

# Clinical and radiological outcomes of surgically treated medial malleolus fractures in skeletally immature patients

Sevan Sivaciođlu,<sup>1</sup> Serkan Bayram,<sup>2</sup> Taha Bedir Demir,<sup>2</sup> İsmail Tarık Atasoy,<sup>2</sup> Buđra Yoldaş,<sup>2</sup> Halil İbrahim Balcı,<sup>2</sup> Mehmet Aşık<sup>2</sup>

<sup>1</sup>Department of Orthopedics and Traumatology, Acibadem Maslak Hospital, İstanbul-Türkiye

<sup>2</sup>Department of Orthopedics and Traumatology, İstanbul University, İstanbul Faculty of Medicine, İstanbul-Türkiye

## ABSTRACT

**BACKGROUND:** Medial distal tibial Salter-Harris Type 3 and Type 4 epiphyseal injuries, also known as McFarland fractures, pose significant risks due to their potential to damage the growth plate and cause long-term joint deformities. Surgical treatment is commonly performed to restore joint congruity; however, there is no clear consensus on whether surgical or conservative treatment yields better outcomes. This study aimed to evaluate the mid-term clinical and radiological outcomes of surgical treatment in patients with McFarland fractures.

**METHODS:** This retrospective study analyzed outcomes of 13 patients, aged 6-17 years, who underwent surgical treatment for McFarland fractures between 2021 and 2023 at a Level I Trauma Center. Surgical methods included screw fixation, K-wire fixation, and tension wire fixation. Outcome measures included radiological deformity assessments (lateral distal tibial angle [LDTA], anterior distal tibial angle [ADTA]), range of motion (ROM), Foot and Ankle Ability Measure (FAAM) scores for functional assessment, and Visual Analogue Scale (VAS) scores for pain. Comparisons were made between the operated and non-operated limbs.

**RESULTS:** LDTA and ADTA values showed minimal differences between the operated and non-operated limbs, indicating successful surgical realignment ( $p<0.05$ ). Although slight ROM limitations were observed in the operated limb, high FAAM scores and low VAS scores reflected good functional recovery and effective pain management. Correlation analysis revealed a moderate positive correlation ( $r=0.45$ ) between FAAM scores and ROM, and a weaker correlation ( $r=0.32$ ) between FAAM scores and radiological alignment.

**CONCLUSION:** Surgical treatment of McFarland fractures resulted in favorable clinical and radiological outcomes, with minimal limitations in ROM and significant improvements in alignment and functional recovery. However, ongoing follow-up is essential, particularly in younger patients, to monitor and manage the risk of potential growth disturbances.

**Keywords:** McFarland fractures; Salter-Harris Type 3 and 4; epiphyseal injuries; surgical treatment; pediatric orthopedics; growth plate.

## INTRODUCTION

Medial distal tibial Salter-Harris Type 3 and Type 4 epiphyseal injuries, commonly referred to as McFarland fractures, can lead to serious complications due to their potential to affect the growth plate and articular surface.<sup>[1]</sup> These injuries often result from high-impact trauma, such as sports injuries, falls, or vehicular accidents, and if not properly managed, can

lead to growth disturbances and joint deformities.<sup>[2]</sup> All intra-articular fractures with displacement greater than 2 mm require precise anatomical reduction and stabilization.<sup>[3]</sup> While open anatomical reduction and internal fixation continue to yield good outcomes in treating intra-articular fractures, the outcomes of physeal injuries remain more difficult to predict.<sup>[4]</sup> Effective surgical intervention is particularly crucial in severely displaced physeal fractures to restore joint alignment

Cite this article as: Sivaciođlu S, Bayram S, Demir TB, Atasoy İT, Yoldaş B, Balcı Hİ, et al. Clinical and radiological outcomes of surgically treated medial malleolus fractures in skeletally immature patients. *Ulus Travma Acil Cerrahi Derg* 2025;31:399-404.

Address for correspondence: Serkan Bayram

Department of Orthopedics and Traumatology, İstanbul University, İstanbul Faculty of Medicine, İstanbul, Türkiye

E-mail: dr.serkanbayram89@gmail.com

*Ulus Travma Acil Cerrahi Derg* 2025;31(4):399-404 DOI: 10.14744/tjtes.2025.74311

Submitted: 12.12.2024 Revised: 23.12.2024 Accepted: 16.01.2025 Published: 28.03.2025

OPEN ACCESS This is an open access article under the CC BY-NC license (<http://creativecommons.org/licenses/by-nc/4.0/>).



and prevent complications such as premature physal closure and limb length discrepancies.<sup>[5]</sup>

The choice of surgical technique depends on the type and complexity of the fracture. Commonly used methods include screw fixation, K-wire fixation, and tension wire fixation, each offering specific advantages based on the fracture characteristics and patient age. Achieving perfect anatomical reduction, if necessary through an open approach, is essential to prevent the formation of a bone bridge, which can lead to epiphysiodesis and post-traumatic deformities due to growth inhibition and/or retardation.<sup>[6]</sup>

This study aimed to evaluate the clinical and radiological outcomes of surgically treated McFarland fractures, and compare the results of the operated limb with the non-operated limb, in order to assess the effectiveness of surgical management.

## MATERIALS AND METHODS

This retrospective study was conducted after receiving approval from the İstanbul University Faculty of Medicine Clinical Research Ethics Committee (Approval Number: 3006365, Date: 07.11.2024). The study was carried out at a single Level I Trauma Center with a unified surgical team. All procedures were conducted in accordance with the principles of the Declaration of Helsinki. The surgical procedures were explained in detail to all participants, and written informed consent was obtained from both the patients and their parents.

Patients who underwent surgery for medial distal tibial Salter-Harris Type 3 and Type 4 epiphyseal injuries between January 2021 and January 2024 were identified through the institution's surgical records. Data collection was conducted using the hospital information management system and by reviewing medical files. Information recorded included demographic data, injury details, surgical procedures, and follow-up outcomes. The hospital's Picture Archiving and Communication System (PACS) was used to review the radiological images of the selected patients and to obtain the necessary radiographic measurements.

### Inclusion criteria included:

- Patients aged under 18 years at the time of surgery,
- Patients diagnosed with medial distal tibial Salter-Harris Type 3 and Type 4 epiphyseal injuries and treated surgically,
- Patients with available postoperative imaging and clinical follow-up data for both limbs.

### Exclusion criteria included:

- A history of previous fractures or surgeries in either limb,
- Pathological fractures,
- Systemic bone disorders.

The study included 13 patients (six females and seven males), born between 2005 and 2014. The age range at the time of injury was 6 to 17 years. The cohort consisted of eight right-sided and five left-sided fractures. The mean follow-up duration was 31.6 months (range: 12-43 months).

All surgical procedures were performed by a unified surgical team, with each operation involving at least one attending orthopedic surgeon. Surgical techniques utilized included screw fixation, K-wire fixation, and tension wire fixation. Screw fixation was performed in 10 cases to achieve secure and stable realignment (Figures 1-3). K-wire fixation was used in two cases requiring less rigid stabilization, while tension wire fixation was applied in one case of fracture-dislocation to ensure adequate stabilization.

**Postoperative Management:** Postoperatively, lower leg cast immobilization was applied for four weeks to protect the fixation and reduce pain and inflammation. All patients were prescribed paracetamol and nonsteroidal anti-inflammatory drugs for pain management. Bone union was assessed at two and four weeks postoperatively. Additionally, radiological and clinical evaluations were conducted during the first and third months to monitor bone healing and union.

Anteroposterior and lateral ankle radiographs of both the operated and non-operated limbs were used to assess deformity parameters, specifically the lateral distal tibial angle (LDTA) and anterior distal tibial angle (ADTA) (Fig. 4).

Clinical outcome assessments included range of motion (ROM) measurements and functional scoring. ROM was measured using a goniometer to evaluate active and passive dorsiflexion, plantarflexion, inversion, and eversion of the ankle on both operated and non-operated limbs during the final



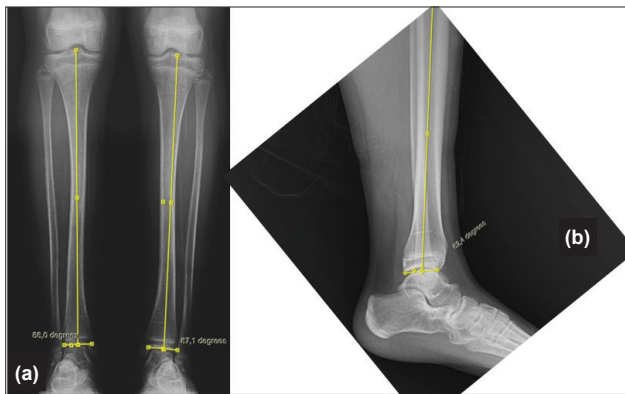
**Figure 1.** Anteroposterior (a) and lateral (b) radiographs of a skeletally immature patient who presented to the emergency room with ankle pain following a fall, demonstrating a fracture of the medial malleolus.



**Figure 2.** The patient underwent an open reduction and fixation procedure, during which a single cannulated screw was used. Following the procedure, a short leg cast was applied for postoperative immobilization.



**Figure 3.** One year postoperatively, the screw was removed. At the final follow-up visit, anteroposterior (a) and lateral (b) radiographs were obtained to assess for ankle deformity.



**Figure 4.** (a) The lateral distal tibial angle is measured between a line parallel to the distal tibial plafond and the mid-diaphyseal line of the tibia. (b) The anterior distal tibial angle (ADTA) is measured as the angle between the anatomical axis of the tibia and the joint line on a lateral radiograph.

follow-up. Functional outcomes were assessed using the Foot and Ankle Ability Measure (FAAM) for functional activity and the Visual Analogue Scale (VAS) for pain evaluation.

Statistical analyses were performed using IBM SPSS Statistics version 30.0 (Statistical Package for the Social Sciences, IBM Corporation, Armonk, NY, USA). Paired t-tests were used to compare the operated and non-operated limbs. Correlation analysis was conducted to evaluate the relationships between FAAM scores, ROM, and radiological outcomes, expressed as Pearson correlation coefficients ( $r$ ). A  $p$  value  $<0.05$  was considered statistically significant.

## RESULTS

The study included 13 patients (six females and seven males), with ages ranging from 6 to 17 years at the time of injury. The follow-up period ranged from 12 to 43 months, with a mean follow-up duration of 31.6 months. Right-sided frac-

tures were observed in eight cases, and left-sided fractures in five cases. Screw fixation was performed in 10 cases, K-wire fixation in two cases, and tension wire fixation in one case (Table 1).

The mean LDTA for the operated limb was  $89.07^\circ \pm 1.97^\circ$ , compared to  $89.3^\circ \pm 1.25^\circ$  in the non-operated limb, indicating a small, non-significant difference ( $p=0.813$ ). The ADTA in the operated limb averaged  $83.9^\circ \pm 2.46^\circ$ , while the non-operated limb had a mean of  $82.61^\circ \pm 1.98^\circ$  ( $p=0.153$ ). These minimal discrepancies suggest successful surgical realignment. Among all techniques, screw fixation demonstrated the most consistent and favorable outcomes, providing stable fixation and contributing to minimal variation in radiological angles (Table 2).

ROM measurements showed that the operated limb had a mean ankle plantarflexion and dorsiflexion arc of  $67.69^\circ \pm 12.35^\circ$ , compared to  $73.07^\circ \pm 4.8^\circ$  in the non-operated limb ( $p=0.138$ ). Although there was a slight reduction, it was not statistically significant and did not impact overall functionality. The mean ankle inversion and eversion arc was  $55^\circ \pm 10.99^\circ$  in the operated limb and  $56.92^\circ \pm 6.93^\circ$  in the non-operated limb ( $p=0.690$ ), also showing no significant difference. Cases treated with K-wire and tension wire fixation showed more variable outcomes, with slightly greater discrepancies in radiological angles and ROM compared to those treated with screw fixation.

Functional assessments, based on FAAM scores for the operated limb, indicated a mean of  $97.2 \pm 2.1$ , suggesting strong functional recovery with minimal impairment. The high FAAM scores demonstrated that patients were able to return to their daily activities and sports following surgery. VAS scores indicated effective postoperative pain management, with a mean score of  $1.2 \pm 0.8$  ( $p<0.01$ ). Patients treated with screw fixation reported higher FAAM scores and lower VAS scores compared to those who underwent K-wire or tension wire fixa-

**Table 1.** Demographic and functional outcomes of patients

Patient No	Age (years)	Gender	Side	Follow-up (months)	FAAM Score	Surgery Type	VAS Score
1	16	Female	Right	24	96	Screw	1
2	18	Female	Left	13	95	Screw	4
3	20	Female	Right	23	100	Screw	1
4	12	Female	Left	44	98	Screw	1
5	16	Male	Right	40	99	Screw	2
6	10	Female	Right	44	100	Screw	1
7	19	Male	Right	37	100	Screw	1
8	19	Male	Left	33	99	Plate	1
9	19	Male	Right	32	98	Wire	3
10	14	Male	Right	31	98	Screw	2
11	16	Male	Left	31	94	Wire	1
12	16	Male	Right	41	100	Screw	1
13	14	Female	Left	40	100	Wire	1

**Table 2.** Comparison of radiological measurements between operated and contralateral side

	Operated Side		Contralateral Side		p value
	Mean±SD	Min-Max	Mean±SD	Min-Max	
LDTA	89.07±1.97	85-92	89.30±1.25	88-92	0.813
ADTA	83.9±2.46	81-90	82.61±1.98	80-86	0.153
Flexion-Extension	67.69±12.35	35-80	73.07±4.8	70-80	0.138
Inversion-Eversion	55±10.99	30-65	56.92±6.93	50-65	0.690

SD: Standard deviation; Min: Minimum; Max: Maximum.

tion, indicating better overall outcomes with screw fixation.

At final follow-up, the physis was closed in eight patients, indicating skeletal maturity, while the remaining five younger patients with an open physis continued to be monitored for potential growth disturbances. Importantly, no premature physeal closure was observed in the operated limb of patients when compared to the non-operated limbs in our cohort.

Correlation analysis showed a moderate positive correlation ( $r=0.45$ ) between FAAM scores and ROM, suggesting that improved ROM is associated with better functional outcomes. A weaker correlation ( $r=0.32$ ) was found between FAAM scores and radiological alignment (LDTA and ADTA), indicating that while radiological alignment is important, functional recovery may also depend on other factors such as patient age and rehabilitation adherence.

## DISCUSSION

The results of this study demonstrate that surgical treatment of McFarland fractures, particularly through screw fixation,

effectively minimizes discrepancies in LDTA and ADTA between the operated and non-operated limbs, thereby contributing to favorable clinical outcomes. The high FAAM scores indicated that patients regained significant functional capacity, while low VAS scores confirmed effective pain control.

Although some limitations in ROM were observed, these did not lead to significant functional impairment, as evidenced by high FAAM scores. The moderate correlation between ROM and FAAM scores emphasizes the importance of preserving joint mobility to support better functional outcomes. Conversely, the weaker correlation between FAAM scores and radiological alignment suggests that while anatomical alignment is essential, it is not the sole determinant of recovery. Other factors, such as rehabilitation and patient adherence to postoperative care, are also crucial.

In comparison with the study by Gleizes et al.,<sup>[7]</sup> which reported a 29% rate of poor outcomes, often associated with factors such as high-energy trauma, medial metaphyseal comminution, and Salter-Harris Type 4 fractures, our study showed a lower incidence of complications. This discrepancy

may be attributed to the smaller sample size in our study and the consistency of surgical techniques, which focused on anatomical reduction and stable fixation.<sup>6</sup> Notably, our findings also highlight the importance of accurate reduction and avoiding fixation materials that could compromise the growth plate, consistent with the findings of Gleizes et al.<sup>7</sup>

The work by Blondin et al.<sup>8</sup> provides additional context, reporting a 15.2% rate of growth disturbances and decreased ankle range of motion in cases of high-energy injuries. Our study similarly identified mild ROM limitations in the operated limbs; however, functional outcomes, as measured by FAAM scores, remained high. This suggests that while some degree of ROM restriction may persist, it does not necessarily result in significant functional impairment. Blondin et al.<sup>8</sup> also emphasized the correlation between high-energy trauma and poorer outcomes, a finding that aligns with our observations that patients with less severe injuries, particularly those treated with screw fixation, exhibited more favorable recovery trajectories.

In a study by Petratos et al.,<sup>9</sup> 20 children diagnosed with McFarland fractures and treated surgically were reviewed, with a mean follow-up period of 8.9 years. They reported premature growth arrest with angular deformity in seven children. The study found a significant correlation between initial displacement and operative delay with the occurrence of premature growth arrest, indicating that both factors act independently and additively. Notably, all children with both risk factors developed premature arrest, while those without either risk factor did not. In contrast, our cohort exhibited no cases of premature growth arrest or angular deformity. This outcome may be attributed to our emphasis on anatomical reduction and timely surgical intervention within 24 hours. Petratos et al.<sup>9</sup> used American Orthopedic Foot and Ankle Society Ankle-Hindfoot Scale to evaluate functional outcomes, reporting a mean score of 98.3 out of 100.<sup>9</sup> Although a different functional scoring system was used in our study, our results were equally satisfactory.

Leary et al.<sup>10</sup> retrospectively reviewed 124 patients with physeal fractures at the distal end of the tibia, treated conservatively, to determine the incidence of premature physeal closure. The mean follow-up period was 57 weeks. Their cohort showed premature physeal closure in 13% of the patients with Salter-Harris Type III fractures and 13% of those with Salter-Harris Type IV fractures. They concluded that the degree of initial fracture displacement and the mechanism of injury have statistically significant predictive value in determining the likelihood of premature physeal closure. These results show a higher rate of premature physeal closure compared to our cohort, which suggests that surgical treatment with anatomical reduction is superior to conservative management in preventing such complications.

In a systematic review and meta-analysis, Asad et al.<sup>11</sup> evaluated 970 distal tibial physeal fractures. They compared open

versus closed treatment methods for these fractures and found no association between the treatment method and the risk of premature physeal closure. However, they reported fewer surgical-related complications with closed treatment. Although we exclusively used closed reduction in our study, the findings suggest that open reduction may be preferable to ensure anatomical alignment when closed techniques are insufficient.

In a retrospective study, Cottalorda et al.<sup>12</sup> examined 48 cases of McFarland fractures to determine whether growth arrest is inevitable. All patients were treated surgically, with a mean follow-up of 3 years and 3 months. They performed open reduction and achieved good outcomes in 45 patients, fair outcomes in two patients, and a poor outcome in one patient. They reported no leg-length discrepancy or malunion at the longest follow-up. These findings are similar to our results, with the main difference being the use of an open technique. These findings further support the idea that surgical treatment provides better outcomes, with anatomical reduction being the critical determinant, irrespective of the technique employed.

Camilleri et al.<sup>2</sup> conducted a retrospective study of 26 McFarland fracture cases. Surgery was performed in 21 patients, while cast immobilization was used for five patients, with a mean follow-up duration of 28.4 months. They reported good long-term outcomes in 24 patients and fair outcomes in two patients. Open reduction was utilized in all surgical cases. Notably, they used a washer to enhance compression and maintain optimal reduction. Their results also align with ours, suggesting that surgical treatment, even in cases with minimal displacements, may be superior to conservative management, and that different techniques and equipment may be used, provided that anatomical reduction is achieved.

The limitations of this study include its retrospective design and small sample size, which may affect the generalizability of the findings. Future research should involve larger cohorts and multicenter studies to validate these results and further explore the long-term impact of McFarland fractures on growth and joint function.

## CONCLUSION

Surgical treatment of medial distal tibial Salter-Harris Type 3 and Type 4 epiphyseal injuries (McFarland fractures) effectively minimizes discrepancies in LDTA and ADTA, thereby achieving both favorable radiological and clinical outcomes. In particular, screw fixation demonstrated consistent and positive results. Continued follow-up, especially for patients with open physes, is essential to monitor for potential growth disturbances and to ensure long-term joint health. Further multicenter research, including larger cohorts, is necessary to validate these findings and to better understand the long-term impact of surgical treatment for McFarland fractures on growth and joint function.

**Ethics Committee Approval:** This study was approved by the İstanbul University Faculty of Medicine Clinical Research Ethics Committee Ethics Committee (Date: 07.11.2024, Decision No: 3006365).

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

**Authorship Contributions:** Concept: S.S.; Design: S.B.; Supervision: H.İ.B.; Data Collection and/or Processing: T.B.D., B.Y.; Analysis and/or Interpretation: T.B.D., İ.T.A.; Literature Review: S.B., İ.T.A.; Writing: S.B., T.B.D., İ.T.A.; Critical Review: M.A.

**Conflict of Interest:** None declared.

**Financial Disclosure:** The author declared that this study has received no financial support.

## REFERENCES

1. Salter RB, Harris WR. Injuries involving the epiphyseal plate. *J Bone Joint Surg* 1963;45:587–622. [CrossRef]
2. Camilleri JP, Leroux J, Bourelle S, Vanel O, Cottalorda J. Mac Farland fractures: A retrospective study of 26 cases. [Article in French] *Rev Chir Orthop Reparatrice Appar Mot* 2005;91:551–7. [CrossRef]
3. Venkatadass K, Sangeet G, Prasad VD, Rajasekaran S. Paediatric ankle fractures: Guidelines to management. *Indian J Orthop* 2020;55:35–46. [CrossRef]
4. Olgun ZD, Maestre S. Management of pediatric ankle fractures. *Curr Rev Musculoskelet Med* 2018;11:475–84. [CrossRef]
5. Jung HS, Park MS, Lee KM, Choi KJ, Choi WY, Sung KH. Growth arrest and its risk factors after physeal fracture of the distal tibia in children and adolescents. *Injury* 2021;52:844–8. [CrossRef]
6. Schurz M, Binder H, Platzer P, Schulz M, Hajdu S, Vécsei V. Physeal injuries of the distal tibia: Long-term results in 376 patients. *Int Orthop* 2010;34:547–52. [CrossRef]
7. Gleizes V, Glorion C, Langlais J, Pouliquen JC. MacFarland fractures. A series of 24 cases. [Article in French] *Rev Chir Orthop Reparatrice Appar Mot* 2000;86:373–80. [CrossRef]
8. Blondin E, Stourbe O, Plancq MC, Deroussen F, Gouron R, Klein C. Outcomes of pediatric distal tibial physeal fractures. *Orthop Traumatol Surg Res* 2022;108:103199. [CrossRef]
9. Petratos DV, Kokkinakis M, Ballas EG, Anastasopoulos JN. Prognostic factors for premature growth plate arrest as a complication of the surgical treatment of fractures of the medial malleolus in children. *Bone Joint J* 2013;95:419–23. [CrossRef]
10. Leary JT, Handling M, Talerico M, Yong L, Bowe JA. Physeal fractures of the distal tibia: Predictive factors of premature physeal closure and growth arrest. *J Pediatr Orthop* 2009;29:356–61. [CrossRef]
11. Asad WA, Younis MHS, Ahmed AE, Ibrahim T. Open versus closed treatment of distal tibia physeal fractures: A systematic review and meta-analysis. *Eur J Orthop Surg Traumatol* 2018;28:503–9. [CrossRef]
12. Cottalorda J, Béranger V, Louahem D, Camilleri JP, Launay F, Diméglia A, et al. Salter-Harris Type III and IV medial malleolar fractures: Growth arrest: Is it a fate? A retrospective study of 48 cases with open reduction. *J Pediatr Orthop* 2008;28:652–5. [CrossRef]

## ORJİNAL ÇALIŞMA - ÖZ

### Büyümesi tamamlanmayan hastalarda medial malleol kırığının cerrahi tedavisinin klinik ve radyolojik sonuçları

**AMAÇ:** McFarland kırıkları olarak da bilinen medial distal tibia Salter-Harris Tip 3 ve Tip 4 epifiz yaralanmaları, büyüme plağı hasarı ve uzun süreli eklem deformiteleri potansiyelleri nedeniyle önemli riskler oluşturur. Eklem uyumunu yeniden sağlamak için cerrahi tedavi yaygın olarak kullanılmaktadır, ancak cerrahi tedavinin mi yoksa konservatif tedavinin mi daha üstün olduğu konusunda bir fikir birliği yoktur. Bu çalışmanın amacı, McFarland kırıklarında cerrahi müdahalenin orta dönem klinik ve radyolojik sonuçlarını araştırmaktır.

**GEREÇ VE YÖNTEM:** Bu retrospektif çalışmada, 2021-2023 yılları arasında I. basamak travma merkezinde McFarland kırığı nedeniyle cerrahi tedavi uygulanan 6-17 yaş arası 13 hastanın sonuçları analiz edildi. Cerrahi tedavi yöntemleri arasında vida fiksasyonu, K-teli fiksasyonu ve gergi teli fiksasyonu yer aldı. Sonuç ölçümleri arasında radyolojik deformite değerlendirmeleri (LDTA, ADTA), hareket açıklığı (EHA) ölçümleri, fonksiyonel sonuçlar için ayak ve ayak bileği yetenek ölçümü (FAAM) skorları ve ameliyat edilen ve edilmeyen uzuvlar arasında yapılan karşılaştırmalarla ağrı için görsel analog skala (VAS) skorları yer aldı.

**BULGULAR:** LDTA ve ADTA ameliyat edilen ve edilmeyen ekstremiteler arasında minimal fark göstererek başarılı bir cerrahi yeniden hizalama olduğunu gösterdi ( $p<0.05$ ). Ameliyat edilen uzuvda ROM hafif kısıtlılık gösterdi, ancak yüksek FAAM skorları ve düşük VAS skorları etkili fonksiyonel iyileşme ve ağrı yönetimini gösterdi. Korelasyon analizi, FAAM skorları ile EHA arasında orta derecede pozitif bir ilişki ( $r=0.45$ ) ve FAAM skorları ile radyolojik hizalama arasında daha zayıf bir korelasyon ( $r=0.32$ ) olduğunu ortaya koydu.

**SONUÇ:** McFarland kırıklarının cerrahi tedavisi, minimal EHA kısıtlamaları ve anlamlı dizilim ve fonksiyonel iyileşmeler ile olumlu klinik ve radyolojik bulgular saptandı.

**Anahtar sözcükler:** McFarland kırıkları; Salter-Harris Tip 3 ve 4; epifiz yaralanmaları; cerrahi tedavi; pediatrik ortopedi; büyüme plağı.

Ulus Travma Acil Cerrahi Derg 2025;31(4):399-404 DOI: 10.14744/tjtes.2025.74311