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# Implementation of physiotherapeutic strategies to prevent the deconditioning effects and hindrance in the fine motor functions followed by Mallet finger: A case report

**Taj Afreen Sheikh**[1*], **Pooja Dhage**[2], **Nikita Deshmukh**[3]

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**Authors' Affiliation:**
[1]Intern, Ravi Nair Physiotherapy College, Datta Meghe Institute of Higher Education and Researh, Sawangi Meghe, Wardha, Maharashtra, India; Email: afreensheikh56788@gmail.com
[2]Assistant Professor, Ravi Nair Physiotherapy College, Datta Meghe Institute of Higher Education and Research, Sawangi Meghe, Wardha, Maharashtra, India; Email: physiopoojadhage@gmail.com
[3]Resident, Musculoskeletal Physiotherapy, Ravi Nair Physiotherapy College, Datta Meghe Institute of Higher Education and Research, Sawangi Meghe, Wardha, Maharashtra, India; Email: nikitadesh09@gmail.com

[*]**Corresponding Author**
Intern, Ravi Nair Physiotherapy College, Datta Meghe Institute of Higher Education and Researh, Sawangi Meghe, Wardha, Maharashtra, India
Email: afreensheikh56788@gmail.com

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## ABSTRACT

38% of all upper extremity injuries that patients arrive in emergency rooms are fingertip injuries, according to statistics. When the extensor tendon on the dorsal surface of the hand's distal phalanges is injured, one of the most common injuries the mallet finger occurs. It is common to sustain a mallet finger. This case report's objective is to provide a summary of the mallet injury and potential side effects. Complications must be identified, diagnosed and managed promptly to be avoided. The Symptoms, diagnosis and treatment of mallet finger injuries are all briefly covered in this case report. This case study demonstrates the critical function of physiotherapy in the recovery of a mallet finger patient by improving strength, ROM and ADL. Physical exercise and a rehabilitation protocol significantly improved outcome measure. *Conclusion:* During the DIPJ immobilization period, range-of-motion exercises for proximal joints and unaffected joints were useful. Ultrasound, Active range of motion exercises, grip strengthening exercises and Home exercise programs and Supplemental interventions may include counselling and informational sessions on the condition. According to our study, Physiotherapy treatment can improve the condition and increase the range of the DIPJ.

**Keywords:** Mallet Finger, Distal Interphalangeal Joint, Avulsion Fracture, Extensor Tendon, Osteoarthritis.

## 1. INTRODUCTION

An avulsion or tendinous of the terminal extensor tendon causes mallet fingers, which often develop after an axial tension is applied to a flexed distal interphalangeal joint (DIPJ) (Cook et al., 2017). In the absence of an active Distal Interphalangeal Joint extension, the term refers to the consequent unopposed flexed joint position. The illness is associated to sports-related

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injuries, but it can also occur during seemingly mundane duties like making the bed and pulling up socks. It is frequently seen in emergency rooms (O'Brien and Bailey, 2011). A common injury called a mallet finger is caused by either a direct lesion an extended finger's tip or a laceration across the dorsal DIPJ of a digit (forced flexion) (Vedder, 1999; Smit et al., 2010). "Jamming injuries", "baseball finger" and "drop finger" are frequent in ball sports as synonyms. The common cause of this condition is when a ball strikes an extended fingertip, causing the DIP joint to flex while the extensor mechanism is actively contracting. As a result, the extensor mechanism over the DIP joint is damaged or stretched.

Basketball players, cricket players, football receivers, catchers in baseball and fielders in football all demonstrate this. Acute closed mallet finger eliminates cases associated with surgeries, open wounds, lacerations, concomitant trauma, rheumatoid or osteoarthritic diseases and those whose existence is more than two months late. It also relates to the manner and timing of the injury (Handoll and Vaghela, 2004). Normally, it is believed that all acute injuries respond best to conservative care, except for the ones that are open or also include more than 1/3$^{rd}$ of the Distal Interphalangeal Joint articular surface (Geyman et al., 1998a; Oetgen and Dodds, 2008; Cheung et al., 2012). In more difficult situations, it is recommended for people who need additional joint involvement and fracture displacement (Oetgen and Dodds, 2007; Lubahn, 1989). The primary reason for this is the observed long-term side effects of surgical intervention, including infection, joint misalignment, nail abnormalities (Auchincloss, 1982) residual extension lag and osteomyelitis (Kang et al., 2001). Conservative therapy is still strongly supported and highly controversial despite recent improvements in surgical techniques and favorable results (Rocchi et al., 2006; Mehdi et al., 2011). Depending on the severity of the damage and how long it has been since the accident before the presentation, non-operative with extended splinting for the treatment of the mallet finger and immobilization to open reduction and rigid fixation (Freshwater, 2014; Cheung et al., 2012).

## 2. PATIENT INFORMATION

We present a patient with a mallet finger. A case of 23 years old female whose right-hand ring finger got injured. Her ring finger got stuck in her dog's belt and her finger got bent and was painful and swollen. Her right-hand ring finger was injured. With this condition, she was taken to a private hospital. All the investigations were done like x-rays. She was prescribed with some medications and a spoon splint was applied and suggested for the surgery. Then she came to the hospital with splint again done with x-ray. The conservative treatment was done in which local anaesthesia was given and traction was applied and then hyperextended the finger and applied a spoon splint (Figure 1, 2) and suggested a follow-up after 10 days. Then after 10 days, she came to the hospital for a follow up. Investigating procedures like x-rays were done again and then physiotherapy was suggested. Physiotherapy was done on the 11$^{th}$ day of the patient's arrival.

**Figure 1** Spoon Splint (Dorsal View)

**Figure 2** Spoon Splint (Volar View)

**Clinical Findings**

While performing a physical examination, flexion of the Distal Interphalangeal joint was present, unable to fully stretch the ring finger's DIP joint. Swelling and tenderness were present on the ring finger which was grade 4. (Figure 3) shows a reduced range of motion and (Figure 4) shows strength was decreased in DIPJ.

**Motor Assessment**

**Table 1** Range of motion of DIPJ of the ring finger.

| DIP | Pre-treatment | Post-treatment |
|---|---|---|
| Flexors | 0-45 ° | 0-55 ° |

**Table 2** Manual Muscle Testing

| DIP | Pre-treatment | Post-treatment |
|---|---|---|
| Flexors | 3+/5 | 4/5 |

**Investigations:**

***Pre-treatment***


**Figure 3** Antero-posterior view of x-ray demonstrates an avulsion of the distal phalanx of the ring finger.


**Figure 4** Antero-posterior view of x-ray demonstrates an avulsion of the distal phalanx of the ring finger.

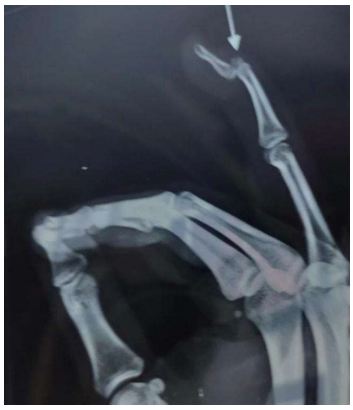

**Figure 5** Lateral view of x-ray demonstrates an avulsion of the distal phalanx of the ring finger.

**Post-treatment**


**Figure 6** X-ray of Antero-posterior view of post-treatment demonstrates bony union.

**Figure 7** X-ray of Lateral view of post-treatment demonstrates bony union.

**Therapeutic intervention**

After conservative treatment goals: The short-term goals were to reduce the swelling and pain, increase the movements, and have self-regulating events of everyday living. The long-term goals were to maintain the achieved range of the finger.

**Management**

Physiotherapy starts after managing conservatively. On day 11$^{th}$ physiotherapy treatment was started, from the day of the injury. Where the evaluation of the patient was done by the physical therapist and the evaluator's findings were finger pain and restricted range of motion. The fundamental goal of physiotherapy, which was developed by professional and knowledgeable therapists, is to keep other joints mobile and so avoid stiffness.

**Phase 1**

***Ultrasound***

The healing process can be accelerated with ultrasound. High-frequency sound waves cause cellular fluids to vibrate and flow, producing an effect that is primarily non-thermal in nature. Increased blood flow to an area can hasten the resolution of an inflammatory process, improve the rate at which certain soft tissues recover and stimulate the formation of collagen during tissue healing. The mallet finger was treated with pulsed ultrasound at a frequency of 3 MHz for seven minutes.

***Finger Passive Range of Motion***

The opposite hand should be used to gently bend the damaged finger. The wounded finger should then be carefully straightened out with assistance from the opposite hand. Slowly repeat, pausing for 5 seconds after each motion. Ten times total. 3 to 5 times per day, perform these exercises (Figure 8).

**Figure 8** Passive Stretch

**Phase 2**

***Paraffin Wax Bath***

Paraffin Wax Bath is extremely useful to improve the ROM of the DIPJ and facilitate the stretching of the injured or repaired tendon. Paraffin Wax Bath was applied at 45 degrees. Paraffin Wax Bath reduces pain, muscle spasm and swelling of the finger, particularly in the sub-acute and early chronic stages of inflammation. The wax also softens adhesions and scars in the skin and thus facilitates mobilization and stretching procedures.

***Active Range of Motion***

Encourage maximum active movements to the DIPJ with an emphasis on flexion. Special attention may be necessary for exercising the extensor digitorum communis. When opposing muscles contract and relax, causing joints to move, this range of motion is known as the "active range of motion". Active range of motion is done for 10 repetitions of 2 sets, thrice a day.

***Grip Strengthening Exercises***

Exercises that increase hand and finger strength might also be beneficial. To rebuild strength and mobility, strengthening activities like gripping a rubber ball or a squeeze ball can be quite beneficial. Ten times in a row, hold this position for 5 seconds.

***Home Program***

Cryotherapy was suggested in-home exercise program and can be performed twice daily for 5 to 10 minutes each time. Applying ice packs, submerging oneself in an ice bath, or using an ice chamber are all forms of cryotherapy. The use of cryotherapy aids in quick healing. The patient was referred to continue physiotherapy exercises at home to maintain mobility and strength and to prevent stiffness. Exercises such as Active Range of Motion and Grip Strengthening Exercises.

**Follow-up and outcome measures**

The patient was effective in enduring life activities and had no pain in their finger pain. As well as the range of the finger increased. The patient was keen to do physiotherapy and was well motivated. The patient has also been briefed on home fitness plans. The improvement is observed gradually as the patient progressed with the exercise or physiotherapy treatment.

**Table 3** Quick DASH Score

| QuickDash | Pre-treatment | Post-treatment |
|---|---|---|
| Score | 77/100 | 20/100 |

**Table 4** Visual Analog Scale

| VAS | Pre-treatment | Post-treatment |
|---|---|---|
| Score | 7/10 | 4/10 |

## 3. DISCUSSION

This study found that continuous immobilization for 6 to 8 weeks was frequently utilized; for bone injuries, this was usually for six weeks and for tendon injuries, it was usually for eight weeks (72% of responders). This result is in line with other survey results and suggested healing timeframes. Despite the splint weaning period's dubious effectiveness, respondents frequently believed that it was therapeutically necessary and based on each patient's presentation and functional need. The majority (81%) agreed that this strategy, which involved splinting on and off as necessary for rest and protection during the day, was acceptable for up to four weeks. During the time when the DIPJ remains immobile, exercises that enhance ROM in nearby, unaffected joints may be appropriate. After taking off the splint, the DIPJ flexion and extensor resilience should be gradually raised. Passive DIPJ flexion and grip strength tended to be disregarded and were seen to be of little value, even though functional ability was the most significant indicator of a successful outcome. A supplemental intervention might include written materials to provide counselling and education on the condition, compliance and prognosis. The results of poor initial management may justify the expenditures of routine, patient-specific therapy interventions. Data on the many therapies routinely employed led therapists to assume that their participation was crucial for the effective treatment of acute, closed mallet finger (Cook et al., 2017).

In cases of mallet finger injuries without subluxation or extensive intraarticular fracture, this study indicated that many hand surgeons favor non operative treatment. There are many different splinting design possibilities, but each one maintains hyperextension of the DIPJ to successfully apposition the ruptured terminal extensor tendon. Even using an elastic double-finger bandage to maintain the distal interphalangeal joint's stretched position has been recommended in cases of simple closed mallet injuries. Extensor tendon injury rehabilitation aims to achieve healing with less gapping and adhesion prevention. The effects of static mobilization include tendon rupture, extension lag, loss of flexion, grip weakness and adhesions. Adhesion or subsequent contractures can be avoided by early mobilization. Additionally, it can increase vascularity and tensile strength. A night splint can be used to maintain maximum extension during the mobilization period. According to this evaluation of the literature, splints are the most effective way to treat basic closed mallet injuries, which make up most injuries caused by mallets. The patient's compliance, however, matters more than the kind of splint that is offered. An apparent protrusion on the finger's dorsum and a minor extensor lag are two common side effects of therapy (Cheung et al., 2012).

This study found that of 315 patients, 83.4 percent were happy with the outcomes of first conservative therapy. The sensitivity analysis for 30 degrees of extensor lag demonstrated that 89.5 percent of patients experienced successful outcomes from conservative treatment. When considered in conjunction with the earlier finding made by other practitioners that patients tolerate small residual abnormalities without complaint unless fingers are stiff or uncomfortable, the case for initial conservative treatment seems strong and should be widely embraced. This strategy's financial repercussions are clear. A single radiograph, a few clinic visits and low-cost splint supplies are typically all that are needed for conservative treatment (Geyman et al., 1998).

According to this review, external splinting seems to be the treatment of choice for mallet injuries that are not complicated. Splinting seems to be just as beneficial as surgical intervention in straightforward acute cases of mallet injuries. Splinting therapy is the greatest way to treat simple mallet injury cases, while surgical solutions are the best way to handle instances that don't respond to splinting therapy. According to most findings, splinting should last at least 6 weeks. After six weeks, physiotherapy can be initiated to assist with distal interphalangeal joint mobilization and track the recovery more frequently. Several writers recommend using a night splint to help maintain the maximum extension when mobilization begins. There are also hints that more frequent exams can increase patients' compliance, leading to better results (Smit et al., 2010).

This research of mallet finger patients shows that adequate patient satisfaction levels can be reached. A new strategy is employed for immediate release from the ED with standardized guidance. The dissatisfaction rate was consistent with the literature that has been reported on mallet finger injuries and as a result, it was equivalent to the results that would have been obtained with a standard fracture clinic evaluation process for all fracture patients. The mallet finger injury was not blamed for the symptoms experienced by those individuals who did describe themselves as experiencing pain, despair, or poor health, but rather other

ongoing health issues. Overall, although while the redesign of the fracture clinic has been primarily patient-focused to reduce unwanted visits to the doctor, inconvenience, cost and time off from work, the same concepts have a huge potential to boost efficiency throughout the entire healthcare system. As a result, this study reveals that a strategy that promotes self-care and does away with routine evaluation led to great function and good satisfaction (Brooksbank et al., 2014).

## 4. CONCLUSION

This case study demonstrates the efficacy of physical therapy in treating mallet fingers. During the DIPJ immobilization period, ROM Exercises of proximal joints or unaffected joints was found to be useful. The initial tendency was to avoid active Distal Interphalangeal Joint bending and handgrip, although functional ability was found to be the single most important predictor of success. Ultrasound is initially used to alleviate pain and oedema. Supplemental interventions may include counselling and informational sessions on the condition. The results of poor initial management may make the expenditures of routine, patient-specific therapy interventions justifiable. Data showing the many therapies regularly employed led therapists to feel that their involvement was crucial for the effective management of mallet fingers.

**Author's contribution**

All writers offered their quality effort for the idea, evaluation, assessment and processing of data

**Informed consent**

The consent was obtained from the patient to prepare the case report.

**Abbreviations**

DIPJ- Distal Interphalangeal Joint
VAS- Visual Analog Scale
ED- Emergency Department
ROM- Range of motion
ADL- Activity of Daily Living

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**Conflict of interest**

The authors declare that there is no conflict of interests.

**Data and materials availability**

All data sets collected during this study are available upon reasonable request from the corresponding author.

## REFERENCES AND NOTES

1. Auchincloss JM. Mallet-finger injuries: A prospective, controlled trial of internal and external splintage. The Hand 1982; 14:168–173. doi: 10.1016/s0072-968x(82)80011-9
2. Brooksbank K, Jenkins PJ, Anthony IC, Gilmour A, Nugent MP, Rymaszewski LA. Functional outcome and satisfaction with a "self-care" protocol for the management of mallet finger injuries: A case-series. J Trauma Manag 2014; 8:21. doi: 10.1186/s13032-014-0021-y
3. Cheung JPY, Fung B, Ip WY. Review on mallet finger treatment. Hand Surg 2012; 17:439–447. doi: 10.1142/S0218810412300033
4. Cook S, Daniels N, Woodbridge S. How do hand therapists conservatively manage acute, closed mallet finger? A survey of members of the British Association of Hand Therapists. Hand Ther 2017; 22:13–25. doi: 10.1177/1758998316664822
5. Freshwater MF. Current concepts in the evaluation and treatment of mallet finger injury. Plast Reconstr Surg. 2014; 133:891e–892e. doi: 10.1097/PRS.0000000000000207
6. Geyman JP, Fink K, Sullivan SD. Conservative versus surgical treatment of mallet finger: A pooled quantitative literature evaluation. J Am Board Fam Pract 1988; 11:382–390. doi: 10.3122/15572625-11-5-382
7. Handoll HH, Vaghela MV. Interventions for treating mallet finger injuries. Cochrane Database Syst Rev 2004; 3. doi: 10.1002/14651858.CD004574.pub2

8. Kang HJ, Shin SJ, Kang ES. Complications of Operative Treatment for Mallet Fractures of the Distal Phalanx. J Hand Surg 2001; 26:28–31. doi: 10.1054/jhsb.2000.0440
9. Lubahn JD. Mallet finger fractures: A comparison of open and closed technique. J Hand Surg 1989; 14:394–396. doi: 10.1016/0363-5023(89)90121-4
10. Mehdi SY, Masood Q, Lawlor D, Eadie PA. Repair of the central slip of extensor tendon and the open mallet using Mitek mini bone anchors. Eur J Plast Surg 2011; 34:13–17. doi: 10.1007/s00238-010-0440-6
11. O'Brien LJ, Bailey MJ. Single blind, prospective, randomized controlled trial comparing dorsal aluminum and custom thermoplastic splints to stack splint for acute mallet finger. Arch Phys Med Rehabil 2011; 92:191–198. doi: 10.1016/j.apmr.2010.10.035
12. Oetgen ME, Dodds SD. Non-operative treatment of common finger injuries. Curr Rev Musculoskelet Med 2008; 1:97–102. doi: 10.1007/s12178-007-9014-z
13. Rocchi L, Genitiempo M, Fanfani F. Percutaneous fixation of mallet fractures by the "umbrella handle" technique. J Hand Surg Edinb Scotl 2006; 31:407–412. doi: 10.1016/j.jhsb.2006.04.014
14. Smit JM, Beets MR, Zeebregts CJ, Rood A, Welters CFM. Treatment options for mallet finger: A review. Plast Reconstr Surg 2010; 126:1624–1629. doi: 10.1097/PRS.0b013e3181ef8ec8
15. Vedder NB. Operative Hand Surgery, 4th Edition, Volumes 1 and 2. Ann Surg 1999; 230(6):825.