



# Is Routine Outpatient Follow-up Required in Fifth Metacarpal Neck Fractures?

## Beşinci Metakarp Boyun Kırıklarında Rutin Poliklinik Takibi Gerekli midir?

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### ABSTRACT

**Aim:** To investigate the factors affecting the healed angulation in patients treated with closed reduction and casting for a fifth metacarpal neck fracture.

**Materials and Methods:** The study consisted of sixty-three patients with a fifth metacarpal neck fracture, who had an angulation  $<30^\circ$  after initial reduction. All the patients were treated with closed reduction and casting. The patients were divided into two groups according to the healing angulation ( $\leq 30$  and  $>30^\circ$  as groups 1 and 2, respectively). The angles of the fifth metacarpal neck fracture were measured at presentation, after reduction, and at the final follow-up visit.

**Results:** Of the sixty-three patients, thirty healed with acceptable angulation (Group 1) and thirty-three with unacceptable angulation (Group 2). There was not a statistically significant difference between two groups according to the mean age, follow-up time, metacarpophalangeal cast angle, wrist extension cast angle, and correction angle. The mean initial fracture angulation was  $41.7^\circ \pm 12.9^\circ$  ( $9^\circ-70^\circ$ ) in Group 1 and  $48.3^\circ \pm 9.9^\circ$  ( $29^\circ-70^\circ$ ) in Group 2 ( $p=0.049$ ). The mean fracture angulation after the reduction was  $15.5^\circ \pm 8.9^\circ$  ( $0^\circ-30^\circ$ ) in Group 1 and  $26^\circ \pm 4.8^\circ$  ( $15^\circ-30^\circ$ ) in Group 2 ( $p<0.001$ ). The mean final follow-up healing angulation was  $20.8^\circ \pm 7.4^\circ$  ( $3^\circ-30^\circ$ ) in Group 1 and  $39.6^\circ \pm 5.7^\circ$  ( $31^\circ-55^\circ$ ) in Group 2, respectively ( $p<0.001$ ). As a result of the ROC curve analysis, the cut-off values were found as  $>44^\circ$  and  $>17^\circ$  for unacceptable result of initial and post-reduction angulations, respectively.

**Conclusion:** In the patients with fifth metacarpal neck fracture treated with closed reduction and casting, the initial angle  $<44^\circ$  and the angulation after reduction  $<17^\circ$  are positive indicators for functional recovery. Routine follow-up may not be required in this group of patients.

**Keywords:** Metacarpophalangeal neck, fifth metacarpal fracture, closed reduction and cast

### ÖZ

**Amaç:** Kapalı redüksiyon ve alçılama ile tedavi edilen beşinci metakarp boyun kırıklı hastalarda iyileşmiş açılanmayı etkileyen faktörleri araştırmak.

**Gereç ve Yöntem:** Çalışma, beşinci metakarpal boyun kırığı olan ve ilk redüksiyondan sonra  $<30^\circ$  açılanması olan altmış üç hastadan oluşuyordu. Tüm hastalar kapalı redüksiyon ve alçı ile tedavi edildi. Hastalar iyileşme açısına göre iki gruba ayrıldı (sırasıyla  $\leq 30$  ve  $>30^\circ$ , Grup 1 ve Grup 2 olarak). Beşinci metakarpal boyun kırığı açıları başvuru sırasında, redüksiyondan sonra ve son kontrolde ölçüldü.

**Bulgular:** Altmış üç hastadan otuz kabul edilebilir açılanma ile (Grup 1) ve otuz üçü kabul edilemez açılanma ile iyileşti (Grup 2). İki grup arasında ortalama yaş, takip süresi, metacarpophalangeal alçı açısı, bilek ekstansiyon alçı açısı ve düzeltme açısı açısından istatistiksel olarak anlamlı fark yoktu. Ortalama başvuru kırık açıları Grup 1'de  $41,7^\circ \pm 12,9^\circ$  ( $9^\circ-70^\circ$ ), Grup 2'de  $48,3^\circ \pm 9,9^\circ$  ( $29^\circ-70^\circ$ ) idi ( $p=0,049$ ). Redüksiyon sonrası ortalama kırık açıları Grup 1'de  $15,5^\circ \pm 8,9^\circ$  ( $0-30^\circ$ ), Grup 2'de  $26^\circ \pm 4,8^\circ$  ( $15^\circ-30^\circ$ ) idi ( $p<0,001$ ). Son kontrolde iyileşme açıları Grup 1'de  $20,8^\circ \pm 7,4^\circ$  ( $3^\circ-30^\circ$ ), Grup 2'de  $39,6^\circ \pm 5,7^\circ$  ( $31^\circ-55^\circ$ ) idi. ROC eğrisi analizi sonucunda başvuru ve redüksiyon sonrası açılanmalarının kabul edilemez sonuç açısından cut-off değerleri sırasıyla  $>44^\circ$  ve  $>17^\circ$  olarak bulundu.

**Sonuç:** Kapalı redüksiyon ve alçı ile tedavi edilen beşinci metakarpal boyun kırıklı hastalarda başvuru açısının  $<44^\circ$  ve redüksiyon sonrası açılanmanın  $<17^\circ$  olması fonksiyonel iyileşme için pozitif göstergelerdir. Bu değerlere sahip hasta grubunda rutin poliklinik takibi gerekmez.

**Anahtar Kelimeler:** Metacarpofalangeal boyun, beşinci metakarpal kırık, kapalı redüksiyon ve alçı

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## INTRODUCTION

Fifth metacarpal neck fractures occur in approximately 20% of all hand fractures<sup>1</sup>. The mechanism of these injuries, which are most frequently seen in young adults, is direct trauma to the fifth metacarpal bone axially due to punching or falling<sup>2</sup>.

In the literature, there are studies reporting that conservative treatment methods are sufficient due to good functional results in fractures with no rotational deformity and angulation of  $<70^\circ$  when compared to the opposite hand<sup>3-5</sup>. However, some studies in the literature have recommended  $30^\circ$  of angulation as the upper limit of a conservative treatment to prevent loss of function<sup>6,7</sup>.

Usually, the patients with fifth metacarpal neck fracture are called to follow-up controls, and X-rays are taken to evaluate whether loss of reduction has occurred or not. Bansal and Craigen<sup>8</sup> reported that out-patient follow-up did not affect the functional results. In the literature, there is not enough information about which patients should be called for follow-up X-rays in this patient group. Also, information about the amount of angular change in conservatively followed fractures is lacking.

The purpose of this study was to evaluate the factors which were effective on healing in functional angulation limits of the conservatively treated fifth metacarpal fractures.

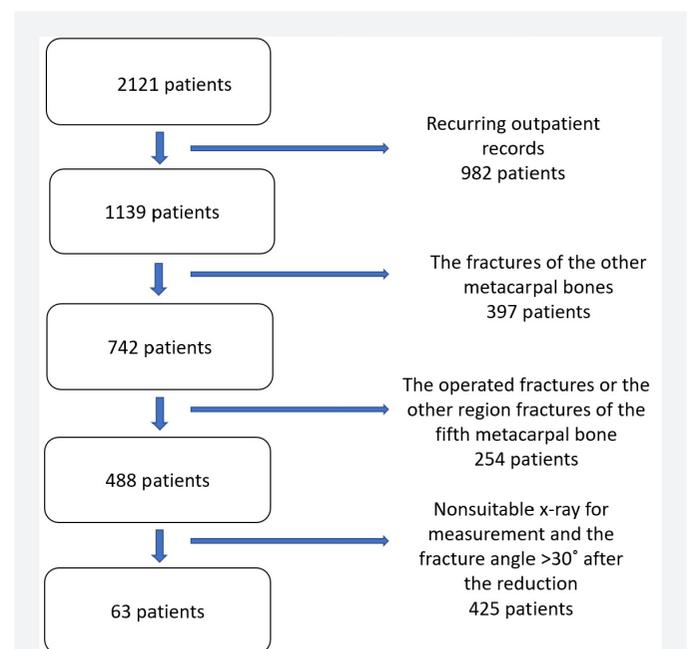
## MATERIALS AND METHODS

After obtaining the ethical committee approval, patients with a diagnosis of metacarpal fracture (ICD Code: S62.30) between January 2018 and January 2022 were searched from the archive system of the hospital. Patients with a fifth metacarpal neck fracture, with a  $\leq 30^\circ$  post reduction angulation, who had appropriate radiographs to make angulation measurements were included in the study. An informed consent form was obtained from all the patients. Exclusion criteria were being younger than eighteen years old, having open fractures, significant rotational deformities, intra-articular fractures and trauma histories older than 10 days. As a result of the searching process, 2121 patients were found. Nine hundred and eighty-two patients with recurrent system entry, 397 patients with fractures in other metacarpals, and 254 patients who underwent direct surgery or had fractures other than the neck region of the fifth metacarpal were excluded, and a total of 488 patients with fifth metacarpal neck fractures were identified. Among these patients, 63 patients, who were treated with closed reduction and casting, who had an angulation  $\leq 30^\circ$  after reduction, who had radiographs in the appropriate position for measurement, and who completed follow-up, were included in the study (Figure 1).

The angulation of the fifth metacarpal neck fracture at initial presentation, post reduction and at the final follow-up was measured. Metacarpophalangeal cast angle and wrist extension cast angle were also measured. For measurement,  $30^\circ$  oblique radiographs were used because of the superposition of other metacarpals in full lateral radiographs and the difficulty of evaluation due to the cast applied after reduction<sup>9,10</sup>. Angle measurements were made by the dorsal cortex method using lines drawn longitudinally from the most dorsal part of the metacarpal cortex (Figure 2a)<sup>11</sup>. For measuring cast angles, straight lines were drawn from dorsal of the finger, metacarpal and forearm parts of the cast. Wrist extension angle of the cast was determined as the angle between the forearm and metacarpals lines, and the angle between the metacarpals and finger lines was evaluated as the metacarpophalangeal flexion angle of the cast (Figure 2b).

The functionally fracture healing angulation was accepted as  $30^\circ$ <sup>6</sup>. Patients were divided into two groups according to their angulations in the last control radiographs; those with angulations  $\leq 30^\circ$  were accepted as Group 1 and those with angulations  $>30^\circ$  as Group 2.

In addition, the number of outpatient clinic visits during the follow-up period, additional complaints in these visits, the number of radiographs taken during these visits, and additional interventions performed on the patient, if any, were analyzed.



**Figure 1.** Schematic view of the patients with a fifth metacarpal neck fracture

### Statistical Analysis

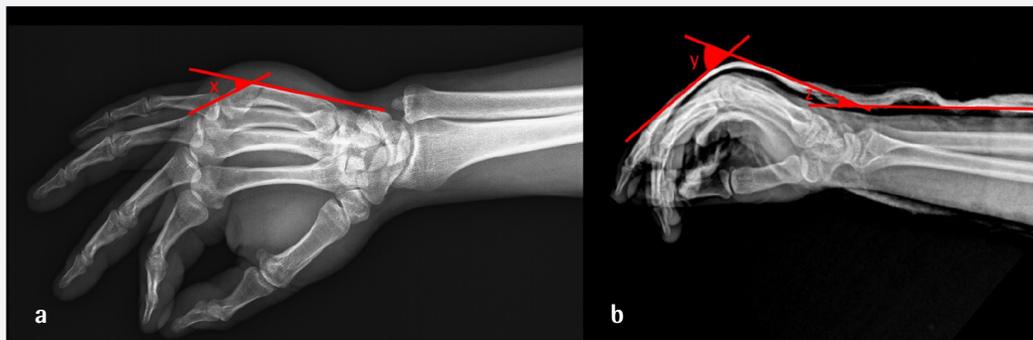
Statistical analyses were performed using the IBM Statistical Package for Social Sciences for Windows, version 24.0 (IBM Corp., Armonk, New York, USA). The normality of the continuous data was evaluated by the Shapiro-Wilk test. For normally distributed data, the t-test was used for the comparison. For not normally distributed data, the Mann-Whitney U test was used. The Fisher's exact test was employed for the comparison of categorical data. The receiver operator characteristics curve analysis was performed for the initial and post-reduction angulations by using the MedCalc Statistical Software version 15.8 (MedCalc Software bvba, Ostend, Belgium; <https://www.medcalc.org>; 2015). A p value <0.05 was accepted as statistically significant.

### RESULTS

Of the sixty-three patients, thirty (47.6%) healed with an acceptable angulation (Group 1) and thirty-three with an unacceptable angulation (Group 2). The mean age and the mean follow-up period of the patients in Group 1 was 35.7±11.5 years

(20-61), and 2.7±2.4 months (1-12), respectively. The mean age and the mean follow-up period of the patients in Group 2 was 36.1±9.1 years (18-53) and 2.2±2.2 months (1-12), respectively. There was not a statistically significant difference in age and follow-up periods among the groups (p=0.803 and p=0.287, respectively). The mean metacarpophalangeal cast angle was 27.3±12.4° (7°-55°) in Group 1 and 25.8±11.9° (5°-50°) in Group 2 (p=0.857), and the mean wrist extension cast angle was 19.6±11.5°(1°-46°) in Group1 and 15.8±8.9° (1°-36°) in Group 2 (p=0.307) (Table 1).

The mean initial fracture angulation was 41.7±12.9° (9°-70°) in Group 1 and 48.3±9.9° (29°-70°) in Group 2, respectively (p=0.049). After the reduction and casting, the mean fracture angulation was 15.5±8.9° (0-30°) in Group 1 and 26±4.8° (15°-30°) in Group 2 (p<0.001). The mean correction angle achieved with a reduction was 26.1±15.6° (2°-55°) in Group 1 and 21.2±9.9° (2°-40°) in Group 2, respectively (p=0.127). The mean loss of reduction amount was 6.6±7.3° (0-27°) in Group 1 and 12.3±7.8° (0-35°) in Group 2 (p=0.001). The mean final follow-up healing angulation was 20.8±7.4° (3°-30°)



**Figure 2.** a) Measurement of the metacarpal neck fracture angle (x) with the dorsal cortex method, b) Measurement of the metacarpophalangeal cast angle (y) and measurement of the wrist extension cast angle (z)

	Healed in acceptable angulation (n=30) mean±standard deviation (minimum-maximum)	Healed in unacceptable angulation (n=33) mean±standard deviation (minimum-maximum)	p value
Age (years)	35.7±11.5 (20-61)	36.1±9.1 (18-53)	0.803
First angulation (°)	41.7±12.9 (9-70)	48.3±9.9 (29-70)	<b>0.049</b>
Angulation after reduction (°)	15.5±8.9 (0-30)	26±4.8 (15-30)	<b>&lt;0.001</b>
Correction angle (°)	26.1±15.6 (2-55)	21.2±9.9 (2-40)	0.127
Loss of reduction (°)	6.6±7.3 (0-27)	12.3±7.8 (0-35)	<b>0.001</b>
Metacarpophalangeal cast angle (°)	27.3±12.4 (7-55)	25.8±11.9 (5-50)	0.857
Wrist extension cast angle (°)	19.6±11.5 (1-46)	15.8±8.9 (1-36)	0.307
Follow-up time (months)	2.7±2.4 (1-12)	2.2±2.2 (1-12)	0.287
Side of fracture (n) (right/left)	23/7	23/10	0.369

in Group 1 and  $39.6^{\circ} \pm 5.7^{\circ}$  ( $31^{\circ}$ - $55^{\circ}$ ) in Group 2, respectively ( $p < 0.001$ ). The ROC curve analysis was performed for the initial fracture angles and post-reduction angles. The initial fracture angulation  $>44^{\circ}$  and the post-reduction angulation  $>17^{\circ}$  were found to be significant indicators of non-functional healing (Figures 3 and 4).

The mean number of outpatient visits was  $3.7 \pm 1.7$  (1-10) and the mean number of control radiographs was  $3.7 \pm 1.6$  (1-10). When the follow-up records of the patients were examined, it was seen that the patients did not report any complaints related to the cast, and no additional intervention (cast change, re-reduction, etc.) was performed in any patient.

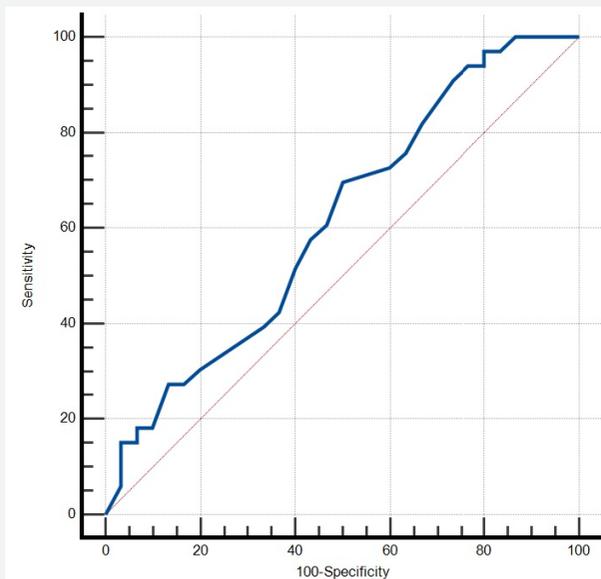
## DISCUSSION

Fifth metacarpal neck fractures are common injuries in young and actively working patients. Conservative treatment protocols for this patient group are still unclear and there is no consensus on whether outpatient follow-up is necessary<sup>12</sup>. The aim of the present study was to evaluate the possible factors affecting the healing angulation of conservatively treated fifth metacarpal neck fractures. The most important results of the present study are that patients with initial fracture angulation  $>44^{\circ}$  and post-reduction angulation  $>17^{\circ}$  have a high risk of healing with a fracture angulation  $>30^{\circ}$ . The patients with these criteria should probably require outpatient follow-up in terms of reduction loss.

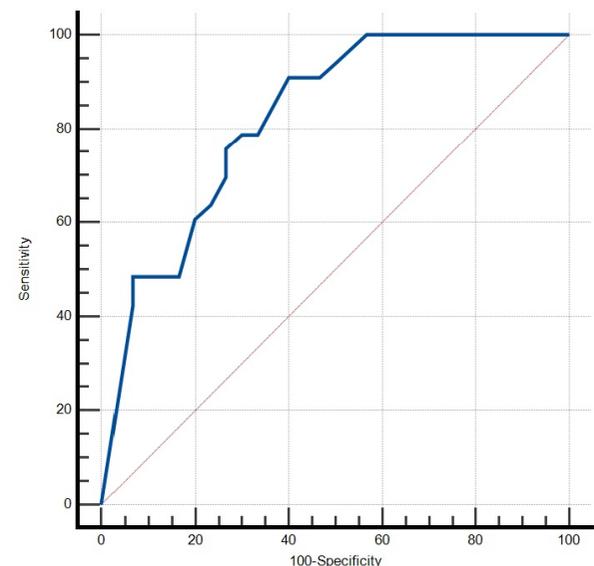
Although there are studies suggesting conservative treatment in  $<70^{\circ}$  dorsal angles in the literature, there is no consensus

on a functional cut-off value<sup>5,13-15</sup>. In cadaver studies, this cut-off value has been specified as  $30^{\circ}$ <sup>6,16,17</sup>. Ali et al.<sup>6</sup> in their biomechanical study on cadavers have suggested that  $30^{\circ}$  should be accepted as the upper limit of the final angulation since the flexor digiti minimi grip strength is preserved at a rate of 92% and the range of motion is preserved at a rate of 78%. Similarly, Birndorf et al.<sup>16</sup> reported a significant decrease in flexor tendon efficiency when the fracture angulation exceeded  $30^{\circ}$  in their cadaveric study. They recommended that the fracture angulation should be reduced to the smallest possible level in terms of hand functions. In another study on cadaveric hands, Low et al.<sup>17</sup> reported that flexor strength decreased as dorsal angulation increased and dorsal angulations above  $30^{\circ}$  were statistically significant. In their cadaveric study, Meunier et al.<sup>18</sup> reported that there would be a loss of interosseous muscle strength with the shortening of the metacarpal length and that only 55% of the functions could be achieved after a shortening of 10 mm. On the other hand, Sletten et al.<sup>11</sup> reported that there was a linear relationship between volar angulation and shortening and that every  $2.4^{\circ}$  volar angulation was responsible for 1 mm shortening. In clinical studies, good results can be affected by many factors related to the patients. Therefore, in the present study, the angular cut-off value for functional recovery was accepted as  $30^{\circ}$  as suggested in the literature discussed above.

Kanatli et al.<sup>7</sup> reported that there was no loss of reduction and no loss of hand grip strength in patients who were reduced below  $30^{\circ}$  and followed up with casting. They suggested



**Figure 3.** Receiver operator characteristics curve analysis of initial angulation of the fracture (cut-off value:  $>44^{\circ}$ , area under curve: 0.614, specificity: 50%, sensitivity: 69.7%)



**Figure 4.** Receiver operator characteristics curve analysis of post-reduction angulation of the fracture (cut-off value:  $>17^{\circ}$ , area under curve: 0.822, specificity: 60%, sensitivity: 90.9%)

that for metacarpal neck fractures reduced below 30°, conservative treatment should be preferred. In the present study, when the fracture angulation was lowered below <30° with closed reduction, it was observed that loss of reduction might occur contrary to Kanatli et al.'s<sup>7</sup> study. There was a significantly higher risk for loss of reduction at follow-up in patients with an initial angle of presentation >44° and post-reduction angle >17°. It was considered that it would be appropriate to follow up this group of patients in terms of loss of reduction in the outpatient clinic.

It has been reported that there is no significant difference between the use of cast and brace in conservative treatment in terms of functional results; however, brace application gives better results in terms of patient compliance and return to work<sup>4,5,11,19</sup>. When these studies were examined, it was seen that there was no clear information about which patients should be followed in the outpatient clinic and the risk factors related to outpatient follow-up were not defined. Bansal and Craigen<sup>8</sup> reported that there was no significant difference between the two groups in their study in which they compared the patients who were followed up with an ulnar gutter splint and routine outpatient controls, and those who were followed up with buddy taping only by telephone visits. Luciani et al.<sup>20</sup> reported that more than twenty percent of patients conservatively treated for fifth metacarpal neck fracture had no outpatient records. They also reported that no additional surgical interventions were performed in this patient group due to nonunion or malunion. In this study, no treatment-related complications were detected in either group of patients. Also, it was found that radiologic examinations were performed very frequently, but no patient underwent a repeat procedure due to loss of reduction. Therefore, routine outpatient follow-up may not be necessary in patients with an initial angulation <44 and a post-reduction angle <17 degrees because of the low risk for reduction loss.

### Study Limitations

The main limitation of this study is that functional assessments were not performed in both patient groups. The 30° angulation determined as the functional cut-off value was determined in accordance with the results of biomechanical and clinical studies in the literature<sup>6,16,17</sup>. Patients were divided into groups according to their healing angles above and below this value. Another limitation of this study is that the shortening of the metacarpals was not evaluated. The main reason for this limitation is that the radiographs of opposite hands could not be obtained. However, according to us, this did not affect the results since dorsal angulation is also a predictor of shortening, as reported by Sletten et al.<sup>11</sup>

## CONCLUSION

In conclusion, in the patients with fifth metacarpal neck fracture treated with closed reduction and splint treatment, the initial angulation of fracture <44° and the angulation after reduction <17° are positive indicators for functional recovery. Routine follow-up and X-ray controls may not be necessary in this group of patients.

### Ethics

**Ethics Committee Approval:** The study was approved by the İzmir Tepecik Training and Research Hospital of Local Ethics Committee (decision no: 2021/09-13, date: 15.09.2021).

**Informed Consent:** Consent form was filled out by all participants.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Surgical and Medical Practices: M.B., A.T., M.Ç.T., V.Z., M.K., E.B., Concept: M.B., A.T., V.Z., M.K., E.B., Design: M.B., A.T., V.Z., M.K., E.B., Data Collection or Processing: M.B., M.Ç.T., V.Z., Analysis or Interpretation: M.B., A.T., Literature Search: M.B., M.Ç.T., M.K., E.B., Writing: M.B., A.T.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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