ORIGINAL ARTICLE

Extension-block pinning versus custom-made plate fixation technique: A comparison of two methods in the treatment of osseous mallet finger injuries

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ABSTRACT

BACKGROUND: Mallet finger injuries, characterized by a flexion deformity caused by trauma to the extensor mechanism at the base of the distal phalanx, can lead to significant functional impairment if not treated appropriately. Surgical interventions for osseous mallet finger injuries often include techniques such as extension-block pinning and perioperative modifying plate fixation. When comparing these two methods, it is critical to assess factors such as technical ease, perioperative considerations, and postoperative outcomes. This study aims to compare these two techniques to provide valuable insights into the optimal surgical approach for treating osseous mallet finger injuries, improving patient care and outcomes.

METHODS: From 2017 to 2022, a retrospective study of 89 patients with Doyle classification type IVB and IVC mallet finger injuries was conducted. The patients were divided into two groups using a surgical technique called block randomization. Group 1 included 46 patients treated with the extension-block pinning fixation technique, while Group 2 comprised 43 patients treated with the perioperative modifying plate fixation technique. Observations included nail deformities and dorsal prominence at the distal interphalangeal (DIP) joint.

RESULTS: All patients were deemed eligible for surgical intervention due to the time elapsed since injury or ineffectiveness of prior conservative treatment. No significant differences in patient demographics were observed between the two groups. While Crawford classification and pain scores showed no significant differences between the groups ($p>0.05$), the Quick Disabilities of the Arm, Shoulder, and Hand (Q-DASH) score and time to return to work significantly favored Group 2, which underwent perioperative modifying plate fixation ($p<0.05$).

CONCLUSION: Extension-block pinning is noted for its simplicity and favorable postoperative range of motion outcomes. In contrast, perioperative modifying plate fixation enhances stability and mechanical performance, positively impacting overall functional recovery. The choice between these techniques should consider procedural simplicity, perioperative demands, mechanical efficiency, and postoperative functional outcomes.

Keywords: Extension-block pinning; functional outcomes; osseous mallet finger; perioperative modifying plate fixation.

INTRODUCTION

Mallet finger injuries, characterized by a flexion deformity resulting from trauma to the extensor mechanism at the base of the distal phalanx, can lead to significant functional impairment if not properly managed. If untreated, these injuries often progress to a "swan neck" deformity.[1] Surgical interventions for osseous mallet finger injuries typically involve techniques

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such as extension-block pinning and perioperative modifying plate fixation. Extension-block pinning is a straightforward and effective approach for treating mallet fractures that provides stability and favorable outcomes.[2] Alternatively, perioperative modifying plate fixation offers enhanced mechanical performance and stability.[3]

When comparing extension-block pinning with perioperative modifying plate fixation for osseous mallet finger injuries, it is critical to evaluate factors such as ease of technique, perioperative requirements, and postoperative outcomes. Extension-block pinning is simpler to perform but may require increased perioperative fluoroscopy compared to plate fixation.[2] On the other hand, the tailored design of perioperative modifying plates enhances mechanical performance and stability, which can be critical for achieving optimal results in mallet finger injuries.[4] Surgical aspects and postoperative functional outcomes must be carefully considered when deciding between these two techniques. Studies suggest that extension-block pinning can result in satisfactory postoperative range of motion, while perioperative modifying plates may provide improved stability and fixation, positively influencing overall functional recovery.[5] Thus, comparing these methods is essential for identifying the most effective approach to ensure optimal outcomes for patients with osseous mallet finger injuries.

The primary outcome measures of this study include postoperative range of motion and functional recovery, assessed using validated scoring systems such as the Disabilities of the Arm, Shoulder, and Hand (DASH) score and the Quick Disabilities of the Arm, Shoulder, and Hand (Q-DASH). Secondary outcome measures focus on the rate of complications, the necessity for additional surgical interventions, and overall patient satisfaction with treatment outcomes.

In conclusion, selecting between extension-block pinning and perioperative modifying plate fixation for osseous mallet finger injuries requires careful evaluation of factors such as procedural simplicity, perioperative requirements, mechanical effectiveness, and postoperative functional outcomes. By comparing these two methods, this study aims to provide valuable insights into the optimal surgical approach for treating osseous mallet finger injuries, ultimately enhancing patient care and outcomes.

Figure 1. (a) Extension-block pinning fixation technique. **(b)** Perioperative modifying plate fixation technique.

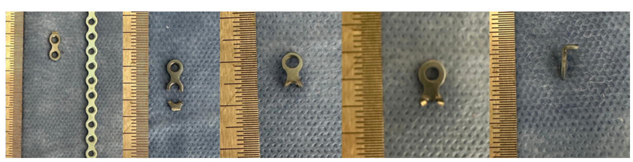

Figure 2. Preparation process of the 1.5-mm mini-plate.

MATERIALS AND METHODS

This study involved a clinical prospective follow-up and retrospectively collected data analysis of 89 patients with Doyle classification type IVB and IVC mallet finger injuries, conducted between 2017 and 2022.[6] The patients were divided into two groups using a surgical technique called block randomization performed by a computer algorithm written in SAS® (Cary, NC), with parameters set as size=1 and block=3. The algorithm assigned patients alternately as non-intervention, intervention, non-intervention, intervention, intervention, intervention, non-intervention and non-intervention. According to the inclusion criteria detailed in Table 1, the initial phase of the study included 49 patients treated surgically in Group 1 and 47 patients in Group 2. During follow-up, two patients in Group 1 and three in Group 2 were lost to follow-up before reaching 12 months due to patient-related reasons such as feeling fine, lack of complaints, or perceiving no need for further check-ups. Additionally, one patient from each group was diagnosed with systemic diseases during the follow-up period, specifically Hodgkin lymphoma and sarcoidosis. Group 1 consisted of 46 patients who underwent the extension-block pinning fixation technique (Fig. 1a), while Group 2 included 43 patients who underwent the perioperative modifying plate fixation technique (Fig. 1b). Patient demographics, including age, gender, mechanism of injury, location and side of injury, time to surgery, and postoperative complications, were recorded. Additionally, a Turkish-adapted and validated version of the Quick Disabilities of the Arm, Shoulder, and Hand score, a Turkish-adapted and validated version of the Pain Catastrophizing Scale (PCS), a visual analog scale (VAS) pain score ranging from 0–100 mm, and time to return to work and/or daily activities were prospectively evaluated.[7,8] Crawford's criteria were utilized to assess functional outcomes after a minimum follow-up period of 12 months. Clinical examinations, including measurements of distal interphalangeal (DIP) joint extensor lag and active flexion range, were conducted using a goniometer by a surgeon who was not involved in the surgical treatment and is the presenting author of this study. Any nail deformity and dorsal prominence at the DIP joint were documented. All patients were deemed eligible for surgical intervention based on the duration of their injury or the ineffectiveness of prior conservative treatments. Radiographs were obtained both preoperatively and postoperatively. Preoperative lateral radiographs were used to determine the percentage of articular surface involvement, the presence of DIP joint volar subluxation, and fracture fragment displacement, in accordance with the Doyle classification of mallet finger injuries. Postoperative radiographs were taken biweekly until fracture union was confirmed, defined as the presence of bridging trabeculae or sclerotic changes at the fracture site with no visible gap. Patients were excluded from the study if they had pre-existing degenerative changes affecting the DIP joint or had previously undergone surgical treatment for a mallet fracture. All surgical procedures were performed by the same surgeon, the corresponding author of this study.

Surgical Techniques

Surgeries employing the extension-block pinning technique were conducted under fluoroscopy. In this procedure, the distal phalanx was maximally flexed, and a Kirschner wire (K-wire) was inserted in the cephalic direction through the terminal band at a 45-degree angle to the mid-phalanx. The fracture fragment was reduced by extending the distal phalanx. Any subluxation of the DIP joint, if present, was corrected, and the DIP was stabilized using a second K-wire (Fig. 1). A finger splint was applied to immobilize the DIP joint for three weeks, while the K-wires were utilized for eight weeks. Active movements were initiated following the removal of the K-wires. For surgeries utilizing the hook plate method, the preparation of the plate began as follows: Two apertures in a 1.3-mm standard mini-plate were excised from the main plate's body. The second ring of the plate was severed at the distal end, creating a two-legged configuration with extended leg lengths compared to earlier plate preparation techniques. The legs were extended to a 90-degree angle from the connection point to the opposite ring, forming a hook plate. Previously, this was achieved by bending the hook legs to a 90-degree angle. Adjustments can be made based on the fragment's size by altering the rotation of the plate legs and spacing between them (Fig. 2). An "H"-shaped incision was performed at the distal interphalangeal joint. The terminal band and fracture fragment were accessed while preserving the nail germinal matrix. The fracture fragment was realigned, and the distal interphalangeal joint was stabilized with a temporary 1.2-mm K-wire. The plate's legs were integrated into the terminal tendon to secure the fragment. The plate was affixed to the distal phalanx using a 1.3-mm screw, and the K-wire was removed. Controlled passive motions commenced at three weeks, and vigorous movements were initiated at four weeks. Full daily mobility was permitted after six weeks.

Each patient provided written informed consent for participa-

Table 1. Inclusion and exclusion criteria for the study

Inclusion criteria	**1.** Diagnosis: Patients diagnosed with Doyle classification type IVB and IVC mallet finger. **2.** Surgical Intervention: Patients eligible for surgical intervention due to inadequate response to conservative treatment or prolonged symptoms. **3.** Age: Patients aged 18 years or older. **4.** Follow-Up: Patients willing to participate in a minimum of 12-month follow-up to assess functional outcomes. **5.** Consent: Patients who provided informed consent for participation in the study.
Exclusion criteria	**1.** Previous Treatment: Patients who had previously undergone surgical treatment for a mallet fracture. **1.** Degenerative Changes: Patients with pre-existing degenerative changes affecting the distal interphalangeal (DIP) joint. **2.** Inadequate Follow-Up: Patients unable or unwilling to attend follow-up appointments for a minimum of 12 months. **3.** Comorbidities: Patients with significant comorbidities that could interfere with recovery or outcome assessment (e.g., severe systemic diseases impairing healing). **4.** Noncompliance: Patients identified as noncompliant with postoperative rehabilitation protocols.

tion in the study, and informed consent was obtained from all participants regarding the use of their clinical photographs. The study protocol was approved by the local ethics committee of Necmettin Erbakan University (approval number: 2023/4250). The principles outlined in the Declaration of Helsinki were adhered to throughout the study.

Statistical Analysis

The data collected during the study were analyzed using the SPSS 28.0 software package (IBM, USA). Patient characteristics were analyzed using descriptive statistics for continuous variables, including means and standard deviations. Comparisons between groups were conducted using chi-squared tests. For categorical variables, counts and percentages were reported. Fisher's exact test was applied to analyze nominal variables, such as dorsal prominence and nail deformity, while the Mann–Whitney U test was employed for continuous variables, including bone healing, time to return to work and/or daily activities, active DIP flexion, DIP extensor lag, PCS scores, VAS scores, and Q-DASH scores. A value of $p<0.05$ was considered statistically significant. To address the issue of multiple testing, Bonferroni corrections were applied by performing each test at a significance level of α/n instead of α. Additionally, the Benjamini-Hochberg procedure was employed, which involves sorting p-values to a diagonal cut-off line, identifying the largest p-value that still falls below this line, and rejecting the null hypotheses for all p-values up to and including this one.

RESULTS

Patients in Group 1 had a mean age of 40.9±7.3 years (range: 27–62), with a male-to-female ratio of 1.3:1 (26 men and 20 women). Group 2 had a mean age of 38.4±4.9 years (range: 21–62), with a male-to-female ratio of 1.26:1 (24 men and 19 women). The average follow-up period for all patients was 19.4±5.7 months (range: 13–29). There were no significant differences in patient demographics between the two groups. All fractures healed within a mean of 4.9±0.7 weeks (range: 4-6). The characteristics of patients in both groups and the comparison of surgical techniques, clinical outcomes, and functional results are presented in Tables 2 and 3. No significant differences were observed between the groups in Crawford classification, pain scores, active DIP joint flexion, or extension lag ($p>0.05$). However, the Q-DASH score and time to return to work were significantly better in Group 2, which underwent the perioperative modifying plate fixation technique ($p<0.05$).

Complications, as summarized in Table 2, were noted in three patients from Group 1 and eight patients from Group 2 (p=0.0733). Among the patients who underwent the extension-block procedure, two experienced nail problems, and one presented with dorsal prominence. In the group that received perioperative modifying plate fixation, six patients had nail problems, and two experienced dorsal prominence. No patients in either group developed a serious infection. Further treatment was not recommended for patients experiencing nail issues. Additionally, none of the surgical cases resulted in catastrophic swan-neck deformity. Among a total of three patients from both groups who exhibited dorsal prominence, no cosmetic complaints were reported during the follow-up period.

DISCUSSION

The primary treatment objectives for bony mallet finger fixation are to ensure a stable DIP joint and achieve a full, painless range of motion. Surgeons have the option to choose between closed and open techniques, each offering distinct advantages and challenges. While the decision-making process often depends on the surgeon's experience and patient-specific factors, it would benefit significantly from more robust comparative studies to guide treatment algorithms and reduce variability in outcomes.

Closed reduction with percutaneous extension-block pinning remains a popular choice due to its simplicity, cost-effectiveness, and minimally invasive nature. However, its limitations, including risks of malunion, secondary osteoarthritis (likely from repeated pinning attempts), and complications such as infections, pin tract issues, and nail deformities, must be carefully considered. These complications can lead to extended recovery periods, delayed return to work, and suboptimal long-term outcomes. In contrast, open techniques, such as the use of mini-screws, mini-anchors, tension bands, and hook plates, have emerged as alternatives offering more precise anatomic reduction. These methods facilitate better functional recovery by enabling early mobilization and reducing complications related to inadequate fixation. Recent literature indicates that open techniques, although more technically demanding, are often associated with fewer long-term complications and superior functional outcomes.[9,11-13]

In our study, the functional outcomes following mini-plate fixation were somewhat lower than those reported in the literature. Szalay et al.[11] described excellent outcomes in a cohort of 59 patients treated with hook plates, while Teoh and Lee[12] similarly reported favorable results with their modified hook plate technique, achieving a DIP joint flexion of 64°. In contrast, our study, which utilized a 1.5-mm mini-plate with 0.8-mm self-tapping cortical screws, yielded lower Crawford scores. This discrepancy may be attributed to differences in rehabilitation protocols. The absence of standardized physical therapy in our cohort likely contributed to the suboptimal functional outcomes. This highlights the critical role of postoperative rehabilitation in achieving the desired range of motion and underscores the necessity for standardized rehabilitation guidelines to ensure consistent outcomes.

The incidence of nail deformities in our study (23.2%) was higher than that reported in previous studies, such as Szalay et al.,[6] where the incidence was 12%. Several factors may

Table 2. Patient characteristics by group

General Data							Final Examination Data								
GROUP I															
#	Age/Gender	Hand Side & Digit Injured	Cause of Injury	Injury to Operation Intervals (days)	Follow-up (months)	Doyle's Classification	Crawford Criteria	PCS Score	VAS (/100 mm)	Q-DASH Score	Active DIP Joint Flexion	DIP Joint Extensor Lag	Bone Healing (weeks)	Time to Return to Work or Daily Activities (days)	Complications
1	34/M	R & R	Sport-related trauma	2	17	IV B	Good	7	12	32	60	5	4	44	-
2	44/M	L & M	Work-related accident	4	13	IV B	Excellent	4	22	23	70	0	4	40	-
3	35/F	R & L	Fall	4	14	IV B	Excellent	5	21	23	65	0	5	47	-
4	34/M	L & I	Work-related accident	5	21	IV B	Excellent	4	23	21	65	0	5	42	-
5	51/F	R & L	Home-related accident	2	19	IV B	Excellent	6	34	26	70	0	6	42	-
6	52/F	R & L	Home-related accident	3	14	IV C	Good	9	27	33	55	5	6	55	-
7	35/F	R & R	Fall	5	27	IV B	Good	8	13	37	60	5	5	48	-
8	28/M	R & L	Other	5	31	IV C	Good	9	15	35	60	5	5	52	-
9	62/M	R & L	Home-related accident	5	36	IV C	Good		12	38	60	5	4	44	-
10	43/M	L & M	Fight	7	14	IV C	Good	11	17	39	65	5	4	49	-
11	55/F	L & I	Home-related accident	3	16	IV C	Good	9	0	33	65	5	4		-
12	57/F	L & R	Fall	2	13	IV B	Excellent	6	14	21	65	0	4	44	-
13	29/F	R & M	Sport-related trauma	2	13	IV C	Good	7	0	38	55	5	4	47	ND
14	44/M	L & M	Work-related accident	3	18	IV B	Good	6	24	36	50	10	5	53	-
15	43/F	R & I	Home-related accident	6	19	IV B	Good	8	22	34	55	10	5	58	-
16	41/F	R & R	Other	3	18	IV B	Fair	33	56	57	50	15	5	51	ND
17	29/M	R & M	Work-related accident	9	14	IV B	Excellent	6	0	31	70	0	6	61	-
18	27/M	R & R	Sport-related trauma	2	17	IV C	Excellent	8	12	29	65	0	6	58	-

R: Right, Ring; L: Left, Little; I: Index; M: Middle; PCS: Pain Catastrophizing Scale; VAS: Visual Analogue Pain Score; DIP: Distal Interphalangeal Joint; Q-DASH: Quick Disabilities of the Arm, Shoulder, and Hand; ND: Nail Deformity; DP: Dorsal Prominence.

Table 2. Patient characteristics by group (continued)

General Data								Final Examination Data						
GROUP I (continued)														
#	Age/ Gender	Hand Side & Digit Injured	Cause of Injury	Injury to Operation Intervals (days)	Follow-up (months)	Doyle's Classification	Craw-ford Criteria	PCS Score	VAS (/100 mm)	Q-DASH Score	Active DIP Joint Flexion	DIP Joint Extensor Lag	Bone Healing (weeks)	Time to Return to Work or Daily Activities (days)	Complica-tions
19	56/F	R & L	Home-related accident	3	26	IV B	Good	14	22	34	65	10	6	59	-
20	58/M	R & L	Home-related accident	2	29	IV B	Excellent	9	13	27	55	0	5	49	-
21	29/M	R & R	Sport-related trauma	3	30	IV B	Good	11	5	38	60	5	6	60	-
22	62/M	R & I	Other	2	21	IV B	Good	8	5	31	55	5	6	58	-
23	48/M	R & M	Work-related accident	2	19	IV B	Fair	35	48	56	50	15	6	63	-
24	37/F	R & L	Fall	5	20	IV C	Good	11	14	39	65	10	6	61	-
25	33/F	R & L	Fall	6	21	IV B	Good	17	22	29	60	5	5	53	-
26	29/M	R & R	Work-related accident	4	21	IV B	Good	11	27	31	65	5	5	49	-
27	30/F	R & I	Home-related accident	7	19	IV C	Excellent	8	16	27	70	0	5	50	-
28	31/M	L & M	Work-related accident	6	14	IV C	Excellent	6	15	33	70	0	4	47	-
29	29/F	L & L	Work-related accident	7	13	IV C	Excellent	7	0	24	65	0	4	40	-
30	56/F	R & R	Fall	9	13	IV C	Excellent	7	0	27	70	0	4	48	-
31	55/F	R & L	Other	11	17	IV B	Fair	28	47	58	50	15	4	63	DP
32	58/M	L & L	Work-related accident	2	19	IV C	Excellent	8	0	23	65	0	5	46	-
33	48/F	R & M	Home-related accident	2	18	IV B	Excellent	7	0	25	60	0	5	44	-
34	28/M	R & M	Fight	2	17	IV C	Excellent	9	23	24	65	0	4	40	-
35	34/F	R & L	Work-related accident	3	13	IV C	Good	9	26	29	55	10	4	43	-
36	41/M	R & M	Work-related accident	3	17	IV B	Good	7	18	33	55	5	4	48	-

R: Right, Ring; L: Left, Little; I: Index; M: Middle; PCS: Pain Catastrophizing Scale; VAS: Visual Analogue Pain Score; DIP: Distal Interphalangeal Joint; Q-DASH: Quick Disabilities of the Arm, Shoulder, and Hand; ND: Nail Deformity; DP: Dorsal Prominence.

Table 2. Patient characteristics by group (continued)

General Data								Final Examination Data							
GROUP 1 (continued)															
#	Age/Gender	Hand Side & Digit Injured	Cause of Injury	Injury to Operation Intervals (days)	Follow-up (months)	Doyle's Classification	Crawford Criteria	PCS Score	VAS (/100 mm)	Q-DASH Score	Active DIP Joint Flexion	DIP Joint Extensor Lag	Bone Healing (weeks)	Time to Return to Work or Daily Activities (days)	Complications
37	43/M	L & L	Other	4	19	IV C	Fair	31	39	60	50	15	4	44	-
38	42/M	L & M	Work-related accident	5	14	IV C	Excellent	11	0	24	65	0	5	47	-
39	49/F	R & M	Fall	3	16	IV B	Excellent	9	0	21	60	0	5	52	-
40	36/M	R & L	Work-related accident	2	14	IV B	Excellent	9	16	22	65	0	5	50	-
41	28/M	R & R	Fight	2	18	IV C	Excellent	5	0	21	70	0	5	50	-
42	34/M	R & R	Fight	3		IV C	Good	14	22	31	55	5	5	48	-
43	41/M	L & M	Work-related accident	3	21	IV B	Good	7	32	29	60	5	5	46	-
44	31/F	R & R	Home-related accident	4	21	IV B	Good	7	18	33	65	5	5	46	-
45	36/M	R & L	Work-related accident	3	23	IV C	Excellent	8	0	19	65	0	5	44	-
46	39/M	L & I	Work-related accident	2	16	IV B	Excellent	7	7	24	60	0	4	48	-
GROUP 2															
1	21/M	R & R	Fight	2	14	IV C	Excellent	13	20	17	65	0	5	31	-
2	26/F	R & L	Fall	6	18	IV C	Excellent	9	16	27	65	0	5	42	-
3	33/M	R & R	Work-related accident	7	19	IV B	Excellent	11	17	18	60	0	5	30	ND
4	56/M	R & L	Work-related accident	7	21	IV C	Excellent	10	13	25	70	0	5	42	-
5	58/M	L & R	Fight	4	23	IV B	Good	8	18	16	55	5	6	58	-
6	43/F	R & L	Home-related accident	5	26	IV B	Good	9	32	34	65	5	4	40	-
7	41/M	R & R	Other	6	27	IV B	Good	16	26	34	60	5	6	59	-
8	33/F	R & M	Fall	6	28	IV B	Good	11	33	26	60	5	6	55	-

R: Right, Ring; L: Left, Little; I: Index; M: Middle; PCS: Pain Catastrophizing Scale; VAS: Visual Analogue Pain Score; DIP: Distal Interphalangeal Joint; Q-DASH: Quick Disabilities of the Arm, Shoulder, and Hand; ND: Nail Deformity; DP: Dorsal Prominence.

Table 2. Patient characteristics by group (continued)

General Data										Final Examination Data					
GROUP 2 (continued)															
#	Age/Gender	Hand Side & Digit Injured	Cause of Injury	Injury to Operation Intervals (days)	Follow-up (months)	Doyle's Classification	Crawford Criteria	PCS Score	VAS (/100 mm)	Q-DASH Score	Active DIP Joint Flexion	DIP Joint Extensor Lag	Bone Healing (weeks)	Time to Return to Work or Daily Activities (days)	Complications
9	32/F	R & L	Sport-related trauma	6	22	IV C	Good	11	25	32	55	10	6	55	ND
10	26/M	L & R	Fall	5	19	IV B	Excellent	8	18	28	70	0	4	37	-
11	29/M	L & I	Home-related accident	4	15	IV B	Excellent	8	0	25	70	0	6	42	-
12	31/F	R & R	Work-related accident	5	14	IV B	Excellent	9	12	18	65	0	5	36	ND
13	33/M	R & L	Fall	3	15	IV B	Excellent	10	0	29	70	0	5	31	-
14	38/F	R & L	Home-related accident	5	20	IV C	Good	13	0	31	65	5	6	48	ND
15	39/F	R & M	Fall	3	17	IV B	Good	13	12	33	60	5	6	44	-
16	42/F	R & L	Home-related accident	8	16	IV C	Good	17	15	28	65	5	6	61	-
17	41/M	R & R	Fall	1	14	IV C	Good	14	17	15	60	10	5	55	-
18	28/F	L & L	Sport-related trauma	2	15	IV B	Good	16	23	16	55	10	5	47	ND
19	29/F	L & I	Fall	8	16	IV B	Good	16	26	18	60	5	5	40	-
20	31/F	L & L	Home-related accident	4	22	IV B	Good	17	21	14	55	5	5	47	DP
21	34/F	R & I	Work-related accident	4	17	IV C	Good	15	0	29	60	5	5	44	-
22	55/F	R & R	Home-related accident	7	18	IV B	Fair	35	53	19	55	15	5	42	DP
23	57/M	R & R	Work-related accident	4	19	IV B	Good	17	15	21	60	10	6	53	ND
24	29/M	L & L	Sport-related trauma	4	21	IV B	Excellent	11	9	24	70	0	6	32	-
25	37/M	R & R	Other	3	22	IV B	Excellent	9	14	27	60	0	6	37	-
26	31/M	L & M	Work-related accident	6	27	IVC	Excellent	5	19	29	70	0	6	38	-

R: Right, Ring; L: Left, Little; I: Index; M: Middle; PCS: Pain Catastrophizing Scale; VAS: Visual Analogue Pain Score; DIP: Distal Interphalangeal Joint; Q-DASH: Quick Disabilities of the Arm, Shoulder, and Hand; ND: Nail Deformity; DP: Dorsal Prominence.

Table 2. Patient characteristics by group (continued)

General Data									Final Examination Data						
GROUP 2 (continued)															
#	Age/Gender	Hand Side & Digit Injured	Cause of Injury	Injury to Operation Intervals (days)	Follow-up (months)	Doyle's Classification	Crawford Criteria	PCS Score	VAS (/100 mm)	Q-DASH Score	Active DIP Joint Flexion	DIP Joint Extensor Lag	Bone Healing (weeks)	Time to Return to Work or Daily Activities (days)	Complications
27	27/M	R & I	Other	4	24	IVC	Fair	37	59	31	55	15	5	44	ND
28	41/F	R & L	Home-related accident	4	22	IVC	Good	18	12	33	60	5	5	48	-
29	44/F	R & R	Work-related accident	4	26	IV B	Good	15	16	18	65	5	4	38	-
30	39/M	R & L	Fight	3	26	IV B	Excellent	8	0	25	60	0	4	42	-
31	29/M	R & L	Work-related accident	2	17	IV B	Excellent	7	11	28	65	0	4		-
32	37/M	R & L	Home-related accident	6	17	IV B	Excellent	9	0	25	55	0	5	50	-
33	59/M	R & M	Fall	7	19	IV C	Excellent	5	12	28	60	0	5	31	ND
34	62/M	R & L	Fall	2	20	IV B	Excellent	8	0	19	70	0	4	35	-
35	61/M	L & L	Sport-related trauma	4	24	IV B	Excellent	9	0	31	65	0	4	35	-
36	60/M	R & M	Sport-related trauma	5	22	IV B	Excellent	7	18	13	70	0	5	40	DP
37	28/M	R & I	Sport-related trauma	6	21	IV B	Excellent	7	24	28	60	0	4	42	-
38	27/M	R & L	Fight	1	26	IV B	Good	11	22	35	65	5	4	35	ND
39	33/M	R & R	Fall	2	29	IV C	Excellent	13	23	31	65	0	6	36	-
40	37/F	R & R	Work-related accident	2	28	IV B	Excellent	10	17	33	60	0	6	48	-
41	23/F	R & M	Sport-related trauma	5	23	IV B	Excellent	13	27	18	65	0	6	43	ND
42	45/F	R & L	Fall	6	17	IV B	Excellent	8	18	25	70	0	6	48	-
43	47/F	L & M	Home-related accident	3	19	IV B	Good	11	17	28	60	5	4	49	-

R: Right, Ring; L: Left, Little; I: Index; M: Middle; PCS: Pain Catastrophizing Scale; VAS: Visual Analogue Pain Score; DIP: Distal Interphalangeal Joint; Q-DASH: Quick Disabilities of the Arm, Shoulder, and Hand; ND: Nail Deformity; DP: Dorsal Prominence.

Table 3. Comparison of clinical and functional outcomes between groups

	Bone Healing (days)	Time to Return to Work (days)	PCS Score	VAS (100 mm)	Q-DASH Score	Active DIP Joint Flexion	DIP Joint Extensor Lag
Group 1	4.8±0.6	48.5±10.3	10.1±21.3	31.4±8.7	31.7±9.4	61.3±11.3	4.1±1.06
Group 2	5.1±0.8	40.7±10.3	12.3±11.7	28.7±5.9	25.1±4.7	62.6±12.2	3.35±0.82
p* value	0.0893	0.0489	0.065	0.534	0.0024	0.0987	0.085

account for this difference. One potential explanation is the difference in hardware used between the studies. Szalay et al. employed the Stryker hook plate, whereas we utilized the TST™ mini-plate system. Another contributing factor could be the timing of hardware removal. Szalay et al.[11] and Teoh and Lee[12] recommended removing the plates within 3–6 months post-surgery, which likely contributed to their lower incidence of nail abnormalities. In our study, plate removal was only performed in patients who developed nail deformities. This delayed removal may have exacerbated the incidence of nail-related complications in our cohort.

It is essential to determine whether the higher rate of nail deformities observed in our study is attributable to the technical limitations of the mini-plate system or the postoperative management approach. Future research should explore whether specific modifications to the mini-plate design, such as changes to the size or structure of the screws or plate, could mitigate these complications. Additionally, studies should investigate whether universally earlier plate removal—rather than removal only in symptomatic cases—could reduce the risk of nail deformities without compromising joint stability or functional outcomes.

The findings of this study highlight the need for a more refined approach to post-surgical management, particularly regarding rehabilitation and hardware removal. Given that the lack of standardized physical therapy in our cohort may have adversely affected patient outcomes, future studies should prioritize the development and validation of universally applicable rehabilitation protocols. Additionally, the single-center design of our study, where one surgical team performed all operations, along with earlier implant removal, could be systematically investigated to reduce complications such as nail deformities, particularly in cases involving the mini-plate system.

The high variability in outcomes across different fixation techniques highlights the need for more randomized controlled trials to comprehensively compare these methods. Such studies should focus not only on functional recovery but also on long-term outcomes, including rates of osteoarthritis, malunion, and recurrent deformities. Additionally, future research should evaluate the cost-effectiveness of these techniques, as the higher initial costs of open surgical interventions may be offset by reduced complications and faster recovery times. Comparative studies on different fixation methods will ultimately help refine treatment algorithms, enhance patient outcomes, and provide surgeons with evidence-based guidelines for managing osseous mallet finger injuries.

CONCLUSION

This study emphasizes the importance of selecting the most appropriate surgical technique for osseous mallet finger injuries. Extension-block pinning offers ease of application and favorable postoperative range of motion, making it a viable option for many patients. In contrast, perioperative modifying plate fixation provides superior stability and mechanical performance, which can enhance overall functional recovery. Therefore, the choice of technique should be guided by a thorough assessment of each patient's specific circumstances, carefully balancing procedural simplicity, mechanical effectiveness, and anticipated postoperative outcomes.

Ethics Committee Approval: This study was approved by the Necmettin Erbakan University Ethics Committee (Date: 17.03.2023, Decision No: 2023/4250).

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REFERENCES

1. Toker S, Türkmen F, Pekince O, Korucu İ, Karalezli N. Extension block pinning versus hook plate fixation for treatment of mallet fractures. J

Hand Surg Am 2015;40:1591–6.
2. Acar MA, Güzel Y, Güleç A, Uzer G, Elmadağ M. Clinical comparison of hook plate fixation versus extension block pinning for bony mallet finger: A retrospective comparison study. J Hand Surg Eur Vol 2015;40:832–9.
3. Saha R, Ebenezer V, Balakrishnan R, Kumar S, Mani M, Vivek M. A comparison between locking plates and miniplates in fixation of mandibular fractures. Biomed Pharmacol J 2015;8:799–804.
4. Liu YF, Fan YY, Jiang XF, Baur DA. A customized fixation plate with novel structure designed by topological optimization for mandibular angle fracture based on finite element analysis. Biomed Eng OnLine 2017;16:131.
5. Chung DW, Lee JH. Anatomic reduction of mallet fractures using extension block and additional intrafocal pinning techniques. Clin Orthop Surg 2012;4:72–6.
6. Doyle J. Extensor tendons-acute injuries. Oper Hand Surg 1993;2:1925–53.
7. Koldas Dogan S, Ay S, Evcik D, Baser O. Adaptation of Turkish version of the questionnaire Quick Disability of the Arm, Shoulder, and Hand (Quick DASH) in patients with carpal tunnel syndrome. Clin Rheumatol 2011;30:185–91.
8. Ugurlu M, Karakas Ugurlu G, Erten S, Caykoylu A. Validity of Turkish form of Pain Catastrophizing Scale and modeling of the relationship between pain-related disability with pain intensity, cognitive, and emotional factors. Psychiatry Clin Psychopharmacol
9. Pegoli L, Toh S, Arai K, Fukuda A, Nishikawa S, Vallejo IG. The Ishiguro extension block technique for the treatment of mallet finger fracture: Indications and clinical results. J Hand Surg Br 2003;28:15–7.
10. Kang HJ, Lee SK. Open accurate reduction for irreducible mallet fractures through a new pulp traction technique with primary tendon repair. J Plast Surg Hand Surg 2012;46:438–43.
11. Szalay G, Schleicher I, Schiefer UR, Alt V, Schnettler R. Operative treatment of osseous pull out of the extensor tendon using a hook plate. Oper Orthop Traumatol 2011;23:151–7.
12. Teoh LC, Lee JYL. Mallet fractures: A novel approach to internal fixation using a hook plate. J Hand Surg Eur Vol 2007;32:24–30.
13. Gurbuz K. Pull-out suture technique and micro-bone anchor fixation: A comparison of two methods in the treatment of non-osseous mallet finger injuries. Cumhuriyet Med J 2019;41:423–31.
14. Theivendran K, Mahon A, Rajaratnam VA. A novel hook plate fixation technique for the treatment of mallet fractures. Ann Plast Surg 2007;58:112–5.

ORİJİNAL ÇALIŞMA - *ÖZ*

Ekstansör blok pinleme ile kişiye özel plak ile fiksasyon tekniği: Kemikli mallet finger yaralanmasında iki farklı cerrahi tekniğin karşılaştırılması

AMAÇ: Distal falanksın ekstansör mekanizmasındaki travmanın neden olduğu fleksiyon deformitesi ile karakterize çekiç parmak yaralanmaları, uygun şekilde tedavi edilmezse önemli fonksiyonel bozulmalara neden olabilir. Kemikli çekiç parmağı yaralanmalarına yönelik cerrahi müdahaleler genellikle ekstansör blok pinleme ve kişiye özel plak ile sabitleme gibi teknikleri içerir. Kemikli çekiç parmak yaralanmaları için ekstansör blok pinleme ile kişiye özel plak sabitlemeyi karşılaştırırken tekniğin kolaylığı, perioperatif hususlar ve postoperatif sonuçlar gibi faktörleri incelemek kritik öneme sahiptir. Bu çalışma, bu iki yöntemi karşılaştırarak, kemikli çekiç parmak yaralanmalarının tedavisinde en uygun cerrahi yaklaşıma ilişkin değerli bilgiler sağlamayı ve bunun sonucunda daha iyi hasta bakımı ve sonuçlara ulaşmayı amaçlamaktadır.

GEREÇ VE YÖNTEM: 2017'den 2022'ye kadar 89 Doyle sınıflandırması tip IVB ve IVC çekiç parmak hastasının retrospektif çalışması yapıldı. Hastalar blok randomizasyon adı verilen cerrahi teknik kullanılarak iki gruba ayrıldı. Grup 1'de ekstansiyon blok pinleme tekniği uygulanan 46 hasta, Grup 2'de ise kişiye özel plak ile tespit tekniği uygulanan 43 hasta yer aldı. DIP ekleminde herhangi bir tırnak deformitesi ve dorsal çıkıntı da kaydedildi.

BULGULAR: Yaralanmanın üzerinden geçen sürenin uzunluğu veya önceki konservatif tedavinin yokluğu veya etkisizliği nedeniyle tüm hastalar cerrahi müdahaleye uygun kabul edildi. İnceleyebildiğimiz iki grup arasında hasta demografik özellikleri açısından anlamlı bir fark yoktu. Gruplar arasında Crawford sınıflaması ve ağrı skorları açısından anlamlı fark yoktu ($p>0.05$), ancak Q-DASH skoru ve işe dönüş süresi, kişiye özel plak ile sabitleme tekniği kullanılan Grup 2 lehine anlamlı olarak farklıydı ($p<0.05$).

SONUÇ: Ekstansör bloğu pinleme basitliği ve ameliyat sonrası iyi hareket aralığı sonuçlarıyla bilinir. Tersine, özel yapım plak ile sabitleme, stabiliteyi ve mekanik performansı artırarak genel fonksiyonel iyileşmeyi olumlu yönde etkiler. Bu teknikler arasındaki seçim işlem kolaylığı, perioperatif gereksinimler, mekanik etkinlik ve postoperatif fonksiyonel sonuçlara dayanmalıdır.

Anahtar sözcükler: Ekstansor blok pinleme; fonksiyonel sonuçlar; kemikli mallet finger; kişiye özel plak fiksasyon.

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