

Original Article

Clinical value of rehabilitation nursing after internal fixation of distal radius fractures

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Abstract: Objective: To evaluate the clinical value of rehabilitation nursing following internal fixation of distal radius fractures (DRFs). Methods: This retrospective study analyzed the medical records of 114 patients who underwent internal fixation for DRFs between July 2019 and May 2023. Among them, 54 patients received routine nursing care (control group) and 60 patients received rehabilitation nursing (observation group). Comparative analyses were conducted on postoperative pain (Visual Analogue Scale [VAS]), swelling, rehabilitation indicators (healing time, time to regain limb mobility, and hospital stays), wrist joint functional recovery (grip strength, Gartland-Werley Scale, rate of excellent and good reduction), quality of life (Short-Form 36 [SF-36]), adverse emotions (Self-Rating Depression Scale [SDS] and Self-Rating Anxiety Scale [SAS]), and nursing satisfaction. Results: The observation group exhibited a significant stepwise decrease in VAS and swelling scores on postoperative days 3 and 7 compared to preoperative levels (all $P < 0.05$), and these scores were lower than those of the control group (all $P < 0.05$). The observation group also showed significantly shorter healing time, faster recovery of limb mobility, and reduced hospital stays (all $P < 0.05$). Additionally, patients in the observation group demonstrated higher grip strength, a greater rate of excellent and good reduction, and significantly lower Gartland-Werley, SDS, and SAS scores compared to the control group (all $P < 0.05$). Higher SF-36 scores and greater nursing satisfaction were also observed in the observation group (both $P < 0.05$). Conclusions: Rehabilitation nursing after internal fixation of DRFs has significant clinical value, evidenced by substantial relief of postoperative pain and swelling, reduction in adverse emotions, enhanced rehabilitation, improved wrist joint function, and higher quality of life and nursing satisfaction.

Keywords: Internal fixation of distal radius fractures, rehabilitation nursing, pain, wrist joint function, excellent and good rate of reduction

Introduction

Distal radius fractures (DRFs) are orthopedic injuries with a bimodal distribution, primarily affecting young men and postmenopausal women [1, 2]. The etiology varies: low-energy trauma is typical in older patients, often with osteopenia or osteoporosis, while high-energy trauma occurs more frequently in younger patients with generally healthy bone stock [3, 4]. DRFs account for 14-18% of all adult limb injuries, with risk factors including environmental factors, lifestyle choices, increased childhood obesity, and extended life expectancy [5].

Internal fixation is a common surgical treatment for DRFs, offering advantages such as

minimal trauma, rapid healing, secure fixation, and early postoperative rehabilitation [6, 7]. However, postoperative challenges include pain and restricted wrist joint function [8], underscoring the importance of robust postoperative rehabilitation management to aid pain relief and functional recovery.

Previous studies have explored various nursing interventions for fracture patients. For example, Li et al. [9] demonstrated that evidence-based nursing improved daily activities and reduced postoperative complications in patients with vertebral osteoporotic fractures. Yu et al. [10] found that the enhanced recovery after surgery pathway facilitated postoperative pain relief, rehabilitation, and improved quality of life in

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fracture surgery patients. Wang et al. [11] reported that painless nursing intervention effectively controlled acute fracture conditions, alleviated pain, and reduced the length of hospital stays in orthopedic surgery patients.

This study focuses on rehabilitation nursing, an intervention based on enhanced recovery after surgery principles, providing care in environmental adjustments, wrist function training, and psychological support from the patient's perspective [12]. Talevski et al. [13] found that rehabilitation nursing significantly improved quality of life and physical function in fragility fracture patients. Similarly, Ortiz-Piña et al. [14] highlighted the benefits of remote rehabilitation nursing in enhancing functional independence and physical condition in elderly hip fracture patients. These findings suggest the potential clinical application of rehabilitation nursing in DRFs treatment.

Currently, there is limited research on the clinical value of rehabilitation nursing for DRF patients after internal fixation. This study aims to fill that gap by providing evidence-based insights into rehabilitation management for these patients.

Methods and materials

General information

This retrospective study was approved by the Ethics Committee of Qingdao Chengyang People's Hospital. A total of 114 patients who underwent internal fixation for DRFs between July 2019 and May 2023 were included. The study population was divided into two groups: 54 patients in the control group received routine nursing care, while 60 patients in the observation group received rehabilitation nursing.

Inclusion criteria: All patients had unilateral DRFs confirmed by X-ray and clinical examination [15] and underwent open reduction and internal fixation. Medical records were complete, the fracture was stable with X-rays showing blurred fracture lines and good callus formation, and patients exhibited varying degrees of wrist dysfunction four weeks post-treatment.

Exclusion criteria: Patients with old or pathological fractures, unhealed forearm skin, poor

fracture stability, osteoporosis, nerve injury symptoms, wound infections, cognitive dysfunction, or mental illness.

Treatment methods

The control group received routine nursing care, which included close monitoring of the affected area to prevent complications. Health education was provided through face-to-face lectures and video presentations. Patients also received guidance on diet, medication, and daily activities.

The observation group was cared for by rehabilitation nursing. Nursing methods: (1) Environmental nursing: Nurses ensured a comfortable hospital environment by maintaining appropriate indoor temperature and humidity. Shades were installed to block strong light, and regular ward disinfection was performed to maintain cleanliness and hygiene. (2) Starting on the first postoperative day, a professional rehabilitation therapist guided passive wrist and metacarpal joint rehabilitation exercises. From day two, depending on the patient's condition, training progressed to active exercises, focusing on improving finger dexterity. Training sessions were conducted 2-3 times daily, with each session consisting of 3-5 repetitions. In cases of severe pain, analgesics were administered under a doctor's supervision before initiating joint rehabilitation. From the third to the seventh postoperative day, therapists assisted with active fist clenching, fist loosening, and forearm tightening and relaxation exercises, conducted 3-4 times daily for 3-5 minutes per session. Between the seventh and fourteenth days postoperatively, patients were instructed in exercises targeting the metacarpophalangeal, wrist, and elbow joints, as well as muscle tissues. Massage and physical therapy were also provided. If local tissue swelling occurred during rehabilitation, appropriate interventions such as massage, warm moist compresses with magnesium sulfate, wax therapy, or infrared therapy were applied to promote circulation and functional recovery. The intensity, duration, and frequency of exercises were adjusted based on patient feedback, X-ray results, and the condition of the surgical site to avoid complications from improper rehabilitation. (3) Psychological nursing: Nurses monitored patients' psychological and emotional states, enhancing communication to address con-

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Table 1. Comparison of general information

Factors	Control group (n=54)	Observation group (n=60)	t/ χ^2	P
Age (years old)	50.17±8.68	46.95±10.26	1.798	0.075
Sex (male/female)	30/24	35/25	0.089	0.765
Disease course (h)	7.17±3.15	7.55±3.28	0.629	0.530
Etiology (falls/traffic accidents/fights/crushing injuries)	40/10/4	35/18/7	3.130	0.209
Open fractures (with/without)	20/34	26/34	0.468	0.494
Marital status (married/unmarried)	48/6	47/13	2.280	0.131
Occupation (migrant worker/individual household/others)	35/10/9	38/15/7	1.060	0.589

cerns. By answering patients' questions and addressing their worries, nurses helped alleviate negative emotions and emphasized the importance of maintaining a positive attitude.

Outcome measures

(1) Pain intensity [16]: Pain levels were assessed using the Visual Analogue Scale (VAS) before surgery, and at 3 and 7 days post-surgery. The VAS scores range from 0 to 10, with higher scores indicating greater pain intensity.

(2) Swelling degree [17]: Swelling was categorized into three levels: 0 - normal; 1 - lighter dermatoglyphs with normal skin color; 2 - disappearance of dermatoglyphs with altered skin color; and 3 - severe swelling, shiny skin, and potential blistering affecting tissue blood circulation, with cyanotic or pale skin.

(3) Rehabilitation indexes [18]: The healing time, time to regain limb mobility, and hospital stays were recorded.

(4) Wrist joint functional recovery [19]: Grip strength was assessed both preoperatively and postoperatively. The efficacy of reduction was evaluated using the Gartland & Werley scoring system, with scores of 0-2 indicating excellent, 3-8 good, 9-20 fair, and ≥ 21 poor; the "excellent and good" rate refers to the percentage of patients with excellent or good outcomes.

(5) Quality of life [20]: Quality of life was assessed using the Short-Form 36 (SF-36) Health Survey before and after surgery. Higher total scores correspond to a better quality of life.

(6) Adverse emotions [21]: Depression and anxiety levels were measured using the Self-Rating Depression Scale (SDS) and the Self-Rating Anxiety Scale (SAS). Higher scores indicate more severe adverse emotions.

(7) Nursing satisfaction [22]: Nursing satisfaction was evaluated by patients on a 100-point scale, with scores above 80 indicating very satisfied, 60-80 indicating basically satisfied, and below 60 indicating dissatisfied. The total satisfaction rate was calculated as the sum of the very satisfied and generally satisfied rates.

Statistical methods

Measurement data were statistically described as mean \pm standard deviation ($\bar{x} \pm sd$). Independent sample t-tests were used to identify differences between groups, and paired t-tests were employed for intra-group comparisons before and after treatment. Repeated measures analysis of variance was used for analyzing data across multiple time points, with the Bonferroni method applied for pairwise comparisons between different time points within the group. Categorical data, expressed as ratios (percentages), were compared using the χ^2 test. Data analysis was conducted using SPSS 19.0, with statistical significance indicated by *P*-values < 0.05 .

Results

Comparison of general information

No statistically significant differences were observed between the two groups in terms of age, sex, disease duration, etiology, open fractures, marital status, or occupation (all $P > 0.05$). Refer to **Table 1**.

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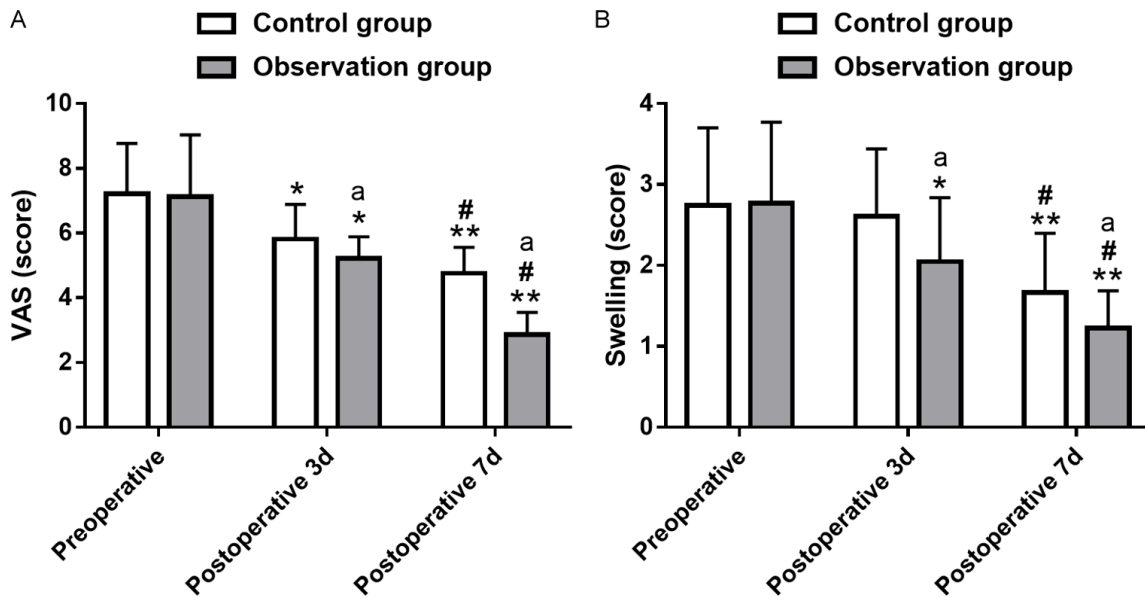


Figure 1. Comparison of postoperative pain intensity and swelling degree. A. Postoperative pain assessment of the two groups of patients. B. Postoperative swelling evaluation of the two groups of patients. Note: * $P < 0.05$, ** $P < 0.01$ vs. the preoperative level; [#] $P < 0.05$ vs. the level at 3 days after surgery; ^a $P < 0.05$ vs. control group. VAS, Visual Analogue Scale.

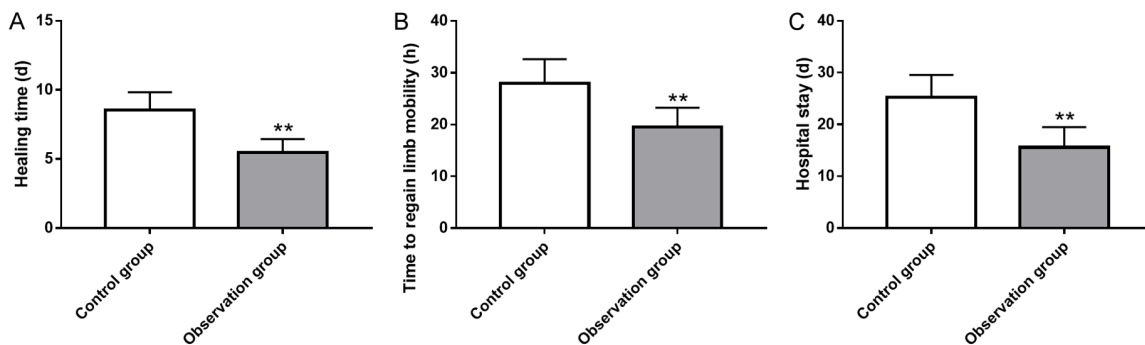


Figure 2. Comparison of rehabilitation indexes of patients in both groups. A. Comparison of healing time. B. Comparison of time to regain limb mobility. C. Comparison of hospital stay. Note: ** represent $P < 0.01$.

Comparison of postoperative pain intensity and swelling degree

Comparative analysis revealed no significant differences in preoperative VAS and swelling scores between the two groups (both $P > 0.05$). However, both VAS and swelling scores decreased significantly in both groups on the 3rd and 7th day postoperatively, with more pronounced reductions observed in the observation group (both $P < 0.05$). Refer to **Figure 1**.

Comparison of rehabilitation indexes

Patients in the observation group experienced faster healing, earlier time to regain limb mobil-

ity, and shorter hospital stays compared to the control group (all $P < 0.05$). Refer to **Figure 2**.

Comparison of wrist joint functional recovery

Preoperative grip strength and Gartland-Werley Scale scores were comparable between the two groups (both $P > 0.05$). Postoperatively, both groups showed significant improvements in grip strength and reductions in Gartland-Werley Scale scores, with the observation group demonstrating superior grip strength and lower Gartland-Werley Scale scores compared to the control group (both $P < 0.05$). Additionally, the excellent and good rate of wrist reduction in the observation group was

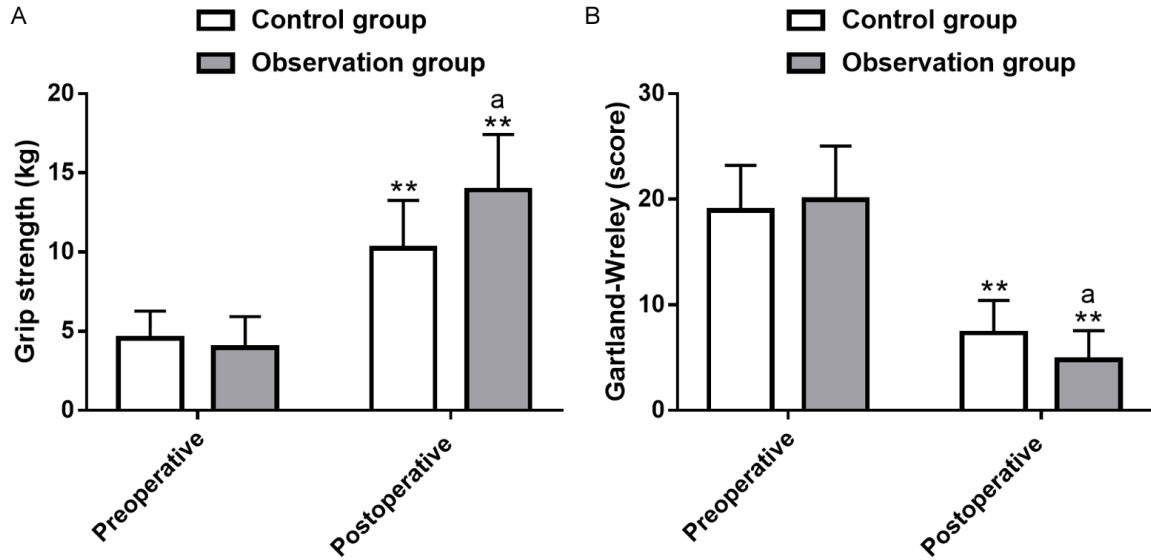


Figure 3. Comparison of wrist joint functional recovery. A. Comparison of grip strength. B. Comparison of Gartland-Werley Scale. Note: **P<0.01 vs. preoperative; ^aP<0.05 vs. control group.

Table 2. Comparison of excellent and good rate of reduction

Factors	Control group (n=54)	Observation group (n=60)	χ^2	P
Excellent	16 (29.63)	24 (40.00)		
Good	22 (40.74)	32 (53.33)		
Fair	5 (9.26)	2 (3.33)		
Poor	11 (20.37)	2 (3.33)		
Excellent and good rate of reduction	38 (70.37)	56 (93.33)	10.360	0.001

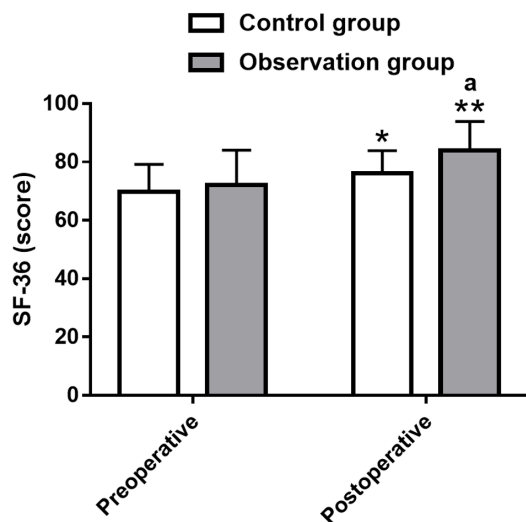


Figure 4. Comparison of quality of life in both groups. Note: *P<0.05, **P<0.01 vs. preoperative; ^aP<0.05 vs. control group. SF-36, Short-Form 36 Item Health Survey.

93.33%, significantly higher than the 70.37% observed in the control group (P<0.05). Refer to **Figure 3** and **Table 2**.

Comparison of quality of life

A comparative analysis of quality of life indicated no significant differences in total SF-36 scores between the two groups before surgery (P>0.05). Postoperatively, total SF-36 scores increased in both groups, with the observation group achieving significantly higher scores compared to the control group (P<0.05). Refer to **Figure 4**.

Comparison of negative emotions

Comparative analysis of SDS and SAS scores revealed no significant inter-group differences before surgery (both P>0.05). Postoperatively, both groups exhibited significant reductions in SDS and SAS scores, with the observation

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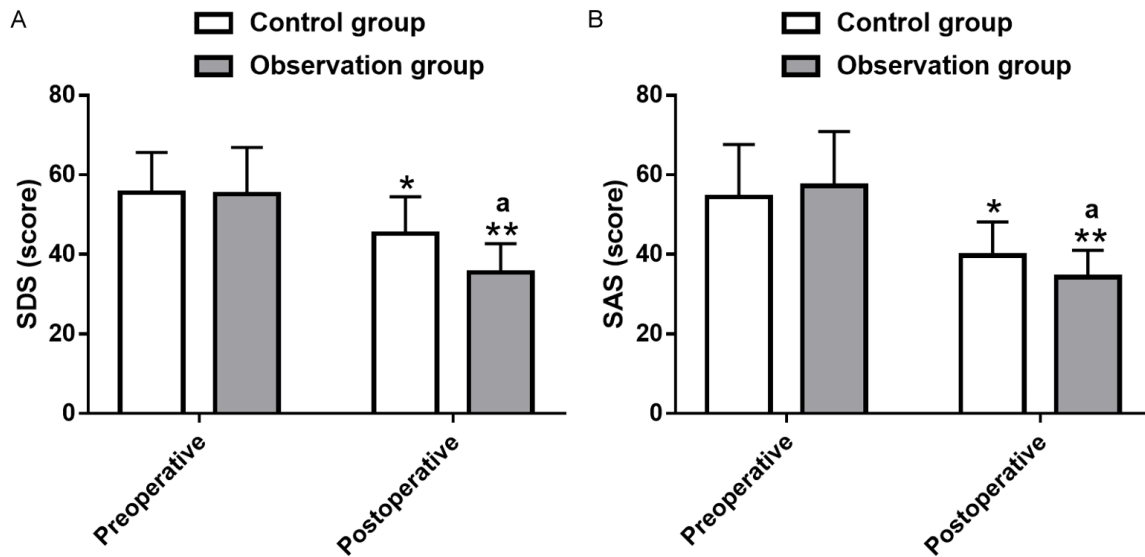


Figure 5. Comparison of adverse emotions. A. SDS scores of the two groups. B. SAS scores of the two groups. Note: * $P < 0.05$, ** $P < 0.01$ vs. preoperative; ^a $P < 0.05$ vs. control group. SDS, Self-Rating Depression Scale; SAS, Self-Rating Anxiety Scale.

Table 3. Comparison of nursing satisfaction

Factors	Control group (n=54)	Observation group (n=60)	χ^2	P
Very satisfied	16 (29.63)	25 (41.67)		
Generally satisfied	23 (42.59)	30 (50.00)		
Dissatisfied	15 (27.78)	5 (8.33)		
Overall satisfaction	39 (72.22)	55 (91.67)	7.428	0.006

group showing even lower scores compared to the control group (both $P < 0.05$). Refer to **Figure 5**.

Comparison of nursing satisfaction

Nursing satisfaction rates were 91.67% in the observation group and 72.22% in the control group, with a significant difference between the groups ($P < 0.05$). Refer to **Table 3**.

Discussion

The treatment objectives after internal fixation surgery for DRFs typically include pain alleviation, restoration of motor function, and enhancement of muscle strength and overall functionality [23]. In this study, the observation group received rehabilitation nursing interventions, while the control group received routine nursing care. The study confirmed that rehabilitation nursing provided superior clinical outcomes compared to routine nursing in terms of reducing postoperative pain and swelling,

improving rehabilitation indicators, enhancing wrist joint functional recovery, and increasing nursing satisfaction. These findings are detailed below.

Internal fixation for DRFs often leads to clinical symptoms such as pain and swelling in the affected area, which can hinder postoperative rehabilitation and negatively impact the recovery of physical functions [24, 25]. Therefore, we first analyzed the postoperative pain intensity and swelling degree in both groups. The VAS and swelling scores of the observation group at 3 and 7 days post-surgery were significantly lower than their preoperative levels and those of the control group, indicating that rehabilitation nursing effectively reduces postoperative pain and swelling after internal fixation for DRFs. This may be attributed to the comprehensive pain and swelling management strategies employed in rehabilitation nursing, including administering analgesics to patients with severe pain and providing timely massage,

warm moist compresses with magnesium sulfate, wax therapy, or infrared physiotherapy to alleviate local tissue swelling, promote blood circulation, and aid functional recovery [26, 27]. Similar findings were reported by Zhao et al. [28], who demonstrated that rehabilitation nursing significantly alleviates pain and swelling in patients with lower limb deep venous thrombosis after spinal fractures, paralleling our results.

Additionally, we observed that the healing time, time to regain limb mobility, and hospital stays were notably shorter in the observation group compared to the control group, further highlighting the effectiveness of rehabilitation nursing in promoting postoperative recovery in DRF patients. Postoperative grip strength also improved significantly in the observation group, surpassing that of the control group, and the Gartland-Werley Scale scores were significantly lower in the observation group. Moreover, the excellent and good rate of wrist reduction, as assessed by the Gartland-Werley Scale, was significantly higher in the observation group compared to the control group (93.33% vs. 70.37%). These findings suggest that rehabilitation nursing is beneficial for improving wrist strength and joint repair in DRF patients after internal fixation. This may be due to the holistic approach of rehabilitation nursing, which encompasses environmental adjustments, targeted wrist function training, and psychological support. Notably, the care model emphasizes the recovery of wrist joint function by providing patients with scientific and effective early rehabilitation training for the metacarpophalangeal, wrist, and elbow joints, adhering to principles of gradual progress and tolerance [29, 30].

Consistent with our findings, Kaji et al. [31] reported that early active grip strength training for patients undergoing surgery for DRFs not only accelerates the recovery of wrist grip strength and flexion but also prevents loss of correction at the fracture site. This aligns with our study results. Reid et al. [32] also noted that wrist joint function training provided during rehabilitation nursing is beneficial for early and rapid recovery in patients with dyskinesia following non-operative cast immobilization for DRFs. In our study, we observed significantly decreased SDS and SAS scores in the observation group after surgery, which were lower than both the preoperative levels and the scores of

the control group. This suggests that rehabilitation nursing is more effective in alleviating adverse emotions in DRF patients. Additionally, the observation group showed a marked increase in total SF-36 scores, significantly higher than those in the control group, indicating that rehabilitation nursing enhances the quality of life for DRF patients. Finally, the observation group had a significantly higher nursing satisfaction rate (91.67% vs. 72.22%), consistent with findings from Kim et al. [33], suggesting that rehabilitation nursing improves nursing satisfaction and has substantial clinical value.

The limitations of this study, identified after ongoing discussion, are as follows: First, the observation period was relatively short; extending this period would help to better understand the long-term effects of rehabilitation nursing after internal fixation surgery for DRFs. Second, there was no in-depth analysis of prognostic factors, which should be explored in future research. Third, factors affecting nursing satisfaction were not analyzed in detail, and addressing this could further enhance the nursing experience in postoperative rehabilitation. Future research will focus on these aspects to continuously improve the study.

In summary, rehabilitation nursing for postoperative patients after internal fixation of DRFs effectively relieves postoperative pain and swelling and accelerates recovery. This is evidenced by significantly shortened healing time, earlier time in regaining limb mobility, and reduced hospital stays. The approach also improves postoperative grip strength, wrist joint function, quality of life, and alleviates adverse emotions, while achieving high nursing satisfaction. Our findings provide better nursing options for postoperative DRF patients, offering a comprehensive and high-quality nursing pathway and a reliable reference for perioperative care.

Disclosure of conflict of interest

None.

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