

The following content was supplied by the authors as supporting material and has not been copy-edited or verified by JBJS.

Supplementary Appendix

Nonoperative versus Operative Treatment for Displaced Finger Metacarpal Shaft Fractures:
 A Prospective, Noninferiority, Randomized Controlled Trial

Table of contents:	Page:
Appendix A, Reference Swedish Fracture Registry	2
Appendix B, Nonoperative treatment regime	3
Appendix C, Operative treatment regime.....	4
Appendix D, X-ray measurement protocol.....	5
Appendix E, Complication rapport	6
References to supplementary appendix	7

Appendix A

Reference Swedish Fracture Registry and calculations

Date

2011-0-01 to 2021-11-08

ICD-10 code

S62.3N – Metacarpal II

S62.3M – Metacarpal III

S62.3R – Metacarpal IV

S62.3L – Metacarpal V

Fracture type

MAO-77-A2.2-N (spiral/oblique fracture of the diaphysis)

Results

Fractured metacarpal	Nonoperative treatment %	Op after nonoperative treatment is abandoned %	Operative treatment as first choice %	Total number of fractures
S62.3N – MC II	67.8	4.0	28.1	398
S62.3M – MC III	83.7	2.7	13.6	1296
S62.3R – MC IV	80.2	2.4	17.4	2702
S62.3L – MC V	80.2	3.2	16.7	2948

Calculations

Total number of fractures

$398+1296+2702+2948=7344$

Added percentage from yellow and blue column for each metacarpal.

%	%	%	% x total number of fractures	Approximate number of fractures operated on
4.0	28.1	32.1	$0.321 \times 398 = 127.758$	128
2.7	13.6	16.3	$0.163 \times 1296 = 211.248$	211
2.4	17.4	19.8	$0.198 \times 2702 = 534.996$	535
3.2	16.7	19.9	$0.199 \times 2948 = 586.652$	587

Total number of fractures operated on

$128+211+535+587= 1461$

$1461/7344 = 0.1989$ approx. 0.2 → **20% MC was operated on out of approx. 7000 fracturs** during the time period of January 1st 2011 and 8th of November 2021.

Appendix B

Nonoperative treatment regime

At inclusion

- No cast or continuous immobilization.
- Appointment with a physiotherapist (Uppsala) or occupational therapist (Falun) at inclusion to procure instructions about early mobilization exercises.
- Exercise: maximum finger flexion and extension: five repetitions, five times a day (total=25).
- Patients should be able to make a fist with no more than 3 cm fingertip-to-palm distance within 5 days from inclusion.
- Unrestricted mobilization and use of the hand are allowed.
- Either a soft or hard wrist orthosis (with metacarpophalangeal joint (MCP)/proximal interphalangeal joint (PIP)/distal interphalangeal joint (DIP) not included) can be made and used by the patient between training sessions if desired.

Appendix C

Operative treatment regime

Open reduction and internal fixation were performed under general or regional anaesthesia with tourniquet control. Using a standard longitudinal dorsal approach, the fractures were reduced and stabilized with at least two lag screws or, if comminute, a dorsally placed VA-LCP plate and screws (2 mm) (LCP compact hand 2.0, DePuy Synthes, Raynham MA, USA). X-ray is available in the theatre to examine anatomic reduction and correct screw length. A backslap plaster cast was applied postoperatively, leaving the proximal inter-phalangeal (PIP) joints free. After 2 weeks, the skin sutures were removed, and the patient started mobilization with physiotherapy or occupational therapy support. Orthoses (e.g., splints) were offered for heavier activities, such as sports or heavy manual work, as in the nonoperative group.

1 week postoperative

- An appointment with a physician for radiological and cast control.

2 weeks postoperative

- Cast removal and appointment with a physiotherapist or occupational therapist for instructions about mobilization exercises.
- Exercise: maximum finger flexion and extension: five repetitions five times a day (total=25).
- Patients should be able to make a fist with no more than 3 cm fingertip-to-palm distance within 5 days.
- A rigid wrist orthosis (with MCP/PIP/DIP not included) was made and used by the patients between training sessions if they requested it.
- Free mobilization without load was allowed 2 weeks postoperatively and after 4 weeks, patients could use their hands unrestricted.

Appendix D

Method for measuring shortening of x-ray.

All radiological pictures for each study participant at inclusion and at 1- and 6-week follow-up were addressed according to the protocol below.

First, measurements were done according to the method of shortening stipulated (SH-stip), as presented by Sletten et al. in 2012.⁵ On a posteroanterior film, a line (metacarpal line) was drawn through the most distal point of the heads of the neighbouring metacarpals. Shortening was defined as the distance from this line to the most distal point of the fractured metacarpal.

In the figure to the right, the white line A represent the metacarpal line and the red line B represent the distance from metacarpal line to the distal part of fractured 4th metacarpal.



Radiographs were measured in chronological order.

Second, measurements were done by identifying overlapping bone at the fracture site in which it was best visualized.

If none of the projections were suitable, we looked at all radiographs (posteroanterior, lateral, oblique) and calculated a mean value.

Radiographs were assessed chronologically.

Measurements for both SH-stip and bone overlap were recorded and the value representing the largest estimated shortening was used for analysis.

In the figure to the right, the red bracket represents the shortening of the fractured 4th metacarpal.



Appendix E

Complications

Three patients (all from the operative group) underwent revision surgery.

One patient did two revision surgeries due to secondary displacement after the primary operation with one lag screw and non-union. The patient ended up with plate fixation and healed.

The second patient had revision surgery due to lag screw fixation failure (two screws) after lifting a 10 kg object 1 week postoperatively and had secondary plate fixation.

The third patient asked for the removal of the screws after 110 days (approximately 3 months) due to local discomfort.

Minor complications

Five minor complications were noted, one in the nonoperative group: (1) one case of triggering of the fractured finger on rare occasions and four in the operative group. Minor complications in the operative group were (1) one case of mild carpal tunnel syndrome that could be treated with a night splint, (2) one case of mild carpal tunnel syndrome and concomitant frozen shoulder, (3) one slight discomfort around the scar and concomitant paronychia that was treated with an oral antibiotic and (4) one case where the fracture healed displaced despite operative treatment. None of the minor complications needed surgery.

References to supplementary appendix

1. Carreño A, Ansari MT, Malhotra R. Management of metacarpal fractures. *J Clin Orthop Trauma*. 2020;11(4):554-561. doi:10.1016/j.jcot.2020.05.043
2. van Onselen EBH, Karim RB, Hage JJ, Ritt MJPF. Prevalence and distribution of hand fractures. *J Hand Surg Edinb Scotl*. 2003;28(5):491-495. doi:10.1016/s0266-7681(03)00103-7
3. Nakashian MN, Pointer L, Owens BD, Wolf JM. Incidence of metacarpal fractures in the US population. *Hand N Y N*. 2012;7(4):426-430. doi:10.1007/s11552-012-9442-0
4. Chung KC, Spilson SV. The frequency and epidemiology of hand and forearm fractures in the United States. *J Hand Surg*. 2001;26(5):908-915. doi:10.1053/jhsu.2001.26322
5. Sletten IN, Nordsletten L, Hjorthaug GA, Hellund JC, Holme I, Kvernmo HD. Assessment of volar angulation and shortening in 5th metacarpal neck fractures: an inter- and intra-observer validity and reliability study. *J Hand Surg Eur Vol*. 2013;38(6):658-666. doi:10.1177/1753193412461582