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## Case Report

## A case report of comminuted trapezium fracture with surgical treatment

Yusuke Eda<sup>a,\*</sup>, Yasukazu Totoki<sup>b,c</sup>, Tsukasa Nakagawa<sup>a</sup>, Masashi Yamazaki<sup>c</sup><sup>a</sup> Department of Orthopaedic Surgery, Ibaraki Western Medical Center, 555 Ootsuka, Chikusei, Ibaraki 308-0813, Japan<sup>b</sup> Department of Emergency and Critical Care Medicine, University of Tsukuba Hospital, 2-1-1 Amakubo, Tsukuba, Ibaraki 305-8576, Japan<sup>c</sup> Department of Orthopaedic Surgery, Faculty of Medicine, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 305-8575, Japan

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## ABSTRACT

Comminuted trapezium fracture is very rare. As the trapezium is necessary for thumb movements, delayed diagnosis and treatment can result in thumb carpometacarpal (CM) joint osteoarthritis and restricted mobility. The K-wire or screw fixation is recommended for repairing displaced fractures. However, there is currently no established treatment protocol for this rare fracture. In trapezium fracture, a technique with K-wire fixation in addition to open reduction and internal fixation (ORIF) has been reported with favorable clinical outcomes. In this report, we present a case of comminuted trapezium fracture successfully treated with surgery. The present case involved a 26-year-old woman who was injured while driving her car, which led to a comminuted trapezium fracture. ORIF was conducted with headless screws and a locking plate, and the first and second metacarpals were temporarily fixed by K-wire with the thumb in traction. Six months after surgery, bony union and favorable clinical outcomes were achieved. This technique could be beneficial to prevent articular surface collapse in the comminuted trapezium fracture and to achieve favorable clinical outcomes.

## Introduction

Trapezium fractures are very rare, accounting for only 1%–6% of all carpal fractures [1,2]. Comminuted fractures, in particular, are an uncommon type of trapezium fracture. As trapezium is necessary for pinching and other thumb movements, early diagnosis and treatment of trapezium fracture are crucial, and delayed treatment can result in thumb carpometacarpal (CM) joint osteoarthritis and restricted mobility. An articular step-off in trapezium fractures is considered an indication for surgery, and open reduction and internal fixation (ORIF) are preferable to obtain accurate articular surface repair [3]. In this report, we present a case of comminuted trapezium fracture treated with ORIF that resulted in favorable clinical outcomes after 6 months of follow-up.

## Case presentation

A 26-year-old woman presented to our hospital with right-hand pain. While driving, she was stuck on the left side by another car. On clinical examination, her right thumb CM joint and the anatomical snuffbox were swollen and tender. The thumb movement was restricted due to pain. The hand X-ray and computed tomography (CT) scan were performed and revealed a trapezium, scaphoid, and

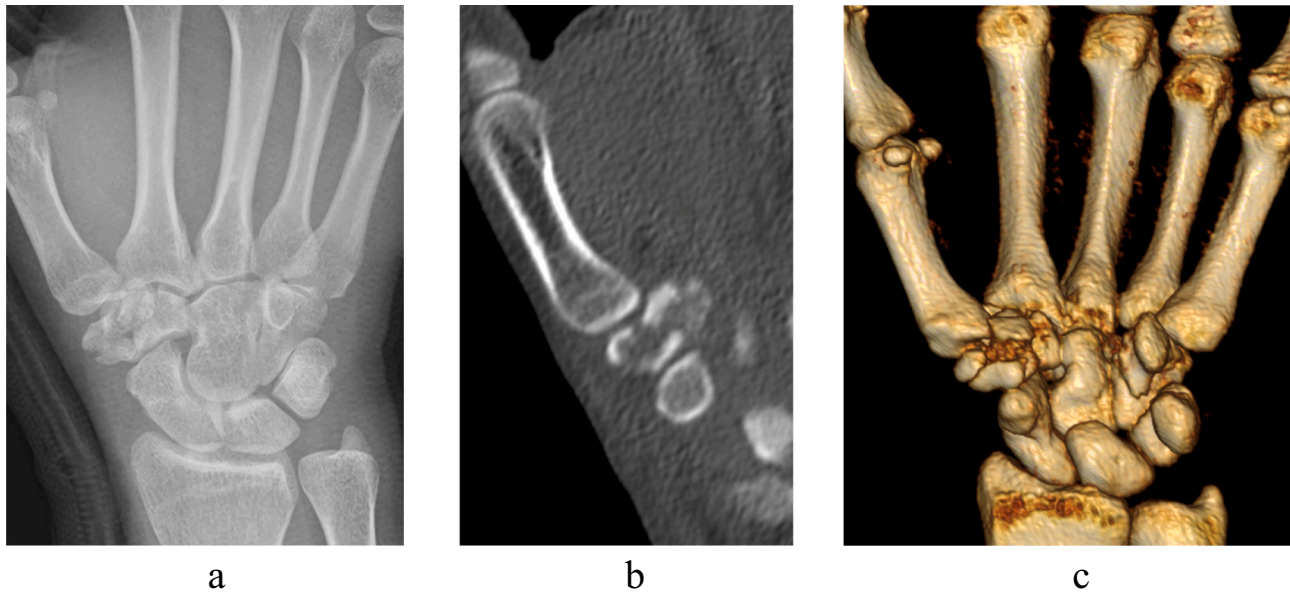
\* Corresponding author.

E-mail address: [y.eda@tsukuba-seikei.jp](mailto:y.eda@tsukuba-seikei.jp) (Y. Eda).<https://doi.org/10.1016/j.tcr.2022.100732>

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**Fig. 1.** An initial X-ray (a), a computed tomography (CT) scan (b), and a three-dimensional (3D) CT scan (c) showed trapezium, scaphoid, and hamate fractures. The trapezium fracture was comminuted, with articular surface collapse.

hamate fracture. The trapezium fracture was comminuted, and the trapezium's articular surface collapsed. The scaphoid and hamate fractures were not displaced (Fig. 1). The operation was conducted 13 days after the injury. Percutaneous headless screw fixation was conducted to repair the scaphoid and hamate fractures. However, the trapezium fracture was repaired with ORIF via a radial approach. The first and second metacarpals were temporarily fixed by K-wire while the thumb was in traction. Therefore, the collapsed articular surface of the trapezium was lifted, and an artificial bone was used to fill the subchondral bone defect, which was fixed by headless screws and a locking plate (Fig. 2).

After six weeks of thumb spica immobilization, the intermetacarpal K-wire was removed, and active range of motion (ROM) exercises with thumb spica orthosis were started. Six months after surgery, bone union was accomplished (Fig. 3). The patient had mild pain with a ROM of 80 degrees for flexion in the interphalangeal (IP) joint, 0 degrees for extension in the IP joint, 60 degrees for flexion in the metacarpophalangeal (MP) joint, 0 degrees for extension in the MP joint, and 50 degrees for dorsiflexion, 55 degrees for palmar flexion, 20 degrees for radial flexion, and 35 degrees for ulnar flexion. The Mayo wrist score was satisfactory (60 points).

## Discussion

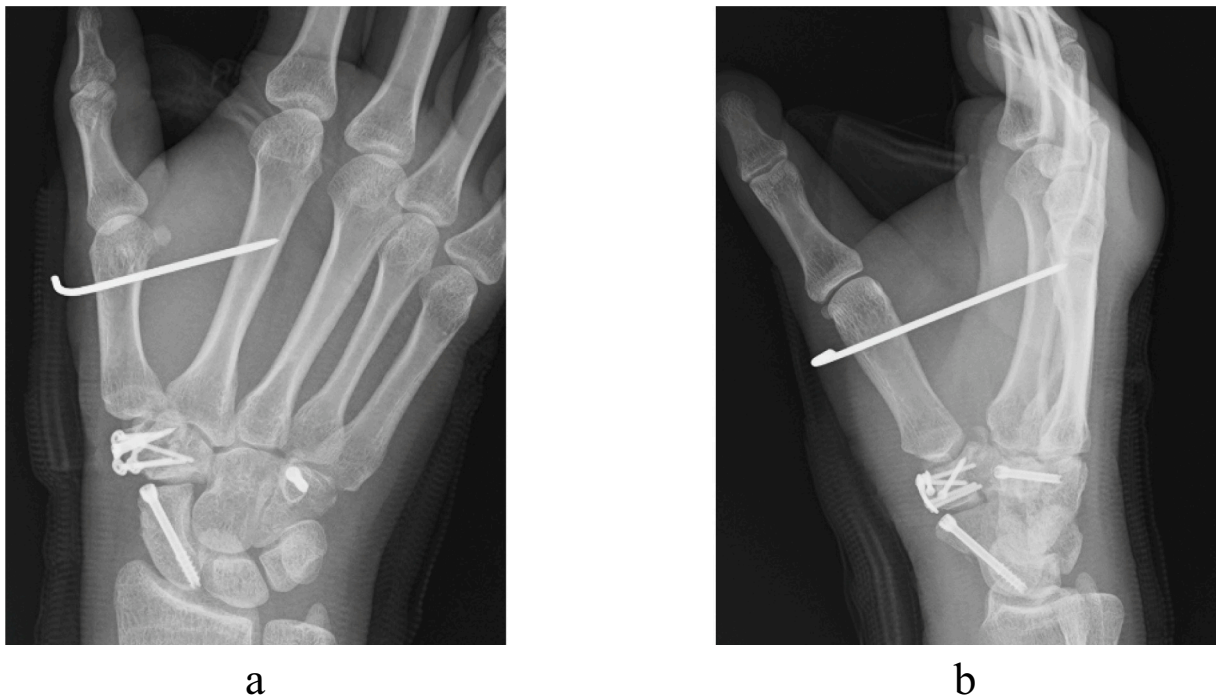
The trapezium articulates distally with the first metacarpal bone, proximally with the scaphoid, and medially with the trapezoid and second metacarpal bone. The thumb has a unique and vital role in hand movements such as grasping and pinching. The trapezium is the main bone that underlies the thumb function. Although trapezium fracture is rare, it is one of the most serious fractures that should not be neglected, since delayed diagnosis and treatment can result in functional limitations of the thumb [4].

According to Walker et al., trapezium fractures were classified into the following five types: type I which is a horizontal body fracture, type II which is a radial tuberosity fracture with a fracture line extending to the CM joint (type IIa), or to the scapho-trapeziotrapezoid joint (type IIb), type III which is an ulnar tuberosity fracture, type IV is a vertical body fracture, and type V which is a comminuted fracture [5]. The injury mechanisms of trapezium fracture have been proposed in two ways: direct dorsoradial impaction or indirect axial loading. Although there are several types of trapezium fracture, the trapezium body fracture has been linked to an indirect mechanism [4]. In the present case, it is presumed that the comminuted trapezium fracture and the scaphoid fracture were caused by an indirect axial loading force to the thumb.

A thumb spica cast could be used to treat type I fractures without surgery [6]. In the case of type II-IV fractures, displaced fractures with an articular step off of more than 2 mm or CM joint dislocation should be treated with K-wire or screw fixation [3].

The blood supply to the trapezium is provided by two pathways, with intraosseous anastomoses connecting them [7]. In contrast to scaphoid fracture, the risk of non-union in trapezium fractures is considered low due to good vascularization [6]. However, Type IV and V fractures have a poor prognosis because they involve both the trapeziometacarpal and scaphotrapezoidal joints [8].

McGuigan et al. reported that 5 of 11 intra-articular fractures resulted in arthropathic changes [3]. The present case was a



**Fig. 2.** X-rays after surgery (a, b) showed that the trapezium, scaphoid, and hamate were fixed with a locking plate and screws, with K-wire fixation between the first and second metacarpals.



Fig. 3. X-rays after six months of operation (a, b) showed that bony union was accomplished.

comminuted fracture (type V), and ORIF was performed to minimize the articular surface. The treatment of comminuted trapezium fractures has received little attention, with traction, closed reduction, or ORIF have all being proposed for stabilization, with satisfactory results. Gelberman et al. applied the traction fixation technique introduced for Bennett's fracture to the trapezium fracture, using K-wire and a rubber band for traction [8]. Furthermore, McGuigan et al. and Aidin et al. performed ORIF for comminuted trapezium fractures [3,7]. K-wire fixation between the first and second metacarpals has also been reported for comminuted trapezium fractures. This technique applies traction on the CM joint to prevent trapezium articular surface collapse [7,9,10]. However, there is currently no established treatment protocol for this rare fracture.

In the present case, ORIF with headless screws and a locking plate was conducted to minimize the articular surface, and the subchondral bone defect was filled with artificial bone. In addition, to prevent trapezium articular surface collapse, the first and second metacarpals were fixed with K-wire in thumb traction. After the K-wire used for traction was removed, there was a mild collapse of the articular surface, but there was no step off of the CM articular surface and the bony union was accomplished. This K-wire fixation technique between the first and second metacarpals to decompress the comminuted CM articular surface in the early stages of treatment could be beneficial to prevent articular surface collapse. This technique may be one feasible operative option to achieve favorable clinical outcomes in comminuted trapezium fractures. However, this study is limited by the possibility of future complications such as osteoarthritis due to the short follow-up period.

In conclusion, we reported a case with a very rare comminuted trapezium fracture that achieved favorable short-term clinical outcomes. In addition to ORIF or K-wire fixation, a K-wire fixation between the first and second metacarpals to decompress the thumb CM joint could be useful for treating comminuted trapezium fractures.

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#### Declaration of competing interest

The authors declare that there are no relevant conflicts of interest.

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