EURASIAN JOURNAL OF ACADEMIC RESEARCH
Innovative Academy Research Support Center
IF = 9.3 www.in-academy.uz/index.php/ejar

CLINICAL AND FUNCTIONAL OUTCOMES OF UNIVERSAL COMPRESSION SCREW FIXATION IN OLECRANON AND PROXIMAL TO MID-SHAFT ULNAR FRACTURES

[1]Ruziev Shakhzod Olimdjon ugli
Assistant of the Department of Traumatology and Orthopedics, Kashkadarya branch of the Republican Scientific Center of Emergency Medicine, Uzbekistan
[2]Shorustamov Mukhammad Tadjalievich
DSc, prof., Tashkent State Medical University, Uzbekistan, Tashkent
https://doi.org/10.5281/zenodo.18655416

ARTICLE INFO

Received: 09th February 2026
Accepted: 15th February 2026
Online: 16th February 2026

KEYWORDS

Ulna; olecranon; forearm fractures; intramedullary osteosynthesis; compression screw.

ABSTRACT

Background. Fractures of the olecranon and proximal/middle third of the ulna require stable fixation to restore function; with conventional techniques, complication rates reach 15–30%. Objective. To evaluate the effectiveness of a universal compression intramedullary screw. Materials and Methods. A single-center study included 30 patients (mean age 38.4 ± 12.6 years) with isolated fractures. Early mobilization was initiated on postoperative days 10–12. The follow-up period was 12 months. Time to union, pain intensity (VAS), and Mayo Elbow Performance Score (MEPS) were assessed. Statistical analysis was performed using the paired t-test. Results. Fracture union was achieved in 100% of patients within 10.1 ± 1.2 weeks (range 8–12). VAS pain scores decreased from 6.8 ± 1.1 to 2.1 ± 0.7 ($p < 0.001$). The mean MEPS was 88.6 ± 6.4: excellent results were observed in 63.3%, good in 26.7%, fair in 10.0%, and no poor outcomes were recorded. The overall complication rate was 13.3% (superficial infection 3.3%; implant-related discomfort 6.7%; motion limitation >30° 3.3%); no cases of nonunion or secondary displacement were observed. Conclusion. Use of a universal compression intramedullary screw in 30 patients resulted in a 100% union rate (10.1 ± 1.2 weeks), significant pain reduction (VAS: 6.8 ± 1.1 → 2.1 ± 0.7; $p < 0.001$), and favorable functional outcomes (MEPS 88.6 ± 6.4; 90.0% good/excellent) with a 13.3% complication rate and no mechanical failure.

INTRODUCTION. Fractures of the olecranon and the proximal or middle third of the ulna significantly affect elbow **congruence and forearm**

biomechanics. Even minimal residual displacement may impair joint stability and range of motion. Current evidence indicates that precise anatomical reduction and stable internal fixation are critical for restoring elbow function (Khaj Khmaidi Mohamed Akhmedovich et al., 2023 [14]; Egorov et al., 2023 [6]). Nevertheless, the optimal fixation method for proximal ulnar fractures remains controversial. Recent advances in fracture management emphasize the importance of combining mechanical stability with preservation of biological healing capacity. Studies of forearm trauma demonstrate that inadequate fixation may result in secondary displacement and suboptimal outcomes (Davydov et al., 2024 [4]; Krainyukov et al., 2024 [9]). Data from adjacent anatomical regions further support the advantages of operative stabilization: surgical fixation of proximal humerus fractures has shown superior early functional recovery compared with conservative treatment (Samborski et al., 2023 [20]), and meta-analytical evidence confirms functional benefits of surgery in distal radius fractures (Yang et al., 2023 [21]). These findings highlight the central role of stable osteosynthesis in upper limb injuries.

Despite the routine use of tension band wiring and plating for olecranon fractures, dedicated clinical evaluations of intramedullary compression screw systems for fractures of the proximal and middle ulna are limited. Most recent publications focus on instability or reconstructive procedures rather than isolated ulnar fracture fixation (Akhmedovich et al., 2024 [1]; Medvedchikov et al., 2025 [10]). At the same time, complication rates after conventional fixation have been reported at 15–30%, including hardware irritation and restricted motion (Egorov et al., 2023 [6]; Khaj Khmaidi Mohamed Akhmedovich et al., 2023 [14]). Controlled interfragmentary compression may enhance primary bone healing by minimizing micromotion, while intramedullary fixation can reduce soft-tissue trauma and support early mobilization (Elkhov et al., 2024 [7]). Insufficient stabilization, in contrast, may lead to delayed union, nonunion, elbow stiffness, chronic pain, and degenerative changes. Given the limited structured evidence on universal compression screw fixation in isolated olecranon and proximal/middle third ulnar fractures, further investigation is warranted. We hypothesized that stable intramedullary interfragmentary compression would promote reliable consolidation and favorable early functional outcomes.

The aim of this study was to evaluate the effectiveness of a universal compression screw in the treatment of olecranon and proximal/middle third ulnar fractures.

MATERIALS AND METHODS. A single-center observational clinical study was conducted in the Department of Traumatology between January 2024 and January 2026. The study was designed as a consecutive case series with prospective follow-up. The mean duration of follow-up was 12 months. All procedures were performed in accordance with institutional clinical standards and the ethical principles outlined in the Declaration of Helsinki. Written informed consent was obtained from all patients prior to surgical

treatment and inclusion in follow-up evaluation.

Thirty patients with acute isolated fractures of the olecranon or proximal/middle third of the ulna were included in the study. The mean age was 38.4 ± 12.6 years.

Inclusion criteria were: fresh isolated fractures of the olecranon or proximal/middle third of the ulna; absence of local infection; absence of severe associated injuries influencing rehabilitation or outcome assessment. Exclusion criteria included: pathological fractures; chronic nonunion; active infection; polytrauma requiring staged surgical management.

Implant Description. All patients underwent osteosynthesis using a universal compression intramedullary screw system (Figure 1) specifically designed for fixation of olecranon and proximal/middle third ulnar fractures. The implant consists of a cylindrical rod with a partially threaded distal segment occupying approximately half of the shaft length. The threaded portion has a greater diameter than the non-threaded segment, enabling interfragmentary compression during insertion. The proximal end incorporates a controlled compression mechanism consisting of a spring and conical washer system, allowing gradual axial compression of fracture fragments. A fixed washer with a hexagonal socket permits controlled advancement using a dedicated instrument. The system includes rods of varying lengths (16 cm, 18 cm, and 20 cm) to allow individualized selection according to the medullary canal dimensions.

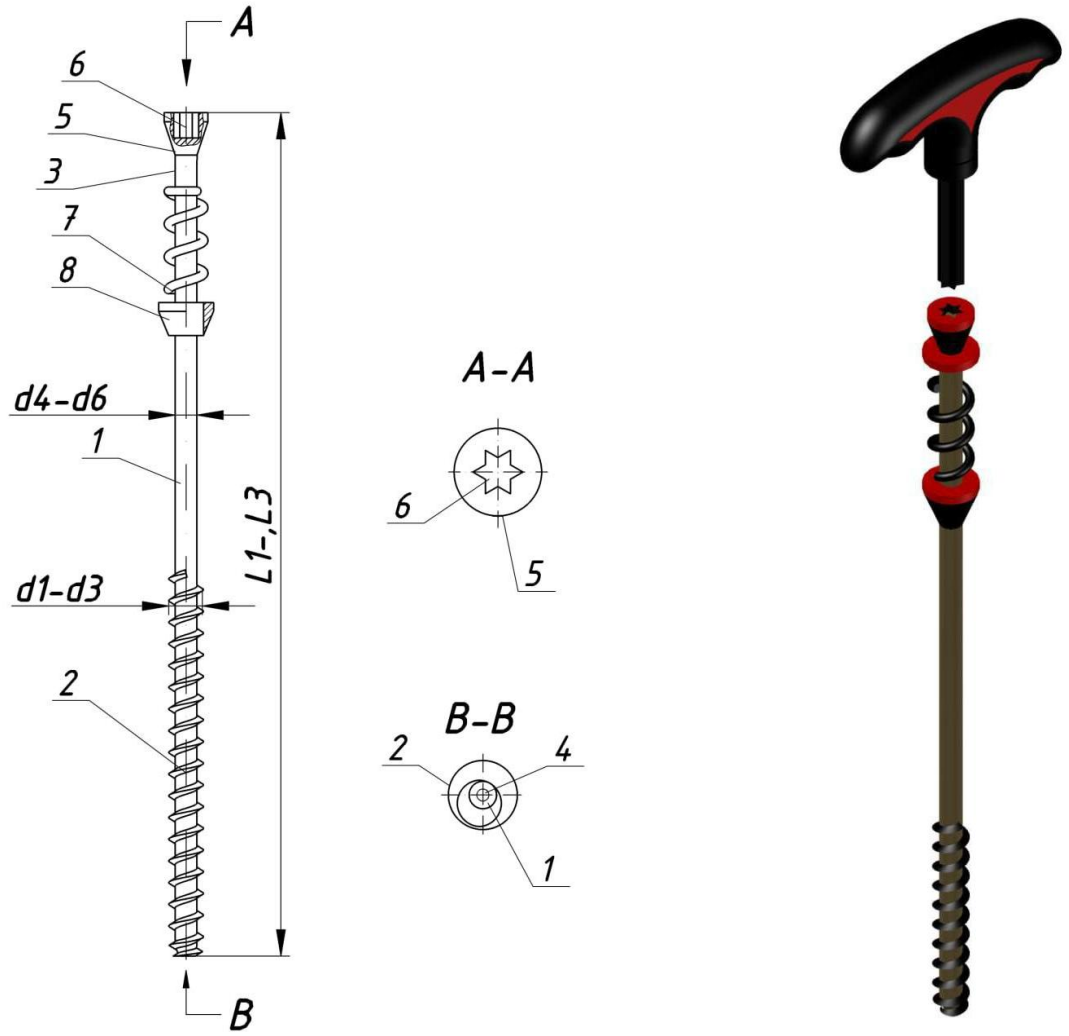

Fig. 1. Universal compression intramedullary screw system used for fixation of olecranon and proximal/middle third ulnar fractures: A cylindrical shaft (1), A threaded distal segment (2), A non-threaded proximal shaft portion (3), A centering recess at the distal tip (4), A proximal fixed washer (5), A hexagonal socket for controlled insertion (6), A compression spring mechanism (7), A conical sliding washer (8).

Surgical Technique. All procedures were performed under regional or general anesthesia. A posterior or posteromedial approach to the ulna was used. After exposure of the fracture site, anatomical reduction was achieved under direct visualization. Preoperative multislice computed tomography was used to determine the medullary canal diameter and select appropriate implant dimensions. A guidewire was inserted retrogradely through the olecranon, and the intramedullary compression screw was advanced along the medullary canal. Controlled axial compression was achieved during screw insertion through activation of the integrated spring mechanism. Intraoperative fluoroscopy was used in all cases to confirm correct alignment and implant positioning. The wound was irrigated, hemostasis achieved, and closure performed in layers.

Early mobilization was encouraged. Controlled active movements of the elbow were initiated on postoperative

days 10–12, depending on pain and soft tissue condition. A standardized rehabilitation protocol was applied for all patients.

Outcome Assessment. Patients were evaluated clinically and radiologically during follow-up.

Primary outcome:

- radiographic fracture consolidation.

Secondary outcomes:

- pain intensity assessed using the Visual Analog Scale (VAS);
- elbow range of motion;
- functional outcome measured using the Mayo Elbow Performance Score (MEPS).

The MEPS system (maximum 100 points) evaluates pain (45 points), function (25 points), range of motion (20 points), and stability (10 points). Results were categorized as excellent (90–100), good (75–89), fair (60–74), or poor (<60). Radiographic union was defined as the presence of bridging callus and absence of progressive fracture line on follow-up radiographs. Functional evaluation and MEPS scoring were performed by the operating orthopedic surgeon (MD, PhD, Professor) together with an assistant surgeon.

Complication Assessment. All intraoperative and postoperative complications were recorded, including infection, implant-related discomfort, limitation of motion, delayed union, nonunion, and secondary displacement.

Statistical analysis was performed using IBM SPSS Statistics software (version 26.0; IBM Corp., Armonk, NY, USA). Quantitative variables were expressed as mean ± standard deviation. Changes in VAS scores between preoperative and postoperative measurements were analyzed using the paired t-test. A p-value < 0.05 was considered statistically significant.

RESULTS. All 30 patients completed the 12-month follow-up period (follow-up rate 100%). No patients were lost to follow-up. The mean age of the cohort was 38.4 ± 12.6 years.

Radiographic Outcomes. Fracture union was achieved in all patients (union rate 100%). The time to radiographic consolidation ranged from 8 to 12 weeks, with a mean duration of 10.1 ± 1.2 weeks. Radiographs obtained during follow-up demonstrated maintained alignment and stable implant positioning in all cases. No secondary displacement, implant migration, delayed union, or nonunion was observed.

Pain Assessment. Mean preoperative VAS score was 6.8 ± 1.1. At the end of the second postoperative week, the mean VAS decreased to 2.1 ± 0.7. Comparison using the paired t-test demonstrated a statistically significant reduction in pain intensity following surgical fixation ($p < 0.001$).

Functional Outcomes. At 12-month follow-up, functional evaluation using the Mayo Elbow Performance Score (MEPS) demonstrated the following distribution:

- Excellent (90–100 points): 19 patients (63.3%)
- Good (75–89 points): 8 patients (26.7%)
- Fair (60–74 points): 3 patients (10.0%)
- Poor (<60 points): 0 patients

The overall mean MEPS was 88.6 ± 6.4 points.

Elbow joint stability was preserved in all patients. Functional arc of motion

exceeded 100° in the majority of cases. A limitation of elbow motion greater than 30° was observed in one patient (3.3%).

Complications. Postoperative complications were recorded in 4 patients (13.3%). Superficial wound infection occurred in 1 patient (3.3%) and resolved with conservative antibiotic treatment. Implant-related proximal discomfort was reported in 2 patients (6.7%); one patient underwent elective implant removal after fracture consolidation. Persistent limitation of motion >30° was observed in 1 patient (3.3%). No cases of deep infection, mechanical failure, secondary displacement, nonunion, or implant breakage were documented.

Fig. 2. Preoperative lateral radiograph demonstrating an oblique displaced fracture of the proximal third of the ulna

Fig. 3. Immediate postoperative lateral radiograph showing intramedullary fixation with a universal compression screw and restoration of anatomical alignment

DISCUSSION. This study assessed the clinical performance of a universal compression intramedullary screw in the management of isolated fractures of the olecranon and proximal/middle third of the ulna. The principal findings were a 100% union rate, statistically significant early pain reduction, a predominance of good and excellent functional outcomes according to MEPS, and a low incidence of minor complications. Within the limits of the study design, these results indicate stable mechanical fixation and satisfactory mid-term functional recovery [2,11,16].

Achieving and maintaining anatomical alignment in proximal ulnar fractures is essential for preserving elbow kinematics and preventing long-term dysfunction [6,14]. Traditional fixation techniques, particularly tension band wiring and plate osteosynthesis, are effective but frequently associated with implant-related irritation and secondary procedures. Reported complication rates in elbow fracture surgery range between 15% and 30%

[6,14], largely due to hardware prominence and restriction of motion. In the present series, the overall complication rate was 13.3%, and all events were minor. No cases of secondary displacement, implant failure, delayed union, or nonunion were recorded. Although direct comparison must be made cautiously due to differences in study design, the observed rate falls at the lower end of previously reported ranges [3,15,18].

The mechanical concept of the investigated implant differs from conventional constructs by combining intramedullary load-sharing fixation with controlled axial compression. The spring-based mechanism allows gradual interfragmentary compression during insertion, while the diameter differential between threaded and non-threaded segments contributes to fragment approximation. From a biomechanical perspective, stable compression may reduce micromotion at the fracture interface and promote primary bone healing [5,8,12,17]. In contrast to plate fixation, the intramedullary position of the implant minimizes periosteal stripping and reduces soft tissue irritation, which may partly explain the low rate of implant-related complaints observed in this cohort.

Evidence from other regions of the upper extremity supports the principle that stable internal fixation facilitates improved functional recovery. Operative stabilization of proximal humerus fractures has been associated with superior early functional outcomes compared with nonoperative management [20], and meta-analytical data on distal radius fractures indicate that surgical stabilization may yield better functional parameters when anatomical alignment is restored [21]. Although anatomical and biomechanical conditions differ, these findings reinforce the importance of mechanical stability and early mobilization in upper limb trauma [13,19].

In the present study, early active elbow motion was initiated within the second postoperative week, and most patients achieved a functional arc of motion exceeding 100°. Nearly 90% of patients demonstrated good or excellent MEPS scores at 12 months. These functional results are consistent with stable fixation and absence of mechanical compromise. Importantly, only one patient required implant removal due to discomfort, suggesting that intramedullary positioning may reduce the need for secondary surgery compared with constructs that rely on subcutaneous hardware.

The study has several limitations. It was conducted at a single center and did not include a control group treated with alternative fixation methods. The sample size was modest, limiting subgroup analysis and external generalizability. Functional assessment was performed by the operating surgical team, which introduces potential observer bias. In addition, follow-up was limited to 12 months and therefore reflects mid-term outcomes rather than long-term joint function.

Despite these limitations, the data demonstrate consistent fracture healing, significant reduction in postoperative pain, preservation of elbow stability, and a low complication profile. Within the constraints of a single-center

observational design, universal compression intramedullary screw fixation showed favorable clinical performance in the treatment of isolated fractures of the olecranon and proximal/middle third of the ulna. Further comparative studies with larger cohorts and randomized methodology are required to confirm these findings and to determine the relative advantages of this technique over established fixation methods.

CONCLUSION. In this single-center series of 30 patients with isolated olecranon and proximal/middle third ulnar fractures, fixation using a universal compression intramedullary screw resulted in a 100% radiographic union rate, with a mean consolidation time of 10.1 ± 1.2 weeks. Postoperative pain decreased significantly from 6.8 ± 1.1 to 2.1 ± 0.7 points on the VAS scale ($p < 0.001$). At 12-month follow-up, the mean MEPS was 88.6 ± 6.4 points, with 63.3% of patients achieving excellent and 26.7% good functional outcomes. The overall complication rate was 13.3%, and no cases of nonunion, secondary displacement, implant failure, or deep infection were observed. These findings indicate that universal compression screw fixation provides stable osteosynthesis, reliable fracture healing, and favorable functional recovery in fractures of the olecranon and proximal/middle third of the ulna.

References:

1. Ахмедович, Х. Х. М., Призов, А. П., Лазко, Ф. Л., Беляк, Е. А., Лазко, М. Ф., Кузнецов, А. В., & Васильев, И. А. (2024). Клиническое наблюдение хирургического лечения рецидивирующего вывиха костей предплечья. Журнал им. НВ Склифосовского «Неотложная медицинская помощь», 13(2), 328-336.
2. Бухаров А.В., Державин В.А., Ядрина А.В., Ерин Е.А., Елхов Д.О., Алиев М.Д., Каприн А.Д. Хирургическое лечение пациентов с метастазами в кости // Клиническая и экспериментальная хирургия. Журнал имени академика Б.В. Петровского. 2022. Т. 10, № 3. С. 100-107. DOI: https://doi.org/10.33029/2308-1198-2022-10-3-100-107
3. Гранкин, Д. Ю., Голяна, С. И., Авдейчик, Н. В., Сафонов, А. В., & Аракелян, А. И. (2023). Создание локтевого сустава у детей с плечелучевым синостозом: клинический случай. Пермский медицинский журнал, 40(5), 158-166.
4. Давыдов, Д. В., Брижань, Л. К., Керимов, А. А., Максимов, А. А., Хоминец, И. В., Лычагин, А. В., ... & Арсомаков, А. З. (2024). Алгоритм хирургического лечения пациентов с диафизарными дефектами костей предплечья после огнестрельных ранений. Гений ортопедии, 30(4), 487-501.
5. Егиазарян, К. А., Ратьев, А. П., Ершов, Д. С., Оханов, О. А., & Михайлова, Е. С. (2023). Повреждения дистального сухожилия двуглавой мышцы плеча: клиника, диагностика, лечение. Хирургическая практика, (2), 61-76.
6. Егоров К.С., Неверов В.А., Зуев В.Ю., Земскова М.А., Черняев С.Н. Выбор тактики хирургического лечения больных с переломами головки лучевой кости. Вестник хирургии имени И.И. Грекова. 2023;182(3):24-32.

7. Елхов, Д. О., Бухаров, А. В., Ерин, Д. А., Державин, В. А., Филоненко, Е. В., Алиев, М. Д., & Каприн, А. Д. (2024). Реабилитация и качество жизни пациентов после онкологического эндопротезирования костей верхней конечности. Сибирский онкологический журнал, 23(3), 15-31.
8. Иманалиев, А., Ташматов, А., & Эрматов, Б. (2024). Оперативное лечение больных с оскольчатыми переломами проксимального отдела плечевой кости . Евразийский журнал здравоохранения, 4(4), 104-108. https://doi.org/10.54890/1694-8882-2024-4-104
9. Крайнюков, П. Е., Николенко, В. К., Погосов, Н. В., Евстигнеев, Д. В., & Колодкин, Б. Б. (2024). Особенности применения элементов реконструктивной хирургии при лечении огнестрельных ран кисти и предплечья на этапе оказания специализированной медицинской помощи. Московский хирургический журнал, (4), 161-170.
10. Медведчиков, А. Е., Анастасиева, Е. А., Олейник, Б. А., Симонян, А. А., Прокопович, Т. Е., & Кирилова, И. А. (2025). Эффективное сочетание методов артроскопической и малоинвазивной хирургии при хронической заднелатеральной нестабильности локтевого сустава. Гений ортопедии, 31(1), 74-82.
11. Назаров, А. С., Орлов, А. Ю., Архиповский, Д. А., Беляков, Ю. В., & Олейник, Е. А. (2024). Эндоскопически-ассистированное подмышечное перемещение локтевого нерва при синдроме кубитального канала. Российский нейрохирургический журнал имени профессора АЛ Поленова, 15(4), 117-121.
12. Смирнов, С. С., Вебер, Е. В., Жогина, М. А., & Киселева, А. Н. (2024). Артроскопические вмешательства в хирургии кисти. Медицинский вестник Северного Кавказа, 19(1), 77-81.
13. Татаринов, Д. В., Державин, В. А., Бухаров, А. В., & Каприн, А. Д. (2025). Варианты хирургического лечения пациентов с опухолевым поражением дистального отдела лучевой кости. Саркомы костей, мягких тканей и опухоли кожи, 17(1), 59-66.
14. Хаж Хмаиди Мохамед Ахмедович, Лазко Федор Леонидович, Призов Алексей Петрович, Загородний Николай Васильевич, Беляк Евгений Александрович, Лазко Максим Фёдорович, & Нечаев Валентин Александрович (2023). Хирургическое лечение заднелатеральной ротационной нестабильности локтевого сустава: систематический обзор. Журнал им. Н. В. Склифосовского «Неотложная медицинская помощь», 12 (3), 435-447. https://doi.org/10.23934/2223-9022-2023-12-3-435-447
15. Ходжанов, И. Ю., Борзунов, Д. Ю., & Байимбетов, Г. Д. (2023). Лечение детей с множественными повреждениями костей, образующих локтевой сустав. Гений ортопедии, 29(1), 12-19.
16. Шамко, И. А., Волотовский, А. И., & Беспальчук, А. П. (2024). Отдаленные результаты хирургического лечения повреждений дистального радио-ульнарного сочленения и треугольного фиброзно-хрящевого комплекса запястья.

17. Щипакин, М. В., & Стратонов, А. С. (2025). Оптимальные методы диагностики и коррекции инконгруэнтности костей предплечья в локтевом суставе у служебных собак разных пород. Нормативно-правовое регулирование в ветеринарии, (4), 91-94.
18. Ямщиков, О. Н. Опыт оперативного лечения открытого многооскольчатого внутрисуставного чрезмыщелкового перелома плеча со смещением отломков (клинический случай) / Тамбовский медицинский журнал. – 2023. – Т. 5, № 1. – С. 5-12. – DOI https://doi.org/10.20310/2782-5019-2023-5-1-5-12
19. Bieling, M., Ellwein, A., Lill, H., Sehmisch, S. & Reeh, F. (2024). Proximal humerus fracture and acromioclavicular joint dislocation. Innovative Surgical Sciences, 9(2), 67-82. https://doi.org/10.1515/iss-2023-0049
20. Samborski, S. A., Haws, B. E., Karnyski, S., Soles, G., Gorczyca, J. T., Nicandri, G., Voloshin, I., & Ketz, J. P. (2023). Early Outcomes of Proximal Humerus Fractures in Adults Treated With Locked Plate Fixation Compared with Nonoperative Treatment: An Age-, Comorbidity-, and Fracture Morphology-Matched Analysis. Journal of orthopaedic trauma, 37(3), 142–148. https://doi.org/10.1097/BOT.0000000000002511
21. Yang, Q., Cai, G., Liu, J. et al. Efficacy of cast immobilization versus surgical treatment for distal radius fractures in adults: a systematic review and meta-analysis. Osteoporos Int 34, 659–669 (2023). https://doi.org/10.1007/s00198-022-06649-8