

What a Ratchet! A Gripping Case Report of an Entrapped Finger with an Unyielding Wrench

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Summary: Finger entrapment with rings or ring-like objects is an uncommon possible hand emergency. In cases in which noncutting removal is ineffective, ring cutters or dental drills with carbide or diamond burs have been successfully used. However, objects composed of hard metallic alloys, such as lug nuts or wrenches, are often resistant to such equipment. In these instances, larger diameter metal cutting burs or rasps may be more advantageous. Due to their increased size and cutting power, these tools are better suited to handle the toughness of hard metals. In this case report, we present the effective and efficient removal of a stainless steel wrench from an entrapped digit using a helicoidal rasp. Availability of this instrument within orthopedic departments may prevent the delays often described in the treatment of finger entrapment when traditional cutting equipment fails. (*Plast Reconstr Surg Glob Open* 2024; 12:e5833; doi: [10.1097/GOX.0000000000005833](https://doi.org/10.1097/GOX.0000000000005833); Published online 22 May 2024.)

Access to appropriate hand trauma care remains a challenge for minorities, uninsured, underinsured, and rural-based populations.¹ Further, despite the hand being the most injured body part, management of hand traumas often lacks standardized practices.¹ Ring entrapment, in which a ring or similar object incarcerates a finger, is one such hand injury described in children, adults, and psychiatric patients.²⁻⁴ Management of ring entrapment includes both noncutting and cutting methods of removal. Various factors, including the severity of entrapment, clinical status of the patient, physical properties of the constricting object, and equipment availability, dictate management.^{2,5} Significant complications, such as neurovascular compromise and infection, may occur if not promptly and appropriately removed, leading to possible amputation.^{1,3,5}

Noncutting, conventional methods of removal should be attempted first to preserve integrity of the ring. These methods include, but are not limited to, arm elevation and icepack compression, lubrication with axial traction, and specialized advancement techniques used to gently

manipulate the ring from the entrapped digit.^{2,3,5,6} In the event that these methods fail, destructive tools (eg, ring cutter, electric saw, dental drill, Midas rex) become necessary to cut or break the ring.^{2,4-9}

Rings are traditionally made from metals like gold, silver, and platinum, although alloys like tungsten, titanium, and stainless steel have been recently popularized.⁷⁻⁹ In addition to ring entrapment, plastic and hand surgeons have increasingly encountered digit entrapment with household or workplace items, like lug nuts, washers, door latches, and wrenches.^{2,6} These items are typically composed of the aforementioned alloys. In comparison with traditional metals, these alloys fall higher on the Mohs hardness scale, often resulting in ineffective removal with traditional destructive tools.^{2,9} This case report describes a novel approach in the removal of a three-fourth inch, stainless steel combination wrench from a finger. In addition, recommendations in the destructive removal of atypical ring-like objects are discussed.

CASE PRESENTATION

A 65-year-old right hand dominant man presented to the emergency room with his left small finger entrapped on the boxed end of a three-fourth inch combination wrench (Fig. 1). The patient had a history of schizoaffective disorder and lived in a group facility. He placed the wrench on his small finger for “protection” from other residents approximately 6 weeks before presentation.

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Fig. 1. The boxed end of a combination wrench is entrapped on the small finger proximal to the proximal interphalangeal joint. The boxed end is circular without an opening and overlapped a smaller ring beneath. Neither object could be removed with nondestructive methods and both were eroding through the skin.

Over the week before presentation, he stated the finger became more swollen and he was no longer able to rotate the wrench without pain. On close inspection of the finger during physical examination, an additional ring was observed underneath the wrench, both of which eroded the dorsal skin. Due to the chronicity of the injury and similar pulse oximeter measurement of 92% between the incarcerated and nonincarcerated fingers, removal in the emergency room was deferred. The patient was admitted, started on antibiotics, and scheduled for removal of the wrench and ring in the operating room the next morning.

In the operating room, the patient received a regional block and sedation, an upper arm tourniquet was placed, and the extremity was exsanguinated. A disposable metal cutting helicoidal rasp with a 3.2-mm diameter × 18.3-mm head length (Stryker, Kalamazoo, Mich.; product no.: 5120-080-030) was used alongside a Stryker handpiece and foot pedal. (See figure, Supplemental Digital Content 1, which shows how metal cutting Helicoidal Rasp 3.2-mm diameter × 18.3-mm head length was used with a Stryker handpiece to cut into the boxed end of a three-fourth inch combination wrench. A freer elevator was wedged between the finger and the metal to protect the underlying structures. Copious irrigation was performed with cystoscopy tubing connected to a hanging saline bag. <http://links.lww.com/PRSGO/D230>.) To protect the skin, a Freer elevator was

placed between the wrench and ring and the wrench was cut dorsally over the extensor mechanism with copious irrigation. The wrench was then rotated, and a second cut was again made dorsally. Each cut lasted for a duration of 2 minutes. With the wrench now freed, the cutting technique was repeated for the ring with cuts performed in 10-second intervals. Figure 2 shows a photograph of the boxed wrench end and ring after destructive removal. The tourniquet was released after 15 minutes, and the small finger perfused. The dorsal skin was eroded with exposed paratenon, and volar skin was intact (Fig. 3). The patient was dressed with xeroform, cast padding, and all cotton elastic and discharged the following day with instructions of once daily dressing changes.

DISCUSSION

Gold, silver, and platinum rings have recently been replaced by those made of titanium, tungsten, and stainless steel.⁷⁻⁹ Additionally, presentation of finger entrapment with hard metallic household or workplace items (eg, lug nuts, wrenches) has become more frequent.^{2,6} These materials resist traditional ring and bolt cutters.^{2,4-9} Alternative destructive techniques exploit the “brittleness” of these metal alloys to shatter rather than cut them. When the aforementioned techniques are unsuccessful, use of dental carbide or diamond burs (1) under copious irrigation and (2) in cut and rest intervals is often attempted.⁶⁻⁹ However, even these instruments may be insufficient in the destructive removal of objects composed of hard metallic alloys.

When traditional cutting tools fail, previous cases have reported the need to contact local fire or public works departments for more powerful cutters or saws.^{2,8} Such instances highlight the need to identify alternative cutting tools within the hospital, as delays in the removal of entrapped digits pose significant risk to the patient, including preventable amputation.² A helicoidal rasp, often used to cut and remove orthopedic hardware, is likely available within most orthopedic departments.¹⁰ In comparison with standard dental burs, helicoidal rasps exhibit a greater kerf and surface area, generating a wider slit in the ring and effectively removing more metal. Moreover, when combined with extensive drip irrigation, this method may allow for greater dissipation of heat. In this report, the helicoidal rasp proved to be safe and efficient, requiring approximately 4 minutes to remove the wrench. In this



Fig. 2. The boxed wrench end and ring after destructive removal.



Fig. 3. Pictures of the hand after removal of the boxed wrench and ring. The volar skin (A) was intact, but the dorsal skin (B) was eroded with intact paratenon. The small finger perfused well after the tourniquet was removed.

context, the helicoidal rasp may serve as a viable solution in similar challenging cases of finger entrapment.

CONCLUSIONS

This report details the successful destructive removal of a stainless steel combination wrench entrapping a finger. Traditionally, ring cutters or dental drills equipped with metal cutting carbide burs have been used for such tasks. However, demanding cases of entrapment with objects composed of hard metallic alloys may require the use of larger diameter metal cutting burs or rasps. The increased size and cutting capacity of these tools may be better equipped to tackle the robustness of hard metals, providing an efficient solution in such challenging scenarios.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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