

Assesment of conservative therapy for pediatric patients with acute mallet finger deformity

Akut çekikç parmak deformiteli çocuk hastalardaki konservatif tedavi sonuçlarının değerlendirilmesi

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Received/Accepted: November 27, 2014/May 21, 2015

Conflict of interest: There is not a conflict of interest.

SUMMARY

Objective: We evaluated the effectivity of conservative treatment for acute mallet finger deformity in hands of pediatric patients due to trauma in this study.

Method: Between 2011-2013, 19 pediatric patients treated due to mallet finger deformity disturbance were reviewed retrospectively. The demographic data and the injury mechanisms of the patients were recorded. We obtained the X-ray films of the patients via PACS system. The classification was applied by the Doyle system. A standard conservative treatment protocol that maintained distal interphalangeal joint (DIP) at extension were applied to all patients. Finger splint was used during the first week for DIP extension. Then another splint that is arranged by also considering the finger diameter and made up of thermoplastic material was used to keep DIP in extension. After the treatment, the patients were clinically evaluated according to Crawford criteria.

Results: 13 patients were male and 6 of them were female. 12 patients were Doyle type 1 and 7 of them were Doyle type 4a. The patients were among 9-16 ages. The mean age was 13.2. The fixation time in extension for Doyle type 1 patients was 4 weeks and was 5 weeks for the patients with Doyle type 4a. Exercise program was started fixation; splint was used one week more only at nights. Excellent results were obtained according to Crawford criteria. 2 patients experienced superficial skin problems which healed without any complication. The duration for achieving full range of motion was one week longer than the other children in three patients.

Conclusion: Thermoplastic stent is an effective and easily applicable treatment method with high patient compliance for patients with acute type 1 and type 4a mallet finger deformity due to trauma.

Keywords: Mallet finger, pediatric patient, conservative treatment, thermoplastic splint

ÖZET

Amaç: Bu çalışmada, travma sonucu elde akut çekikç parmak deformitesi gelişen çocuk hastalarda konservatif tedavinin etkinliği değerlendirildi.

Yöntem: Çekiç parmak deformitesi nedeniyle 2011-2013 yılları arasında tedavi edilen 19 çocuk hasta retrospektif olarak incelendi. Hastaların demografik bilgileri, yaralanma mekanizmaları kaydedildi. Hastaların grafilerine PACS sisteminden ulaşıldı. Sınıflandırma Doyle sistemine göre yapıldı. Tüm hastalara distal interfalangeal eklemi ekstansiyonda tutan standart konservatif tedavi protokolü uygulandı. İlk hafta distal interfalangeal (DİP) eklemi ekstansiyonda tutan parmak ateli ile takip yapıldı. Sonrasın da ise hastanın parmak çapına göre termoplastik malzemenen hazırlanan yine DİP eklemi ekstansiyonda tutan splint kullanıldı. Tedavi sonrasında hastalar klinik olarak Crawford ölçütlerine göre değerlendirildi.

Bulgular: Hastaların 13 tanesi erkek, 6 tanesi kadın idi. Hastaların 12 tanesi Doyle Tip I, 7 tanesi Doyle Tip IVa idi. Hastalar 9-16 yaş arasında idi. Ortalama yaş 13,2 idi. Ekstansiyonda tespit süresi Doyle Tip 1 hastalarda 4 hafta, Doyle Tip 4a hastalar da ise 5 hafta idi. Tespit sonlandırıldıktan sonra hastalara egzersizler başlandı, splint 1 hafta daha gece kullanıldı. Crawford ölçütlerine göre tüm hastalarda mükemme sonuç elde edildi. 2 hastada splinte bağlı gelişen yüzeysel cilt problemi sorunsuz şekilde iyileşti. 3 hastada tam hareket açıklığı kazanımı için gereken süre diğer hastalara göre 1 hafta daha uzundu.

Sonuç: Travma sonucu gelişen akut Tip 1 ve Tip 4a çekiç parmak deformitesi olan çocuk hastalarda termoplastik splint kolay uygulanabilen, hasta uyumunun yüksek olduğu, etkin bir tedavi yöntemidir.

Anahtar sözcükler: Çekiç parmak, çocuk hasta, konservatif tedavi, termoplastik splint

INTRODUCTION

Mallet finger generally develops in the form of avulsion fracture or tendon rupture due to traumatic separation of the extensor tendon from the distal interphalangeal joint (DIP) because of sudden and excessive flexion while the finger is in extension¹. This situation leads to the loss of active extension of the distal phalanx. The effect of superior flexion forces on the joint causes fixed flexion deformity. Mallet finger, a frequently observed finger deformity, is observed at lower rates in children compared to adults.

The first treatment choice for acute mallet finger deformity is the conservative treatment of splinting²⁻⁵. In the literature there are many splinting methods described with various forms⁶⁻¹⁰. Surgical treatment is applied to mallet finger when conservative treatment is unsuccessful, if there is palmar subluxation of the distal phalanx or if there is more than 30% involvement of the articular surface¹⁰⁻¹².

The aim of this study is to evaluate the efficacy of thermoplastic splint after finger splint used for the first week, different to other studies, in pediatric patients with acute mallet finger deformity.

MATERIAL AND METHOD

Nineteen pediatric patients who were treated for mallet finger deformity from 2011-2013 at Sivas State Hospital Orthopedic and Traumatology Department were retrospectively investigated. The patients were included the the study after permission was granted by Cumhuriyet University Ethics Committee and consent was given.

Exclusion criteria for the study include those with adult mallet finger deformity,

patients with intraarticular displacement fractures, non-compliance of patients with treatment and patients who refused treatment.

The demographic information about the patients was obtained from computer records and patient files. The patient graphics were obtained from the PACS system. Classification was according to the Doyle system¹³ (Table 1).

Table 1: Doyle classification of mallet finger injuries.

| Type | Description |
|------|--|
| I | Closed injury, with or without small avulsion fracture |
| II | Open injury (laceration) |
| III | Open injury (to the tendon level) |
| IV | Mallet fracture |
| IVa | Physeal injury of distal phalanx (pediatric) |
| IVb | Including 20-50% of articular surface |
| IVc | Including >50% of articular surface |

All patients underwent a standard conservative treatment protocol with distal interphalangeal joint held in extension. After diagnosis the patients had a finger splint applied to hold the distal interphalangeal (DIP) joint in extension for the first week until edema resolved. One week later the patients were seen at routine check-up, and X-rays were taken to check reduction. Then a splint made of thermoplastic material prepared according to the diameter of the finger was applied to hold the DIP joint in extension. Patients with Doyle Type I were monitored for 3 weeks, while those with Doyle Type IVa were monitored for 4 weeks (Figure 1). When the splint was applied the patient and family were warned about possible skin problems that may develop. The patients were monitored with weekly X-rays and at the end of the 4th week,

patients were seen at the clinic and the splint was removed. Final graphics were taken and final status was checked. The movement degree of the finger was

evaluated. The patients began exercising. The splint was used at night for 1 further week.

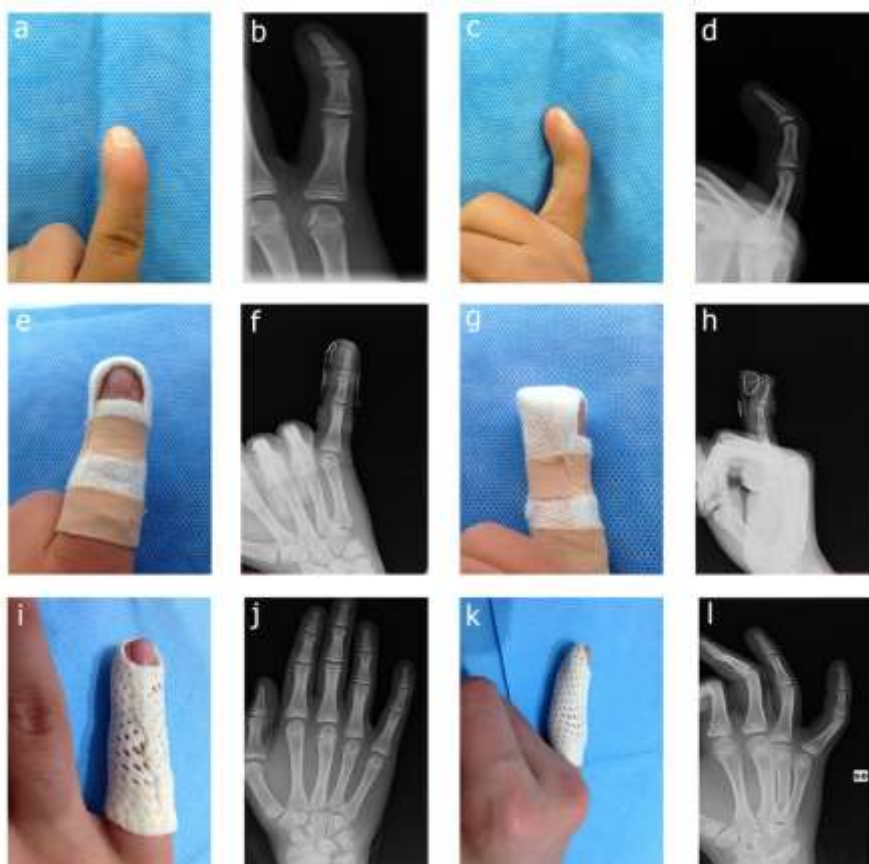


Figure 1: Images of patient with mallet finger deformity before treatment (a-d), with temporary splint in the first week (e-h) and later splint images and X-ray graphics (i-l).

After treatment the patients were clinically evaluated according to the Crawford criteria¹⁴. This evaluation system allows assessment from excellent to poor according to flexion-extension movement deficit of the DIP joint and possible continuing pain (Table 2).

Table 2: Crawford evaluation criteria.

| Result | Description |
|-----------|---|
| Excellent | Full extension, full flexion of distal interphalangeal joint; no pain |
| Good | 0-10 degree extension deficit, full flexion; no pain |
| Fair | 10-25 degree extension deficit, flexion deficit of any angle; no pain |
| Poor | More than 25 degree extension deficit or persistent pain |

RESULTS

A total of 19 patients compliant with the criteria were included in the study. Of patients 13 (68.4%) were boys and 6

(31.6%) were girls. The patients were aged from 9-16 years with mean age of 13.2 years.

The mechanism of injury was sports injuries (basketball, football impacts) in 9 cases (47.4%), blows (kicks to the finger, direct trauma) in 6 cases (31.6%) and falls in 4 cases (21%). The mallet finger deformity was on the right hand in 13 patients (68.4%) and on the left hand in 6 patients (31.6%). The finger injury was to the 3rd finger in 2 patients, to the 4th finger in 7 patients and to the 5th finger in 10 patients.

Of patients 12 had Doyle Type I (63%), and 7 had Doyle Type IVa (37%). The duration of fixed extension was 4 weeks for Doyle Type I patients and 5 weeks for Doyle Type IVa patients. After the fixed extension was ended, the patients began exercising. The splint was used at night for

1 further week for Doyle Type I patients and for 2 further weeks for those with Type IVa.

According to the Crawford criteria all patients obtained excellent results. Surficial skin problems linked to the splint healed without incident in 1 patient. For 3 patients the time to gain full movement was 1 week longer than for the other patients.

DISCUSSION

Mallet finger is a frequently observed form of injury in society. While it may appear to be a minor injury, when it occurs there is 6 weeks of loss of work power, and if not treated it may result in permanent function loss of the finger. As a result appropriate and correct treatment is necessary.

In appropriate cases with acute mallet finger deformity, Hart et al.⁵ and Maitra et al.⁶ used aluminum-coated dorsal splint while Kalainov et al.⁷, Crawford et al.¹⁴, Mauffrey¹⁵ and Jablecki et al.¹⁶ used polyethylene splints shaped to the patient's finger. In our study we used a polyethylene thermoplastic splint shaped to the patient's finger. However, the difference was that in the first week while the patient's splint was prepared and until swelling subsided, we used a finger splint. With this finger splint the pediatric patients more easily overcame the first week and we believe they adapted to the later splint more easily after pain and edema had subsided one week later.

The duration of treatment is 5 weeks for pediatric patients and 6 weeks for adult patients^{2, 17-18}. During this time patients must continuously use the splint and not allow flexion of the DIP joint. Then treatment continues at night for 1 week for pediatric patients and 2 weeks for adult patients^{6, 19}. If patients do not comply with treatment, flexion contracture of the finger may develop. Schmidt et al.¹⁸ in a study of pediatric patients with mallet finger deformation recommended 5 weeks of continuous and 1 week of night splint use. In our study we found similar results.

We evaluated patient results after treatment according to the Crawford criteria. Schmidt et al.¹⁸ in their study obtained 94% excellent results. In our

study we obtained excellent results for all our patients. In 3 patients the time to gain full movement was 1 week longer than for the other patients.

Surgical treatment of patients with mallet finger deformity is applied when conservative treatment is unsuccessful, when there is palmar subluxation of the distal phalanx and when there is more than 30% involvement of the articular surface. Which surgical technique should be used is still a topic of debate. In the literature many different studies mention different surgical methods¹⁰⁻¹². A study of 21 patients by David et al.²⁰ found good results from conservative treatment of patients with more than 1/3 of the articular joint involved and with fractures with no subluxation. They stated their support for the necessity of non-surgical treatment in terms of patient pain, daily life and work, and finger functions.

In our study though we included acute cases, a study by Altan et al.²¹ found no significant difference between patients arriving in the first 2 weeks and those who applied 2-4 weeks later. They stated that conservative treatment should be attempted even for patients applying 2 weeks later.

Among complications that may develop during treatment with a splint, the most frequently observed are skin macerations and ulceration, allergies, continuing extension deficit after treatment, joint stiffness and nail problems^{5, 15-16, 18, 22}. Studies by Hart et al.⁵ and Schmidt et al.¹⁸ reported the most frequently observed complications were surficial skin ulcerations. In our study 2 cases developed skin problems. On follow-up, no problems were observed.

In conclusion; in appropriate cases of acute mallet finger deformation in pediatric patients, the first treatment choice should be conservative treatment. One of the most frequently chosen conservative treatment methods is splinting. Splints are easily prepared and are a cheap and easily applied method. Patient compliance is higher for adult patients compared to pediatric patients. As a result to increase compliance of pediatric patients, the use of a finger splint for the first week may be an

alternative method. However patients should be warned of possible development of skin problems and not to remove the splint during treatment. More care should be taken about these topics, especially for pediatric patients.

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