Preprints.org

Article

Not peer-reviewed version

Minimally Invasive Antegrade Fixation of Proximal Phalangeal Fractures with Intramedullary Cannulated Compressive Screws

Seung Yun Oh and Seokchan Eun *

Posted Date: 23 March 2026

doi: 10.20944/preprints202603.1680.v1

Keywords: proximal phalanx fracture; intramedullary headless screw; cannulated compressive screws; intramedullary fixation; antegrade approach

Preprints.org is a free multidisciplinary platform providing preprint service that is dedicated to making early versions of research outputs permanently available and citable. Preprints posted at Preprints.org appear in Web of Science, Crossref, Google Scholar, Scilit, Europe PMC.

Copyright: This open access article is published under a Creative Commons CC BY 4.0 license, which permit the free download, distribution, and reuse, provided that the author and preprint are cited in any reuse.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 23 March 2026 doi:10.20944/preprints202603.1680.v1

Disclaimer/Publisher's Note: The statements, opinions, and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions, or products referred to in the content.

Article

Minimally Invasive Antegrade Fixation of Proximal Phalangeal Fractures with Intramedullary Cannulated Compressive Screws

Seung Yun Oh [1] and Seokchan Eun [2,*]

[1] The University of Melbourne Medical School, Parkville, Victoria, 3010, Melbourne, Australia

[2] Department of Plastic and Reconstructive Surgery, Seoul National University College of Medicine, Seoul National University Bundang Hospital, 82 Gumi-ro 173beon-gil, Bundang-gu, Seongnam 463-707, Republic of Korea

* Correspondence: sceun@snu.ac.kr; Tel.: +82-31-787-7223; Fax: +82-31-787-4055

Abstract

Background/Objectives: Proximal phalangeal fractures account for 38% of all phalangeal fractures, with unstable patterns requiring surgical intervention. Various modalities have been explored, including open reduction and internal fixation, percutaneous K-wire fixation, and intramedullary techniques. This study explores the technical nuances, indication, and outcomes of antegrade cannulated compressive screw (CCS) fixation of proximal phalangeal fractures. **Methods**: This retrospective case series involved 18 closed proximal phalanx fractures in 16 patients who underwent intramedullary headless screw fixation between January 2018 and December 2023. Records were reviewed for demographics, fracture characteristics, and screw type. With the metacarpophalangeal joint flexed at 60°–75°, a 1 cm longitudinal incision was made, the extensor tendon split, and a 0.9 mm guidewire advanced anterogradely along the phalangeal axis under fluoroscopy. A 2.2 mm or 3.0 mm SpeedTip CCS (Medartis, Basel, Switzerland) was selected based on phalanx size and advanced until fully buried below the cartilage line. Postoperatively, patients were immobilized in a volar intrinsic-plus splint, transitioned to a gutter splint within five to seven days, and commenced on range of motion exercises within one week. Primary outcomes included radiographic union, TAM, QuickDASH scores, and postoperative complications. **Results**: All fractures were healed within acceptable radiological parameters and with no postoperative complications. Mean TAM was measured to be 216° ± 7.7° (range 200°-230°) and mean QuickDASH was 10.1 ± 3.8 (range 5-16). **Conclusions**: Antegrade intramedullary headless screw fixation is a safe and effective technique for unstable proximal phalanx fractures yielding excellent functional outcomes with early mobilization and minimal complications.

Keywords: proximal phalanx fracture; intramedullary headless screw; cannulated compressive screws; intramedullary fixation; antegrade approach

---

1. Introduction

Phalangeal fractures are among the most common injuries of the upper extremities accounting for approximately 10% of all fractures [1,2]. Within the hand, the proximal phalanx is the second most common injured bone accounting for approximately 15% to 20% of all hand fractures and 38% of all phalangeal fractures [3,4]. The primary goal of treatment is to achieve fracture healing in an acceptable anatomical alignment while preserving the functionality of the hand to allow early mobilization [5]. This balance is critical to prevent stiffness of the distal interphalangeal (DIP) and proximal interphalangeal (PIP) joints in order to preserve the gliding motion of surrounding flexor and extensor tendons [4,5].

© 2026 by the author(s). Distributed under a Creative Commons CC BY license.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 23 March 2026 doi:10.20944/preprints202603.1680.v1

Management of these fractures depends on their stability. Stable, non-displaced fractures can often be treated via conservative, non-operative, means with aims of providing sufficient stability while minimizing the risks associated with immobilization such as joint stiffness [6]. However, unstable fractures based on fracture pattern and mechanism of injury, patient characteristics, and functional requirement may require surgical intervention [6,7]. Historically, surgical options have included percutaneous Kirschner-wire (K-wire) fixation, open reduction with plates and screws, and internal fixation with K-wires, screws, and microplates [8]. While these methods can be effective, they each have inherent drawbacks. Plate fixation provides absolute stability but requires extensive soft tissue dissection, which can lead to tendon adhesions, stiffness, and the potential need for second surgery for hardware removal [9]. Whereas K-wire fixation, although less invasive, provides less rigid stability, often requires prolonged immobilization, and carries postoperative complication risks such as pin-site infections and extensor tendon tethering [6,8,9].

To address these limitations, intramedullary fixation using cannulated compressive screws (CCS), also known as intramedullary headless screws (IMHS), has emerged as a reliable and minimally invasive alternative [2,10]. This technique was first popularized for scaphoid fractures by Herbert and Fischer, but in recent years have been adapted for phalangeal and metacarpal fractures [11–13]. The minimally invasive nature of this technique offers the advantage of providing rigid internal fixation with minimal disturbance to surrounding soft tissues, tendons, and joints, all of which facilitates early postoperative mobilization with minimal pain [2,6,10,13]. However, this technique also has its own unique set of complications. A primary concern is the creation of a defect in the articular cartilage at the screw's entry point, which could potentially lead to joint damage over time [14,15]. Furthermore, in a case series by Kupperman [16] hardware-related issues such as screw unravelling has been noted, but particularly so in the dense bone of younger patients. Several studies attribute this hardware complication to the self-drilling nature of headless screws resulting in "catching" to the dense cancellous bone in younger patients [17]. This in combination with rotational momentum provided upon insertion of the screw increases its risk to unravel [17–20].

Despite the growing use of these implants and existing literature elucidating its effectiveness, technical precision and precaution is highlighted in avoiding adverse outcomes. As such, this study aims to evaluate the clinical complications and outcomes following antegrade cannulated compressive screw fixation of proximal phalangeal fractures. Furthermore, to also provide suggestions on how to avoid the potential complications associated with this surgical technique.

2. Materials and Methods

This study is a single surgeon (S.C. Eun) retrospective case series review conducted on all patients who underwent intramedullary headless screw fixation for proximal phalangeal fractures between January 2018 to December 2023. This study received approval from the Seoul National University institutional review. All patients were treated with intramedullary headless screw fixation during this period were included. Cases with complex fractures such as comminuted and long oblique fractures were considered for alternative techniques. Patient medical records, operative reports, and radiographs were reviewed to collect data on demographics, fracture characteristics, and screw type. Informed consent was obtained from all patients prior to their procedure. The primary outcomes assessed in this study were radiographic union, functional recovery, patient-reported outcomes, and postoperative complications.

2.1. Surgical Technique

All procedures were performed following sterile preparation of the operative extremity and manual reduction of the fracture under fluoroscopic guidance. With the metacarpophalangeal (MCP) joint flexed between 60° and 75°, a longitudinal incision of approximately 1 cm was made over the joint. The extensor tendon was split longitudinally to expose the base of the proximal phalanx. Once manual reduction was achieved, a 0.9 mm guidewire was inserted along the longitudinal axis of the phalanx in an antegrade manner under fluoroscopic guidance. The position of the guidewire was

© 2026 by the author(s). Distributed under a Creative Commons CC BY license.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 23 March 2026 doi:10.20944/preprints202603.1680.v1

confirmed with fluoroscopy. Following this, a drill was used over the guidewire, and appropriate screw length was determined from preoperative imaging. A 2.2 mm or 3.0 mm SpeedTip cannulated compression screw (Medartis, Basel, Switzerland) was selected based on phalanx size, with 2.2 mm screws being used in most cases. The screw was advanced until fully buried below the cartilage line, with precaution taken to avoid over-insertion given the self-drilling, self-tapping nature of the implant. Furthermore, to prevent rotational deformity, the proximal phalanx was held firmly as the implant was inserted. Rotational alignment was verified clinically by confirming finger cascade after full screw insertion. Following confirmation, the skin was then closed with 2-0 nylon suture.

2.2. Postoperative Management, Rehabilitation, and Outcome Measurement

Postoperatively, patients were placed in a volar splint with the hand in an intrinsic-plus position. This was then transitioned to a custom forearm-based radial (second and third digit fractures) or ulnar gutter splint (fourth and fifth digit fractures) within five to seven days. Patients were then commenced on active and passive-assisted range of motion exercises within one week of surgery, with progression to strengthening as tolerated during follow-up visits. The postoperative protocol was modified depending on the needs of the concomitant injuries.

Radiographic union and healing were evaluated on plain radiographs taken at every follow-up visit. To measure functional outcome, Total Active Motion (TAM; active flexion of metacarpophalangeal, proximal interphalangeal, and distal interphalangeal joints minus the extension deficits in these joints) was measured using a handheld goniometer by an independent assessor (physician assistant) in every follow-up visit. Quick Disabilities of the Arm, Shoulder and Hand (QuickDASH) outcome scores was recorded to measure patient-reported outcomes. Finally, postoperative complications were defined as infection, loss of fixation, hardware failure, malrotation, nonunion, malunion, scar tenderness, metal allergy, delay in return to activities of daily living, or any need for repeat surgical intervention.

3. Results

In this case series, a total of 18 closed transverse fractures were treated in 16 patients with a mean age of 51.1 ± 13.0 years (range 24-71). 9 of the patients were males whereas the remaining 7 were females. All surgeries were performed within 10 days of injury. Furthermore, all patients were right hand dominant with no significant comorbidities. 11 patients had fractures involving the left hand and 5 patients with fractures sustained on the right hand. 2 patients had 2 fractures sustained on one hand whereas the remaining patients only had 1 fracture. There was 1 fracture involving the first digit, 6 fractures involving the second digit, 2 fractures involving the third digit, 5 fractures involving the fourth digit, and 4 fractures involving the fifth digit. 14 fractures were at the level of the base of the proximal phalanx and 4 fractures at the level of the shaft (Table 1).

3 (18.8%) fractures were fixed with a 3.0 mm headless cannulated screw (Medartis, Basel, Switzerland), two of which involved the second digit and one involving the fourth. The remaining 13 (81.3%) fractures were fixed with a 2.2 mm headless screw. The mean screw length was 25.9 ± 1.1 mm (range 24-28) (Table 2).

Mean postoperative follow-up was 11 ± 3.8 weeks (range 6-21) and all fractures were healed at the latest follow-up appointment verified with plain radiographs (Figures 1–4). No patient required reoperation for malrotation, malunion, delayed union, MCP joint stiffness, screw migration, or infection. Furthermore, no patients exhibited allergic or any adverse reaction to the implant and no postoperative complications were observed. Through patient-reported testimonies, all working patients resumed full duties without significant limitations and non-workers have returned to activities of daily living without any limitations. Mean TAM was 216° ± 7.7° (range 200°-230°) and mean QuickDASH was 10.1 ± 3.8 (range 5-16) (Table 3).

© 2026 by the author(s). Distributed under a Creative Commons CC BY license.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 23 March 2026 doi:10.20944/preprints202603.1680.v1

Table 1. Patient Demographics.

Demographics	Value
No. of Patients	16
Mean Age ± SD (range), years	51.1 ± 13.0 (24-71)
Sex	
Male	11 (68.8%)
Female	5 (31.3)
Hand Involvement	
Right	5 (31.3%)
Left	11 (68.8%)
Digit Fractured	
1st	1 (5.6%)
2nd	6 (33.3%)
3rd	2 (11.1%)
4th	5 (27.8%)
5th	4 (22.2%)
Level of Fracture	
Base	12 (75%)
Shaft	4 (25%)

Table 2. Operative Characteristics.

Digit	2.2 mm	3.0 mm	Total
1st	1 (6.7%)	0	1 (5.6%)
2nd	4 (26.7%)	2 (66.7%)	6 (33.3%)
3rd	2 (13.3%)	0	2 (11.1%)
4th	4 (26.7%)	1 (33.3%)	5 (27.8%)
5th	4 (26.7%)	0	4 (22.2%)
Total	15	3	18

Table 3. Postoperative Outcomes.

Outcomes	Value
Mean Follow-Up ± SD (range), weeks	11 ± 3.8 weeks (6-21)
Mean TAM ± SD (range)	216° ± 7.7° (200°-230°)
Mean QuickDASH ± SD (range)	10.1 ± 3.8 (5-16)

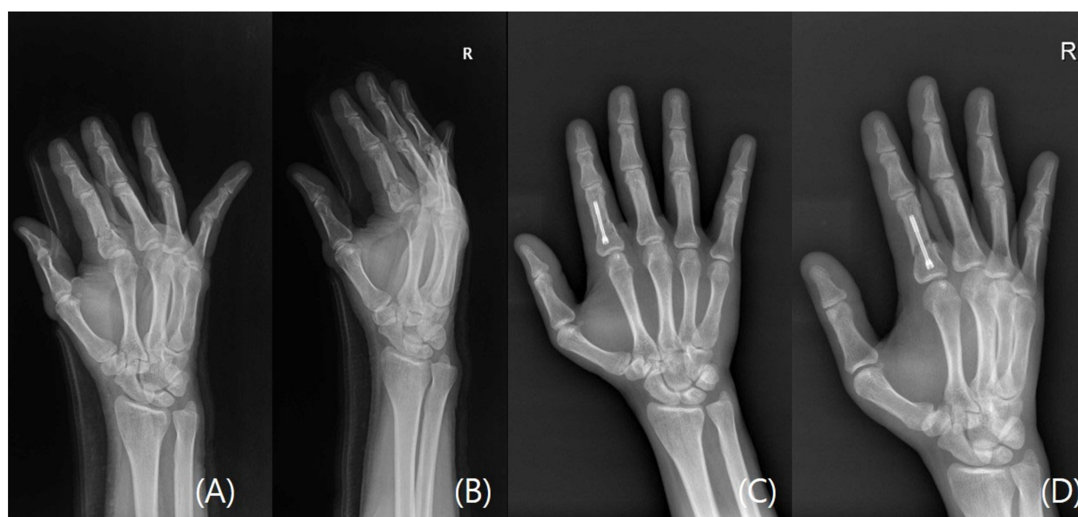

Figure 1. A case of a right second digit transverse proximal phalanx fracture. (**a**) Preoperative plain radiograph PA view; (**b**) Preoperative plain radiograph oblique view; **(c)** Postoperative plain radiograph PA view taken at last follow-up visit; **(d)** Postoperative plain radiograph oblique view taken at last follow-up visit.

© 2026 by the author(s). Distributed under a Creative Commons CC BY license.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 23 March 2026 doi:10.20944/preprints202603.1680.v1

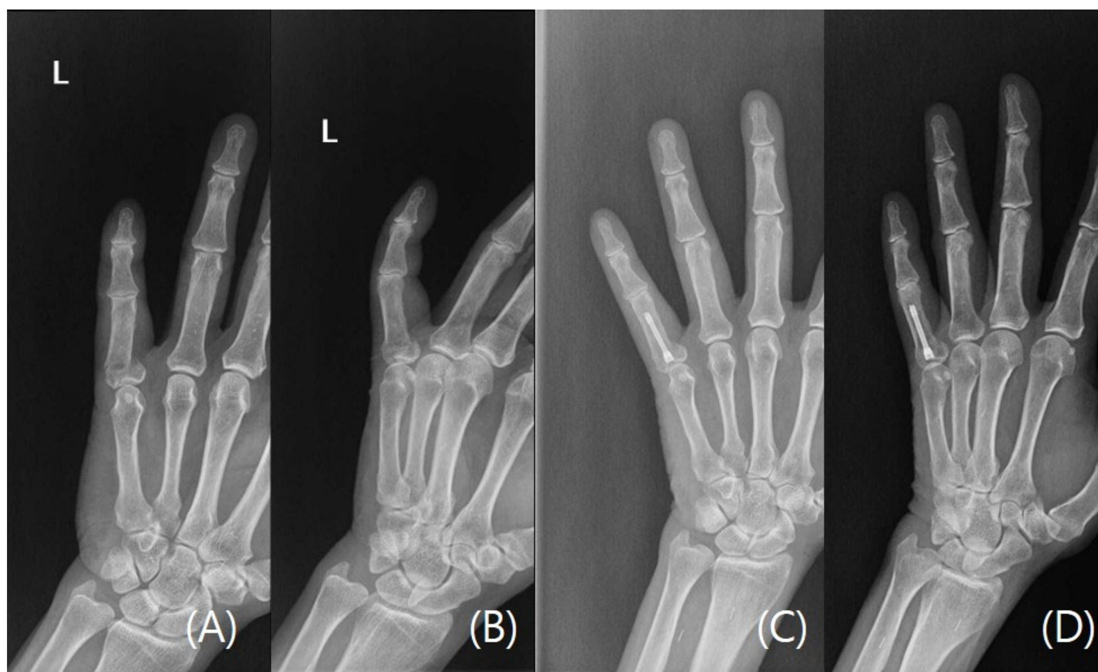

Figure 2. A case of a left fifth digit transverse proximal phalanx fracture. (**a**) Preoperative plain radiograph PA view; (**b**) Preoperative plain radiograph oblique view; **(c)** Postoperative plain radiograph PA view taken at last follow-up visit; **(d)** Postoperative plain radiograph oblique view taken at last follow-up visit.

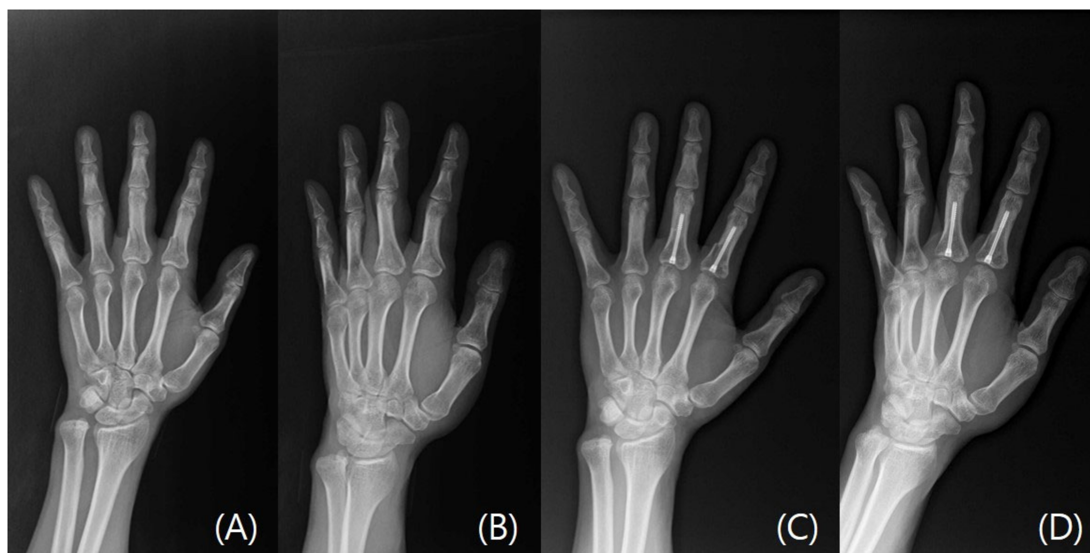

Figure 3. A case of a left second and third digit transverse proximal phalanx fracture. (**a**) Preoperative plain radiograph PA view; (**b**) Preoperative plain radiograph oblique view; **(c)** Postoperative plain radiograph PA view taken at last follow-up visit; **(d)** Postoperative plain radiograph oblique view taken at last follow-up visit.

© 2026 by the author(s). Distributed under a Creative Commons CC BY license.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 23 March 2026 doi:10.20944/preprints202603.1680.v1

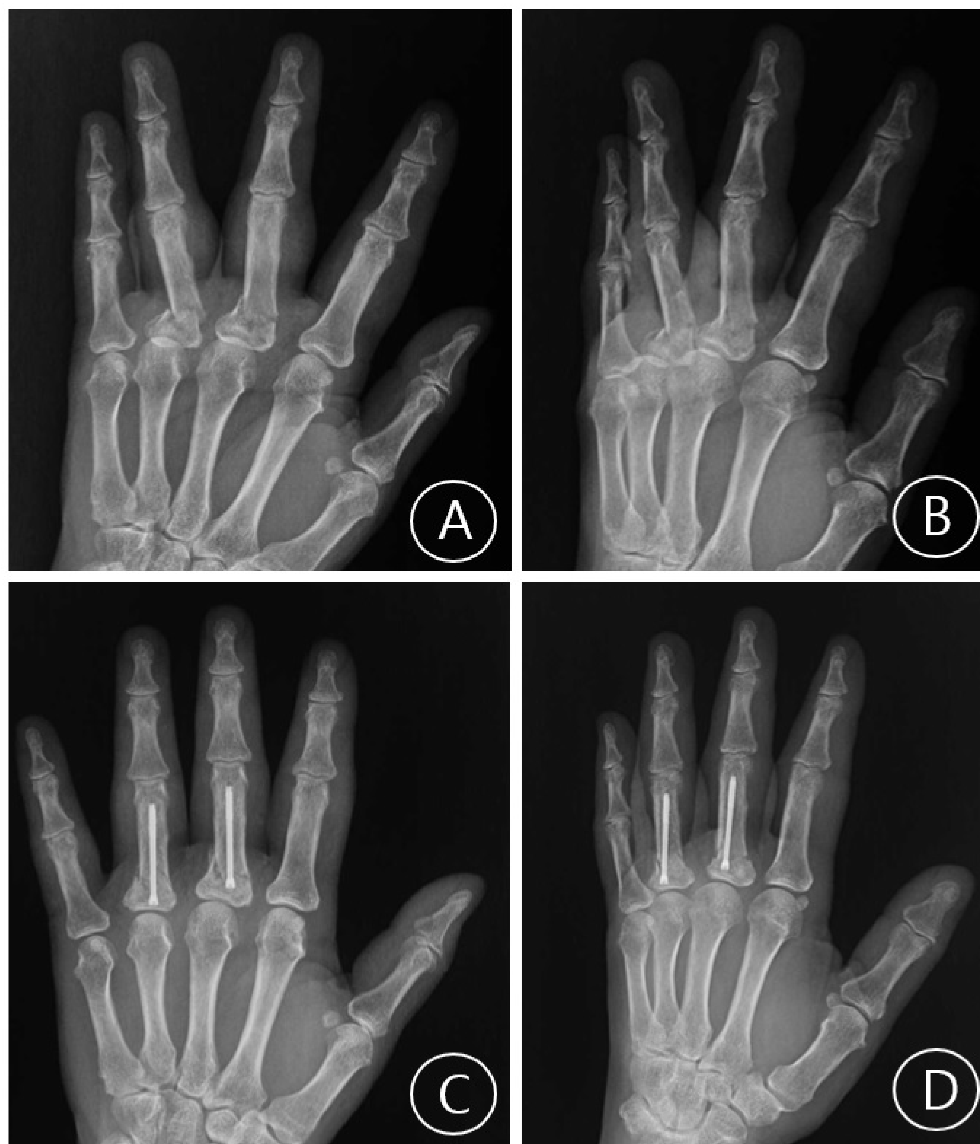

Figure 4. A case of a left third digit transverse proximal phalanx fracture. (**a**) Preoperative plain radiograph PA view; (**b**) Preoperative plain radiograph oblique view; **(c)** Postoperative plain radiograph PA view taken at last follow-up visit; **(d)** Postoperative plain radiograph oblique view taken at last follow-up visit.

4. Discussion

This study demonstrates that antegrade CCS fixation is a safe and effective treatment for unstable proximal phalanx fractures, resulting in consistent radiographic union, excellent function outcomes, and a low complication profile. The primary goal of surgical intervention for these common hand injuries is to provide a construct stable enough for early mobilization, thereby minimizing tendon adhesions and joint stiffness that frequently complicate treatment [21,22]. Our findings suggest that the minimally invasive nature of intramedullary screw fixation successfully achieves this objective.

The clinical outcomes observed in our cohort are consistent with the growing body of literature supporting IMHS fixation. The mean TAM of 216° in our series is comparable to the pooled mean TAM of 237° reported in a recent systematic review of 204 proximal phalanx fractures [23]. Similarly, our mean QuickDASH score of 10.13 aligns well with the averages of 3.58 and 6.2 reported in other series [21,23]. When compared directly to other fixation methods, intramedullary screws offer distinct

© 2026 by the author(s). Distributed under a Creative Commons CC BY license.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 23 March 2026 doi:10.20944/preprints202603.1680.v1

advantages. A comparative study by Silins [14] found that patients treated with screws had significantly better TAM, a shorter duration of work disability (5.6 vs 9.9 weeks), and a much lower rate of hardware removal (17.6% vs 93%) compared to those treated with plate fixation. Biochemical studies support these clinical findings, demonstrating that intramedullary screw provide stability equivalent to plate fixation for short oblique fractures and superior stability compared to K-wires, particularly in resisting bending forces [6,12,24,25].

Beyond the choice of implant, specific technical considerations are critical to optimizing outcomes. Our preference for an antegrade insertion pathway is deliberate. This approach provides a direct, accessible entry point at the base of the proximal phalanx while critically avoiding disruption to the delicate extensor tendon mechanism and articular surfaces of the PIP joint, which would be at risk with a retrograde technique [2,4,26]. Furthermore, we favor an intra-articular entry point over a trans-articular one. A trans-articular approach, which would cross MCP joint from the metacarpal head, was intentionally avoided to prevent iatrogenic injury to the articular cartilage of the metacarpal head [4,26]. The intra-articular method confines the necessary cartilage defect to a small portion of the proximal phalanx base alone. While creating any articular defect is a concern, a cadaver study by Borbas [26] quantified this defect, finding that a 2.2 mm antegrade screw creates a defect of approximately 4.6% of the proximal phalanx's articular surface, while a 3.0 mm screw affects 8.5%. While the long-term consequences of such defects in non-load-bearing upper extremity joints are not fully known, a multicenter case series on IMHS fixation of metacarpal fractures by Warrender [27] have revealed headless screws to not leave large cartilage defects as all screw entry sites were filled with fibrocartilage and remain in congruence with the metacarpal head inferring such technique to confer minimal to no significant sequelae.

A key advantage of this technique is that it provides rigid internal fixation while minimizing violation of the extensor apparatus and surrounding soft tissues [6]. Unlike plate osteosynthesis, which requires extensive dissection that can lead to scarring and diminished motion, the percutaneous placement of an intramedullary screw preserves the delicate soft tissue envelope [2,4,28,29]. This stable fixation allows for the immediate initiation of postoperative range of motion therapy, which is crucial for preventing stiffness and optimizing functional recovery. Furthermore, the headless design allows the screw to be completely buried beneath the articular surface, removing the need for routine hardware removal and avoiding interference with joint mechanics. Despite these benefits, potential drawbacks and complications must be considered. Besides the concern for iatrogenic damage to the articular cartilage mentioned above, other reported complications, though not observed in our series, include screw unraveling, particularly in younger patients with denser bones, and loss of fixation in long oblique fracture patterns [4,16]. As such, careful surgical technique, including pre-drilling in dense bone and frequent fluoroscopic monitoring, is recommended to mitigate these risks.

The success of CCS fixation is highly dependent on appropriate fracture selection. As reported by other studies this technique is best suited for transverse and short oblique fracture patterns, where it can provide excellent compression and stability [13,30]. Conversely, its use is relatively contraindicated for long oblique fractures, where compression can lead to shortening and collapse, highly comminuted fractures, and marginal subchondral fractures, as in such cases, the amount of bone remaining may not allow sufficient purchase for the leading screw and introduce the risk of splitting [4,30]. For such complex cases, the utilization of a more complex construct such as a "Y-strutting" or dual-screw technique as described by del Piñal [13] is recommended. Absolute contraindications include fractures with an open epiphysis or active infection [2,13].

This study has several noteworthy limitations, including its retrospective design, small cohort size, and the absence of a direct comparison group. The retrospective nature introduces a risk of selection bias, and the small sample size limits the generalizability of our findings. Although our results are encouraging and align with existing literature, the lack of a control group treated with an alternative fixation method prevents a definitive conclusion regarding the superiority of CCS fixation.

© 2026 by the author(s). Distributed under a Creative Commons CC BY license.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 23 March 2026 doi:10.20944/preprints202603.1680.v1

5. Conclusions

In conclusion, antegrade fixation with cannulated compressive screws is a reliable and effective treatment for unstable transverse and short oblique proximal phalanx fractures, facilitating early mobilization and yielding excellent functional results with minimal complications. However, surgeons must remain mindful of the technique's specific indications and potential complications. Further large-scale, prospective trials are warranted to compare this method directly with other fixation modalities as well as to evaluate long-term functional outcomes.

Author Contributions: Conceptualization, S.C.E. (Seokchan Eun), S.Y.O. (Seung Yun Oh); Investigation, S.C.E.; Methodology, S.C.E.; Data Curation: S.C.E.; Formal Analysis, S.C.E.; Resources, S.C.E.; Writing—original draft preparation, S.Y.O.; writing—review and editing, S.Y.O., S.C.E.; visualization, S.Y.O. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of Seoul National University (B-2507-983-109) on June 26, 2025.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

DIP	Distal Interphalangeal
PIP	Proximal Interphalangeal
CCS	Cannulated Compressive Screws
IMHS	Intermedullary Headless Screws
MCP	Metacarpophalangeal
TAM	Total Active Motion
QuickDASH	Quick Disabilities of the Arm, Shoulder, and Hand

References

1. Dohse, N.; Jones, C.; Ilyas, A. Intramedullary Fixation of Metacarpal and Phalangeal Fractures with Headless Compression Screws: Indications and Techniques. *Arch. Bone Jt. Surg.* **2022**, doi:10.22038/abjs.2022.64506.3102.
2. Guidi, M.; Frueh, F.S.; Besmens, I.; Calcagni, M. Intramedullary Compression Screw Fixation of Metacarpal and Phalangeal Fractures. *EFORT Open Rev.* **2020**, *5*, 624–629, doi:10.1302/2058-5241.5.190068.
3. Varney, A.C. Hand Fractures. In *Fundamentals of Hand Therapy*; Elsevier, 2014; pp. 361–382 ISBN 978-0-323-09104-6.
4. Giesen, T.; Gazzola, R.; Poggetti, A.; Giovanoli, P.; Calcagni, M. Intramedullary Headless Screw Fixation for Fractures of the Proximal and Middle Phalanges in the Digits of the Hand: A Review of 31 Consecutive Fractures. *J. Hand Surg. Eur. Vol.* **2016**, *41*, 688–694, doi:10.1177/1753193416641330.
5. Lögters, T.T.; Lee, H.H.; Gehrmann, S.; Windolf, J.; Kaufmann, R.A. Proximal Phalanx Fracture Management. *HAND* **2018**, *13*, 376–383, doi:10.1177/1558944717735947.
6. Sivakumar, B.S.; An, V.V.G.; Symes, M.J.; Graham, D.J.; Lawson, R.D.; Clarke, E. Temporal Trends in the Management of Metacarpal and Phalangeal Fractures in the 21st Century: An Analysis of Australian Population-Based Data. *ANZ J. Surg.* **2022**, *92*, 2655–2660, doi:10.1111/ans.17818.
7. Gaston, R.G.; Chadderdon, C. Phalangeal Fractures: Displaced/Nondisplaced. *Hand Clin.* **2012**, *28*, 395–401, x, doi:10.1016/j.hcl.2012.05.032.

© 2026 by the author(s). Distributed under a Creative Commons CC BY license.

8. Liodaki, E.; Kisch, T.; Wenzel, E.; Mailänder, P.; Stang, F. Percutaneous Cannulated Compression Screw Osteosynthesis in Phalanx Fractures: The Surgical Technique, the Indications, and the Results. *Eplasty* **2017**, *17*, e8.
9. Fader, L.; Robinson, L.; Voor, M. Headless Compression Screw Fixation for Proximal Phalanx Fractures: A Biomechanical Study. *Hand N. Y. N* **2022**, *17*, 239–244, doi:10.1177/1558944720926647.
10. Chao, J.; Patel, A.; Shah, A. Intramedullary Screw Fixation Comprehensive Technique Guide for Metacarpal and Phalanx Fractures: Pearls and Pitfalls. *Plast. Reconstr. Surg. Glob. Open* **2021**, *9*, e3895, doi:10.1097/GOX.0000000000003895.
11. Herbert, T.J.; Fisher, W.E. Management of the Fractured Scaphoid Using a New Bone Screw. *J. Bone Joint Surg. Br.* **1984**, *66-B*, 114–123, doi:10.1302/0301-620X.66B1.6693468.
12. Rausch, V.; Harbrecht, A.; Kahmann, S.L.; Fenten, T.; Jovanovic, N.; Hackl, M.; Müller, L.P.; Staat, M.; Wegmann, K. Osteosynthesis of Phalangeal Fractures: Biomechanical Comparison of Kirschner Wires, Plates, and Compression Screws. *J. Hand Surg.* **2020**, *45*, 987.e1-987.e8, doi:10.1016/j.jhsa.2020.04.010.
13. Del Piñal, F.; Moraleda, E.; Rúas, J.S.; De Piero, G.H.; Cerezal, L. Minimally Invasive Fixation of Fractures of the Phalanges and Metacarpals With Intramedullary Cannulated Headless Compression Screws. *J. Hand Surg.* **2015**, *40*, 692–700, doi:10.1016/j.jhsa.2014.11.023.
14. Silins, K.; Turkmen, T.; Vögelin, E.; Haug, L.C.P. Comparing Treatment of Proximal Phalangeal Fractures with Intramedullary Screws versus Plating. *Arch. Orthop. Trauma Surg.* **2022**, *143*, 1699–1706, doi:10.1007/s00402-022-04516-z.
15. Ten Berg, P.W.L.; Mudgal, C.S.; Leibman, M.I.; Belsky, M.R.; Ruchelsman, D.E. Quantitative 3-Dimensional CT Analyses of Intramedullary Headless Screw Fixation for Metacarpal Neck Fractures. *J. Hand Surg.* **2013**, *38*, 322-330.e2, doi:10.1016/j.jhsa.2012.09.029.
16. Kupperman, E.; Franko, O.; Indresano, A.; Girard, P. Cannulated Screw Unraveling: A Case Series and Literature-Based Review of an under-Recognized Complication. *Arch. Orthop. Trauma Surg.* **2013**, *133*, 65–67, doi:10.1007/s00402-012-1638-9.
17. Mooney, J.F.; Simmons, T.W. A Previously Unreported Complication of the AO Cannulated 4.0- and 4.5-Mm Screw Systems: A Review of Three Cases. *J. South. Orthop. Assoc.* **2003**, *12*, 160–162.
18. Chen, A.; Willis-Owen, C.; Akhtar, K.; Kamineni, S. Failure of Asnis Iii 5.0 Mm Cannulated Screw: A Case Report. *Cases J.* **2010**, *3*, 9, doi:10.1186/1757-1626-3-9.
19. Levene, A.P.; Templeton, P. Previously Unreported Failure of a Synthes 4.0mm Diameter Cannulated Screw. *Inj. Extra* **2008**, *39*, 212–215, doi:10.1016/j.injury.2007.10.017.
20. Sabnis, B.; Brenkel, I.; Chesney, D.; Weir, I. Unusual Mode of Mechanical Failure of an AO Cannulated Self Drilling Screw. A Case Report. **2009**, *75*.
21. Abbot, H.; George, A.R.; McCarron, L.; Graham, D.J.; Sivakumar, B. Intramedullary Screw Fixation of Proximal Phalangeal Fractures: Short- to Medium-Term Outcomes. *HAND* **2025**, *20*, 684–690, doi:10.1177/15589447241235339.
22. Gray, R.R.L.; Rubio, F.; Heifner, J.J.; Hoekzema, N.A.; Mercer, D.M. Double Barrel Screw Fixation for Proximal Phalanx Fracture. *Tech. Hand Up. Extrem. Surg.* **2022**, *26*, 214–217, doi:10.1097/BTH.0000000000000387.
23. Peckston, D.C.; Faulkner, H.; Graham, D.J.; Sivakumar, B.S. Intramedullary Compression Screw Fixation of Proximal Phalanx Fractures: An Updated Systematic Review.
24. Ibanez, D.S.; Rodrigues, F.L.; Salviani, R.S.; Roberto, F.A.R.; Pengo Junior, J.R.; Aita, M.A. Experimental Trial on Surgical Treatment for Transverse Fractures of the Proximal Phalanx: Technique Using Intramedullary Conical Compression Screw versus Lateral Compression Plate. *Rev. Bras. Ortop. Engl. Ed.* **2015**, *50*, 509–514, doi:10.1016/j.rboe.2014.12.009.
25. Miles, M.R.; Krul, K.P.; Abbasi, P.; Thakkar, M.Y.; Giladi, A.M.; Means, K.R. Minimally Invasive Intramedullary Screw Versus Plate Fixation for Proximal Phalanx Fractures: A Biomechanical Study. *J. Hand Surg.* **2021**, *46*, 518.e1-518.e8, doi:10.1016/j.jhsa.2020.11.013.
26. Borbas, P.; Dreu, M.; Poggetti, A.; Calcagni, M.; Giesen, T. Treatment of Proximal Phalangeal Fractures with an Antegrade Intramedullary Screw: A Cadaver Study. *J. Hand Surg. Eur. Vol.* **2016**, *41*, 683–687, doi:10.1177/1753193416641319.

© 2026 by the author(s). Distributed under a Creative Commons CC BY license.

Preprints.org (www.preprints.org) | NOT PEER-REVIEWED | Posted: 23 March 2026 doi:10.20944/preprints202603.1680.v1

27. Warrender, W.J.; Ruchelsman, D.E.; Livesey, M.G.; Mudgal, C.S.; Rivlin, M. Low Rate of Complications Following Intramedullary Headless Compression Screw Fixation of Metacarpal Fractures. *HAND* **2020**, *15*, 798–804, doi:10.1177/1558944719836214.
28. Gaspar, M.P.; Gandhi, S.D.; Culp, R.W.; Kane, P.M. Dual Antegrade Intramedullary Headless Screw Fixation for Treatment of Unstable Proximal Phalanx Fractures. *HAND* **2019**, *14*, 494–499, doi:10.1177/1558944717750919.
29. Carrera Casal, O.; Rivera Vegas, M.; Estefanía Díez, M.; García Cano, P.; Maya Gonzalez, J.; Nevado Sanchez, E. Percutaneous Osteosynthesis with Headless Cannulated Screws in the Treatment of Metacarpal and Proximal and Middle Phalanxes Fractures of the Hand. *Rev. Iberoam. Cir. Mano* **2018**, *46*, 117–125, doi:10.1055/s-0038-1676080.
30. Itadera, E.; Yamazaki, T. Trans-Metacarpal Screw Fixation for Extra-Articular Proximal Phalangeal Base Fractures. *J. Hand Surg. Asian-Pac. Vol.* **2017**, *22*, 35–38, doi:10.1142/S021881041750006X.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

© 2026 by the author(s). Distributed under a Creative Commons CC BY license.