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Techniques and Procedures

A MODIFIED STRING TECHNIQUE FOR ATRAUMATIC RING REMOVAL

Chelsea Boe, MD and Sanjeev Kakar, MD

*Department of Orthopaedic Surgery, Mayo Clinic, Rochester, Minnesota
Reprint Address: Sanjeev Kakar, MD, Mayo Clinic, 200 First Street SW, Rochester, MN 55905

□ **Abstract—Background: We describe a modified string technique for ring removal from an edematous finger, a critical step in the initial treatment of a patient with upper-extremity trauma. Technique: This technique involves multiple sutures looped around the ring to provide differential tension on the ring as it is advanced distally over a lubricated digit. With the use of an assistant, the ring can be advanced in caterpillar fashion without sliding back proximal when the direct pressure is released as a result of edema. Conclusions: This multisuture technique adds to the armamentarium of methods for ring removal in the setting of upper-extremity trauma without reverting to alternate techniques for cutting or shattering the ring.** © **2018 Elsevier Inc. All rights reserved.**

□ **Keywords—edematous finger; upper-extremity trauma; hand**

INTRODUCTION

Injuries to the hand are common, resulting in pain and swelling of the affected digit. This can be as a result of hand or upper-extremity trauma, allergic reaction, bite or sting, infection, or generalized fluid retention from multiple causes. Often, a ring might be in place on the injured digit and can become constrictive, resulting in worsening pain, swelling, ischemia, nerve damage, and impaired viability of the digit (1).

Techniques for removal of trapped rings are multiple and varied, and can be simplified into two main categories: destructive and non-destructive (or cutting and non-cutting) (2). The destructive techniques involve cutting and bending or shattering the ring. Non-destructive techniques are targeted at ring removal by exsanguinating, lessening edema in the finger, or creating a force on the ring to overcome the edema and bulk of the proximal interphalangeal joint (2).

Specific strategies for non-destructive removal of a trapped ring include the caterpillar method, winding technique, compression technique, glove method, and twin-string technique, as well as their respective modifications. All of these methods are aided by elevation, icing of the digit, and adequate pain control (1–12).

The caterpillar method involves stepwise progression of the ring down the digit with the use of a lubricant and is likely similar to the way in which rings are removed in the absence of trauma and significant edema, excepting perhaps the generous use of lubricant (12). In the winding technique, a suture (or ribbon gauze) is passed under the ring proximal to distal then wrapped circumferentially about the digit to compress the tissue (13). Subsequently, the string is pulled from the proximal end, propelling the ring forward as it unwinds (4,10). The compression technique involves one or multiple Penrose drains wrapped from distal to proximal, compressing the edema distal to the ring so it can be

Procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 and 2008.

Informed consent for research purposes was obtained per institutional protocol.

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Figure 1. Initial suture passage beneath a trapped ring.

manipulated off the digit (6). This has also been described with the use of a Coban wrap (3M Healthcare, Minneapolis, MN) in place of the Penrose, and either can be repeated several times as needed (11). Though similar, the winding and compression techniques differ in the direction of compression (proximal to distal in the winding technique, distal to proximal in the compression technique) and in the lack of need to pass an item beneath the ring in the compression technique.

The glove method also requires space beneath an entrapped ring to pass a detached glove finger. To accomplish this, the finger of a glove is cut on both ends to create a cylindrical tube, which is passed beneath the ring and then pulled from proximal to distal in order to propel the ring distal (7,8). The advantage of this technique is that the glove protects the underlying soft tissues, especially important in the setting of burn; open wound; or sensitive, inflamed skin. The twin-string technique requires the passage of two strings beneath the ring, such that tension can be placed alternately on opposing sides of the ring to prevent it from slipping back as it is propelled forward by manual pressure. This has been

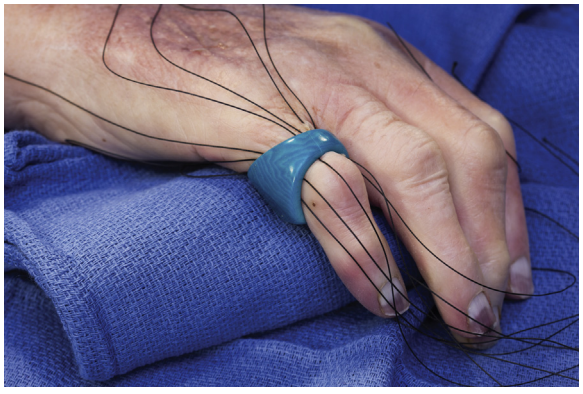

Figure 2. Multiple sutures passed.

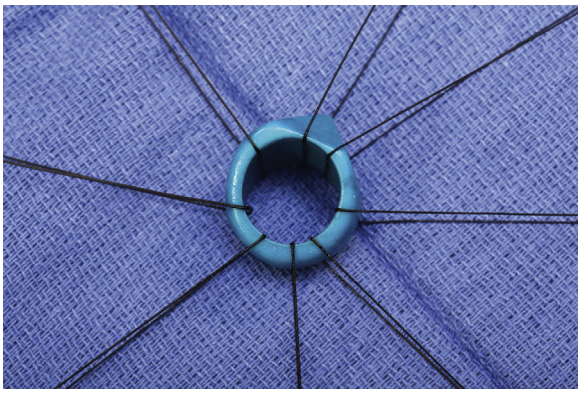

Figure 3. Sutures spaced at roughly equal intervals about the ring.

modified with the use of rubber bands to generate traction on the skin (9).

We present a modification of the twin-string and caterpillar techniques that has allowed us to remove rings swiftly, easily, and without destruction, utilizing implements readily available at bedside in the emergency department.

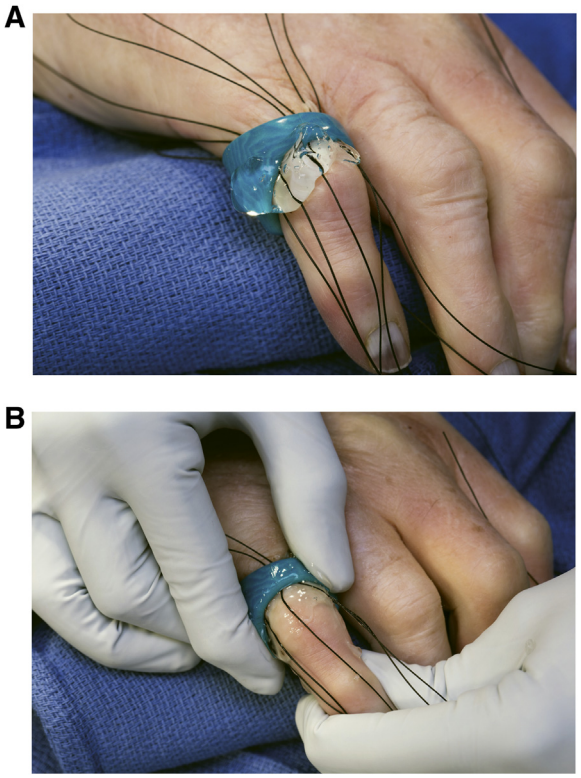

Figure 4. (A) Water-based lubricant applied distal to ring. (B) The lubricant is spread to tissue under the ring by gentle agitation or spinning as able.