean temperatures than monopolar devices.

Clinical relevance RFE application increases the mean temperature in the DRUJ after 30 seconds to a level that may jeopardize cartilage tissue. *(J Hand Surg Am. 2016;■(■):■−■. Copyright © 2016 by the American Society for Surgery of the Hand. All rights reserved.)*

Key words Temperature, cartilage DRUJ, RFE, wrist, arthroscopy.

Arthroscopic debridement of central triangular fibrocartilage complex (TFCC) tears to a stable rim has become a standard procedure during the last 2 decades with good long-term results.[1−6] A smooth sealed rim of the remaining TFCC edges after mechanical resection[7,8] is achieved by collagen shrinkage, using radiofrequency energy (RFE) that starts at a temperature of 65°C.[9] However, it is known that cartilage damage may occur at temperatures between 45°C and 55°C because of overheating of the joint, even under vigorous irrigation.[10−12] It is theorized that the heat energy is focused in the area 1 mm around the smooth sealed rim during RFE application.[13] However, a recent study revealed that temperatures above 50°C can be detected even at a 5-mm radius from the probe.[14] Thus, unexpected cartilage damage may be induced during resection of the TFCC.[8]

To date, no data exist regarding the temperature distribution in the distal radioulnar joint (DRUJ) and the adjacent anatomical structures during RFE application for TFCC tears. The objective of this study was to obtain temperature profiles during simulated arthroscopic debridement of the TFCC, especially in

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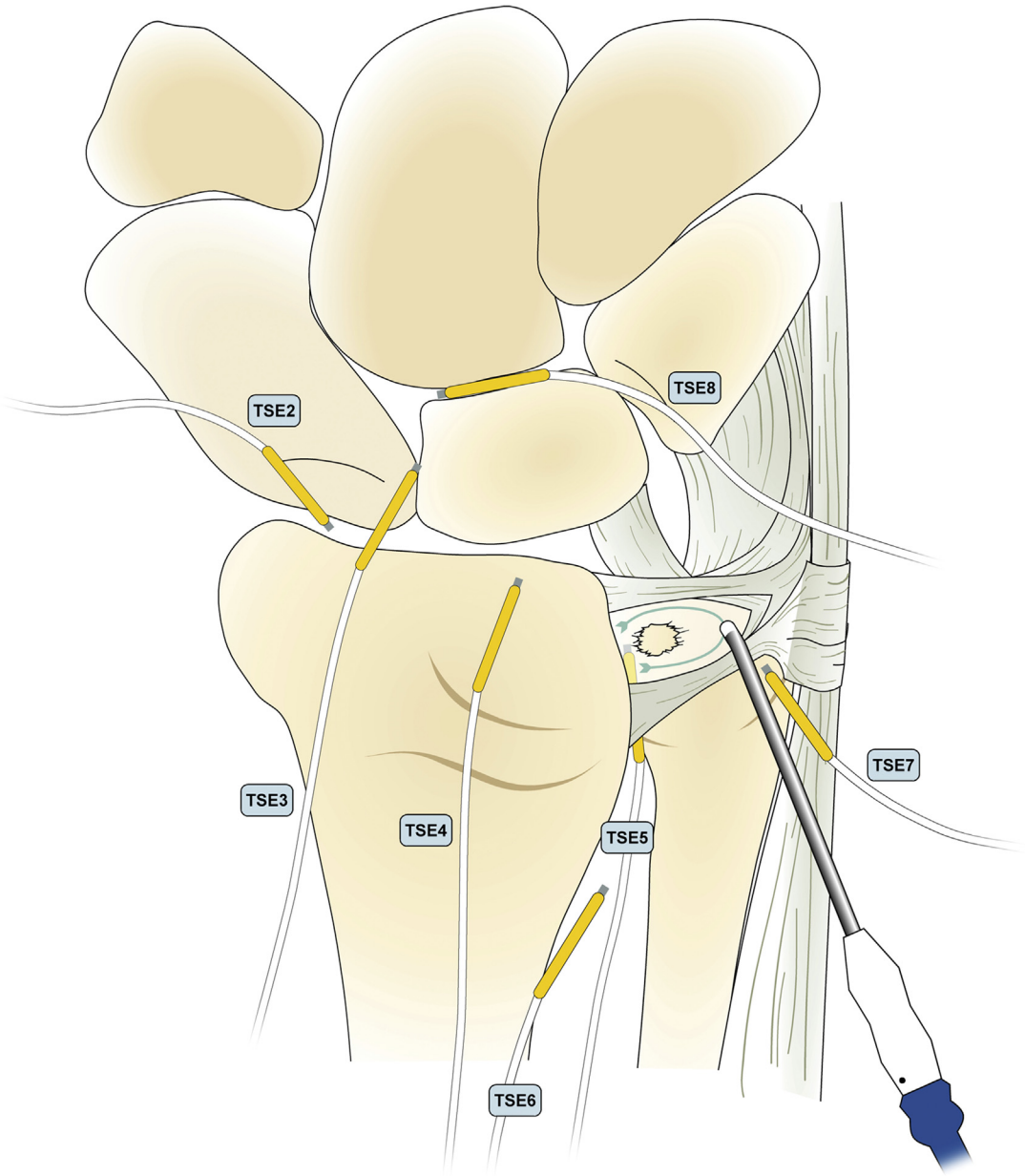

FIGURE 1: Experimental setup with temperature sensor element (TSE) location: TSE 2, radial recess; TSE 3, scapholunate ligament; TSE 4, lunate fossa; TSE 5, distal radioulnar joint; TSE 6, tendon sheath of 4/5; TSE 7, ulnar nerve; TSE 8, midcarpal.

the DRUJ, because the cartilage in the joint is exposed by a TFCC tear. We hypothesized that a debridement of the TFCC with RFE leads to a heat distribution profile with temperatures that are different from when RFE is used for other purposes in the wrist, for example, scapholunate ligament shrinkage.[15] Moreover, we expected a different temperature profile between monopolar and bipolar devices due to the different flow of the energy current.

MATERIALS AND METHODS

Fourteen upper limbs were obtained from seven fresh cadavers. The arms were stored at −20°C without any further fixation and were thawed to room temperature before the experiment. A sample size estimate was not carried out before conducting this study. Recently, published cadaver studies have used similar numbers of specimens.[12,16]

Temperature sensing elements (TSEs) containing platinum-chip sensors (Pt 1000, TYP PCA, 1.1505.10M JUMO GmbH & Co.KG, Fulda, Germany) were used for all experiments. They are capable of measuring 2 temperatures per second, with an accuracy of ±0.1°C. Eight TSEs were used and placed adjacent to susceptible structures in the wrist to monitor temperature changes at those locations.[17]