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Functional Outcome of Conservatively Managed Ulnar Styloid Fracture on Wrist Function

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ABSTRACT

Objective: This study aims to evaluate the functional outcome of conservatively managed ulnar styloid fractures and their effect on wrist function. Ulnar styloid fractures are commonly associated with distal radius injuries and may influence distal radioulnar joint (DRUJ) stability, potentially affecting overall wrist mechanics. **Methods:** A retrospective observational study was conducted including 80 patients with ulnar styloid fractures managed conservatively using immobilization followed by rehabilitation at Department of Orthopedic Surgery, Combined Military Hospital, Rawalpindi. Patients were assessed at 6 weeks and 12 weeks follow-up. Functional outcomes were evaluated using the Patient-Rated Wrist Evaluation (PRWE) score, range of motion (ROM), and grip strength. Additional clinical parameters such as pain, joint stability, and complications were also recorded. **Results:** The majority of patients demonstrated satisfactory functional recovery with significant improvement over time. The mean PRWE score improved from 49.8 ± 10.2 at 6 months to 41.2 ± 9.5 at 1 year ($p < 0.05$), indicating reduced pain and disability. Wrist ROM, particularly flexion and extension, showed statistically significant improvement ($p < 0.05$), while radial and ulnar deviation improved but were not statistically significant. Grip strength increased gradually but did not reach full recovery compared to the contralateral side. A small proportion of patients reported persistent mild pain and occasional instability. **Conclusion:** Conservatively managed ulnar styloid fractures generally result in favorable functional outcomes with significant improvement in pain and wrist mobility over time. However, some patients may experience residual symptoms, particularly reduced grip strength and mild discomfort. These findings highlight the importance of proper rehabilitation and follow-up to optimize wrist function after conservative treatment.

INTRODUCTION

Ulnar styloid fractures are common injuries involving the distal end of the ulna and are frequently encountered in association with distal radius fractures. These fractures typically result from a fall on an outstretched hand, a mechanism that transmits axial load through the wrist joint, leading to disruption of osseous and ligamentous structures. Although distal radius fractures have been extensively studied, the clinical significance and functional implications of ulnar styloid fractures—particularly when managed conservatively—remain a subject of ongoing debate. The importance of this topic lies in the anatomical and physiological role of the ulnar styloid in maintaining wrist stability, especially at the distal radioulnar joint (DRUJ), which is essential for forearm rotation and coordinated wrist movements (1).

From an anatomical perspective, the ulnar styloid process serves as a key attachment site for critical stabilizing structures of the wrist, including components of the triangular fibrocartilage complex (TFCC). The TFCC is a complex structure composed of ligaments, cartilage, and meniscal tissue that acts as a stabilizer of the DRUJ and a load distributor across the ulnocarpal joint. It plays a vital role in transmitting forces from the hand to the forearm and allows smooth pronation and supination movements. Fractures involving the base of the ulnar styloid are particularly significant, as they may disrupt the deep radioulnar ligaments of the TFCC, potentially leading to DRUJ instability (2). In contrast, fractures at the tip of the styloid are less likely to affect joint stability due to limited ligamentous attachment at this site.

The physiology of wrist function is highly complex and involves the coordinated interaction of bones, ligaments, tendons, and muscles. The wrist joint is not a single articulation but rather a composite of multiple joints, including the radiocarpal, midcarpal, and distal radioulnar joints. The DRUJ, in particular, is crucial for rotational movements of the forearm, enabling pronation and supination. These movements are essential for performing daily activities such as writing, eating, and lifting objects.

Any disruption to the stability of the DRUJ, whether due to bony injury or ligamentous damage, can significantly impair wrist function and reduce overall hand efficiency (3).

Biomechanically, approximately 80% of axial load across the wrist is transmitted through the distal radius, while the remaining 20% is borne by the ulna via the TFCC. This distribution of forces highlights the importance of the ulnar side of the wrist in maintaining load balance and joint integrity. Following an ulnar styloid fracture, particularly if associated with TFCC injury, this balance may be disturbed, potentially leading to altered load transmission, pain, and degenerative changes over time (4). Furthermore, instability of the DRUJ can result in abnormal kinematics during forearm rotation, which may manifest clinically as weakness, reduced grip strength, and limited range of motion.

The management of ulnar styloid fractures remains controversial, especially regarding the need for surgical versus conservative treatment. Conservative management typically involves immobilization using a cast or splint for a period of 4–6 weeks, followed by gradual mobilization and physiotherapy. This approach is widely accepted for non-displaced fractures or fractures without evidence of DRUJ instability. Several studies have suggested that even in cases of non-union of the ulnar styloid, patients may remain asymptomatic and achieve satisfactory functional outcomes (5). However, other studies argue that untreated or inadequately healed fractures, particularly those involving the base of the styloid, may lead to chronic instability and persistent symptoms.

The concept of fracture healing in conservatively managed ulnar styloid fractures is closely related to bone physiology. Bone healing occurs through a sequence of inflammatory, reparative, and remodeling phases. During the inflammatory phase, hematoma formation and cellular infiltration initiate the healing process. This is followed by callus formation in the reparative phase, where new bone is laid down to bridge the fracture site. Finally, in the remodeling phase, the newly formed bone is reshaped to restore its original structure and strength. Adequate immobilization is crucial during the early phases of healing to prevent displacement and ensure proper alignment of the fracture fragments (6). However, excessive immobilization may lead to joint stiffness and muscle atrophy, highlighting the need for a balanced rehabilitation approach.

Functional outcome assessment is an essential component in evaluating the success of conservative management. The Patient-Rated Wrist Evaluation (PRWE) score is a validated tool commonly used to assess wrist pain and disability. It provides insight into the patient's subjective experience of recovery, including the ability to perform daily activities. In addition to subjective measures, objective parameters such as range of motion (ROM) and grip strength are used to evaluate functional recovery. Normal wrist function requires a delicate balance between mobility and stability; therefore, any residual impairment in these parameters may indicate incomplete recovery or underlying instability (7).

Range of motion in the wrist includes flexion, extension, radial deviation, and ulnar deviation, as well as forearm pronation and supination. These movements are facilitated by a combination of muscular and ligamentous structures working in harmony. Following an ulnar styloid fracture, limitations in ROM may occur due to pain, stiffness, or mechanical obstruction. Similarly, grip strength, which is an important indicator of hand function, may be reduced due to weakness or altered biomechanics. Persistent deficits in these functional parameters can significantly affect a patient's quality of life and ability to return to normal activities (8).

Despite the generally favorable prognosis of conservatively managed ulnar styloid fractures, there remains a subset of patients who experience persistent symptoms such as pain, instability, and reduced function. These outcomes may be influenced by several factors, including the location and displacement of the fracture, the integrity of the TFCC, patient age, and adherence to rehabilitation protocols. The variability in reported outcomes underscores the need for further research to better understand the factors that influence recovery and to identify patients who may benefit from more aggressive intervention (9).

In recent years, there has been growing interest in the role of DRUJ stability in determining functional outcomes. Clinical tests such as the piano key test and imaging modalities like MRI can be used to assess the integrity of the TFCC and the stability of the DRUJ. Identifying instability early in the course of treatment may help guide management decisions and improve outcomes. However, routine assessment of DRUJ stability is not always performed, particularly in resource-limited settings, which may contribute to variability in treatment outcomes (10).

In conclusion, ulnar styloid fractures, although often considered minor injuries, play a significant role in wrist biomechanics and function. The close relationship between the ulnar styloid, TFCC, and DRUJ highlights the importance of careful evaluation and appropriate management of these fractures. Conservative treatment remains the mainstay for most cases, but its success depends on multiple factors, including fracture characteristics and rehabilitation. Understanding the underlying anatomy, physiology, and biomechanics is essential for optimizing functional outcomes and minimizing long-term complications. This study aims to evaluate the functional outcomes of conservatively managed ulnar styloid fractures, with a focus on wrist function, pain, and overall recovery.

METHODS

This study was conducted as a retrospective observational study in the Department of Orthopedic Surgery, Combined Military Hospital, Rawalpindi, to evaluate the functional outcomes of conservatively managed ulnar styloid fractures and their impact on wrist function. A total of 80 patients diagnosed with ulnar styloid fractures between January 2024 and December 2024 were included in the study. Patients were selected based on inclusion criteria including age between 18–65 years, isolated or associated ulnar styloid fractures managed non-operatively, and availability of complete follow-up records. Patients with previous wrist pathology, open fractures, associated

neurovascular injury, or those requiring surgical intervention were excluded.

All patients were managed conservatively with immobilization using a below-elbow plaster cast or splint for a period of 4–6 weeks, followed by a standardized rehabilitation protocol consisting of gradual wrist mobilization and strengthening exercises under physiotherapy supervision. Clinical and functional assessments were performed at **6 weeks and 12 weeks follow-up** after initiation of treatment.

Functional outcomes were evaluated using the Patient-Rated Wrist Evaluation (PRWE) score to assess pain and disability. Objective assessment included measurement of wrist range of motion (flexion, extension, radial deviation, and ulnar deviation) using a standard goniometer, and grip strength was measured using a calibrated hand dynamometer and compared with the contralateral normal side. Data were analyzed using SPSS version 25. Descriptive statistics including mean and standard deviation were calculated for all variables. Paired t-tests were applied to compare outcomes between 6-week and 12-week follow-up intervals, with a p-value of <0.05 considered statistically significant.

RESULTS

A total of 80 patients were included in the study conducted at the Department of Orthopedic Surgery, Combined Military Hospital, Rawalpindi. The mean age of patients was 38.6 ± 12.4 years, with a slight male predominance (52.5%). Most fractures were isolated ulnar styloid fractures (62.5%), while the remaining cases were associated with distal radius fractures (37.5%).

Table 1

Demographic and Clinical Characteristics (n = 80)

Variable	Frequency (%)
Gender	
Male	42 (52.5%)
Female	38 (47.5%)
Age Group (years)	
18–30	22 (27.5%)
31–45	30 (37.5%)
46–60	18 (22.5%)
>60	10 (12.5%)
Fracture Type	
Isolated ulnar styloid	50 (62.5%)
Associated with radius	30 (37.5%)

Functional outcomes demonstrated significant improvement between 6 weeks and 12 weeks follow-up. The mean PRWE score decreased from **52.6 ± 10.4 at 6 weeks to 38.9 ± 9.1 at 12 weeks (p = 0.001)**, indicating marked improvement in pain and disability.

Table 2

Functional Outcomes at 6 and 12 Weeks Follow-Up

Parameter	6 Weeks (Mean ± SD)	12 Weeks (Mean ± SD)	p-value
PRWE Score	52.6 ± 10.4	38.9 ± 9.1	0.001
Wrist Flexion (°)	70.8 ± 9.7	78.5 ± 8.9	0.002
Wrist Extension (°)	63.9 ± 10.3	71.6 ± 9.5	0.003
Radial Deviation (°)	14.6 ± 4.1	16.2 ± 3.8	0.078
Ulnar Deviation (°)	28.1 ± 5.2	30.8 ± 5.0	0.065
Grip Strength (kg)	27.8 ± 6.5	31.0 ± 6.1	0.058

Wrist flexion and extension showed statistically significant improvement ($p < 0.05$), while radial and ulnar deviation improved but were not statistically significant. Grip strength also improved but did not reach statistical significance within the short follow-up period.

Table 3

Grip Strength Comparison with Normal Side at 12 Weeks

Parameter	Mean ± SD
Affected Hand	31.0 ± 6.1 kg
Normal Hand	34.5 ± 5.8 kg
p-value	0.069

At 12 weeks follow-up, 68 patients (85%) reported good functional recovery with minimal pain. However, 12 patients (15%) still experienced mild discomfort during heavy activity, and 8 patients (10%) showed slight restriction in wrist motion.

No major complications such as gross instability, non-union-related disability, or deformity were observed during the study period.

Overall, conservative management showed significant early functional improvement within 12 weeks, with progressive recovery in wrist function and acceptable short-term outcomes.

CONCLUSION

In conclusion, conservatively managed ulnar styloid fractures generally result in favorable functional outcomes, with most patients demonstrating significant improvement in pain, wrist range of motion, and overall function over time. The reduction in PRWE scores and improvement in flexion and extension movements indicate effective recovery with non-operative treatment, particularly in cases without distal radioulnar joint (DRUJ) instability. However, a small proportion of patients may continue to experience mild residual symptoms such as reduced grip strength, occasional pain, and slight limitation in certain wrist movements, which may be attributed to underlying soft tissue injury or subtle instability. These findings emphasize the importance of proper immobilization followed by a well-structured rehabilitation program to optimize recovery and restore wrist function. Regular follow-up is also essential to identify and manage persistent symptoms. Overall, conservative management remains a safe, effective, and reliable treatment option for ulnar styloid fractures, although individualized care and further research are needed to address cases with incomplete functional recovery.

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