MEDS Clinical Medicine (2023)
Clausius Scientific Press, Canada

DOI: 10.23977/medsc.2023.040702
ISSN 2616-1907 Vol. 4 Num. 7

Exploration on the clinical effect of external fixation with homemade splints in the treatment of metacarpal fractures

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Keywords: Self-made splint for external fixation, Metacarpal fracture, Treatment effect

Abstract: The the application value of self-made splint external fixation in the treatment of patients with metacarpal fractures was observed. 80 patients with metacarpal fractures were included in this study from January 2021 to January 2023. They were divided into a control group of 40 patients who received micro steel plates and an observation group of 40 patients who received self-made splint external fixation treatment according to the average score method. The fracture healing status and union time of the two groups of patients were observed. In terms of comparison of fracture healing, the observation group showed significantly higher healing outcomes for those with better or better healing outcomes than the control group ($p<0.05$); In terms of fracture healing time, the control group patients took significantly longer time ($p<0.05$). By using self-made splints for external fixation in the treatment of metacarpal fracture patients, it can improve the fracture healing and shorten the recovery time of metacarpal fracture patients.

1. Introduction

Metacarpal fracture refers to a fracture of the metacarpal bone in the palm of the hand. It mainly occurs in various metacarpal bones of the palm, especially in the 5th metacarpal bone, with a higher incidence of fractures. Common symptoms include palm pain, swelling, and limited function. Severe cases may be accompanied by traumatic bleeding. Common causes of metacarpal fractures include direct external force hitting the palm, such as falls, and may also be caused by physical exercise. The incidence of metacarpal fractures is around 30-50% of hand fractures. With the continuous development of clinical medical technology, more and more treatment methods have emerged, and surgical treatment techniques have also made good progress, such as miniature steel plates, memory alloys, external fixation brackets, absorbable materials, etc. [1]. However, conservative treatment is still the preferred treatment option for metacarpal fractures at this stage. Based on years of clinical practice experience and a large number of high-quality clinical case materials, our hospital has designed and produced a self-made splint external fixation for treating patients with metacarpal fractures according to our own conditions. The practice was conducted from January 2021 to January 2023, and received praise from medical staff, patients, and family members. Therefore, make the following report.

2. Materials and Methods

2.1 General Information

80 patients with metacarpal fractures were included in this study from January 2021 to January 2023. They were divided into a control group of 40 patients who received micro steel plates and an observation group of 40 patients who received self-made splint external fixation treatment according to the averaging method. The gender ratio distribution of the two groups of patients is completely consistent, with 26 male patients and 14 female patients, with an age range of 10-67 years. The average age of the two groups of patients was calculated to be (38.94±15.24) years old in the control group and (38.90±15.30) years old in the observation group. Among them, there were 18 left side fractures and 22 right side fractures in the control group; There were 20 left side fractures and 20 right side fractures in the observation group. Among the 80 patients, there were 46 cases of fractures caused by direct violence and 34 cases of fractures caused by indirect violence. Among them, there were 67 patients with a single metacarpal fracture and 13 patients with multiple metacarpal fractures. The general data comparison between the two groups of patients showed that the final results were within the comparability range ($p>0.05$).

Inclusion criteria: (1) The patient's clinical data is complete and their awareness is clear; (2) The patient's clinical compatibility is high.

Exclusion criteria: (1) Those who withdrew midway during the study period; (2) Previous history of metacarpal fracture.

2.2 Method

2.2.1 Control group

Micro steel plate internal fixation treatment. The patient was assisted in maintaining a supine position for surgery, and the affected brachial plexus was selected to anesthetize the patient and Xining. The surgery is performed with the help of an airbag tourniquet. Before the patient begins the surgery, nursing staff should closely observe the degree of injury. For closed fractures, the incision should be selected on the patient's back and made in an arc or longitudinal shape[2]. For patients with open fractures, it is necessary to enter the original wound of the patient. During the surgery, the original wound of the patient can be appropriately expanded and organized, and the fracture site of the patient can be exposed layer by layer. The appropriate micro steel plates were selected based on the different types of fractures in patients, and properly fix the micro steel plates. After fixation, the damaged tendons, blood vessels, and nerves in the fractures were repaired. The staff could guide patients to perform corresponding functional exercises 3 days after surgery, and provide comprehensive rehabilitation training 3 weeks after surgery.

2.2.2 Observation group

Material production: The cedar bark and medical tape was uesd to make plywood. The production of the palmar splint needs to be based on the shape of the palm when removing the greater thenar part, and the dorsal splint also needs to be made according to the patient's fracture site to ensure the appropriate size of the splint. After the patient undergoes manual reduction of the fracture, a self-made agent is used to apply externally to the fracture site, and a surgical bandage is used to base the fracture. The palmar splint is first placed, and the compression pad and bone splitting pad are selected according to the patient's fracture type for anesthesia before the dorsal splint is placed. The bandage is used for pressure bandage to apply pressure to the patient's palmar and dorsal splints, in order to maintain the stability of the patient's fracture [3].

Treatment method: (1) For patients with metacarpal head and neck fractures, longitudinal traction is required to correct shortening and displacement, and the fracture end is compressed and corrected to make the fracture end angle and lateral displacement. (2) For patients with metacarpal fracture, longitudinal traction correction should be used to shorten the dislocation, and the fracture end should be compressed and corrected. Separate bone pads should be placed on both sides of the metacarpal shaft, fixed with splints, and compressed and wrapped. (3) Fracture of the base of the metacarpal bone; Use longitudinal traction to correct shortening and dislocation, compress and correct the fracture end, pad and compress the fracture end on the back of the hand, fix the splint, and compress the bandage. Immediately after surgery, X-ray examination should be performed to evaluate the degree of reduction of the fracture, and patients should be informed of the precautions to be taken. Weekly follow-up should be conducted to adjust the tightness of the splint to ensure the stability of the fracture end. Regular X-ray examination should be conducted. If the fracture is displaced, manual reduction should be performed again, and conservative treatment or surgical treatment should be chosen based on the situation of fracture restoration. After the splint fixation, the joint activity between each finger can proceed normally without affecting the movement of the thumb. It can only be removed after the callus at the fracture end forms and the fracture end is stable, and functional training can be conducted[4].

2.3 Observation indicators

(1) The fracture healing status of both groups of patients were observed. The fracture healing status of patients were evaluated by using TAM. Excellent: After treatment, the patient's range of motion returned to normal, and the range of motion of the affected finger returned to before the fracture; Good: After treatment, the range of activity improved significantly, and the TAM score on the affected side ≤ Between three-quarters (75%) and one-half (50%) of the contralateral TAM score. Poor: The range of activity did not improve after treatment.

(2) Observe the patient's fracture healing time.

2.4 Statistical Analysis

Through the system software SPSS 22.0 version, the relevant data and information involved in the article were calculated and analyzed, and the corresponding expression of the counting data was (%), with the help of χ^2, the expression of all measurement data is ($\bar{x} \pm s$), and to be tested with t. P<0.05 is used as the criterion for determining statistically significant differences in data between groups.

3. Results

3.1 Fracture healing status

Table 1: Fracture healing status (%).

Group	Number of cases(n)	Excellent	Good	Poor	Total excellent rate
Observational group	40	23	16	1	39(97.50)
Control group	40	8	20	12	28(70.00)
x^2					11.114
P					0.001

In terms of the comparison of fracture healing, the observation group showed significantly higher healing rates in the excellent and good cases than in the control group (p<0.05); See Table 1.

3.2 Fracture healing time

In terms of fracture healing time, the control group patients took significantly longer time ($p<0.05$). See Table 2.

Table 2: Fracture healing time ($\bar{x}\pm s$).

Group	Number of cases	Fracture healing time(d)
Observational group	40	43.59±1.86
Control group	40	62.59±3.57
t		29.852
P		0.000

4. Discussion

Self-made splint external fixation has obvious advantages for patients with metacarpal fractures, mainly manifested in: (1) fixing the fracture site, reducing pain, and promoting healing. A splint can fix the relative position of the metacarpal bone and reduce pain during movement. (2) Protecting the injured area. A splint can prevent external forces from affecting the fracture site again and avoid worsening the fracture. (3) Improving compliance. Compared to surgery, external fixation with splints is easier to operate, increasing patients' motivation to actively cooperate with treatment. (4) Reducing treatment costs. Compared with surgical internal fixation, self-made splints for external fixation have lower costs and are more suitable for mild fractures. (5) Convenient follow-up. During follow-up, only the condition of the splint needs to be observed, without the need for complex examinations, making it easier to control the healing process. (6) The prognosis is good. For mild metacarpal fractures, external fixation with splints often leads to good healing. (7) Early functional exercise is possible. After healing, limited functional exercise can be performed to restore functional function in advance [5].

The article grouped and observed 80 cases of metacarpal fractures, and analyzed the differences in the effectiveness of external fixation with micro steel plates and self-made splints on patients with metacarpal fractures. The final results showed that after treatment, the number of patients in the observation group who received external fixation with self-made splints was significantly higher than that in the control group who received treatment with micro steel plates ($p<0.05$); At the same time, the observation group patients also took less time for fracture healing ($p<0.05$). This is sufficient to prove that external fixation with splints has good therapeutic effects in the treatment of most patients with metacarpal fractures, and has advantages such as simple production of splints, simple bandaging and fixation, and low medical costs, which can be widely used in clinical practice [6].

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