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Evaluating Stack Splint Use for Mallet Finger

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Background: Stack splint is commonly used for mallet finger treatment but patients had a tendency to frequently remove it because of skin complications. We hypothesized that a comprehensively instructed splinting regime would increase patients' compliance and lead to favorable outcomes with fewer skin complications. The aims of this study were to assess the patients' compliance and to evaluate outcomes with that particular splinting regime.

Methods: Forty-six consecutive patients were enrolled in this prospective study. They were instructed to wear the Stack splint for 24 hours a day every day in the first six weeks and remove it once a day for 10 minutes to vent. They were told to support distal interphalangeal joint volarly both while wearing the splint and when it was removed. Free movement of proximal interphalangeal joint within the splint was checked after each application. Following whole-day regime for 6 weeks, night splinting continued for 2 more weeks. Range of motion, skin complications, patients' compliance and satisfaction were assessed at last follow-up.

Results: There were 26 patients with a mean age of 39.8 and mean follow-up period of 6.7 months. No skin complications or proximal interphalangeal joint stiffness were reported. However, nine patients declared that they wore the splint ≤ 4 weeks, the compliance rate to our regime was 65.4% (17/26). In the 17 fully compliant patients, mean distal interphalangeal joint extension lag was 12.4 and nine of them (52.9%) were satisfied with the outcome.

Conclusions: Our both hypotheses failed; comprehensive instructions for the splinting regime did not improve patients' compliance satisfactorily, nor did it lead to favorable outcomes. Although Stack splint has practical points, we no longer use it.

Keywords: *Mallet finger, Stack splint, Skin irritation, Extension lag*

INTRODUCTION

It is not uncommon for hand surgeons to encounter patients complaining of drop finger, or mallet finger, despite weeks of conservative treatment. This common injury typically responds well to a prolonged splinting regime, especially when classified as Doyle's type 1 (closed injury with or without avulsion fracture).[1-5] However, it has also been clearly shown that the patient's compliance with the splinting regime plays a crucial role in the outcome.[1,3,4,6,7]

Stack splints[8] are commonly used for external splinting of mallet fingers because they are cheap, easy to apply, and practical both for the physicians and patients.[4,9] In two previous surveys reviewing referral and treatment methods, the majority of mallet injuries were initially managed by a prefabricated Stack splint (48%–59%).[10,11] Similarly, most of the orthopedic and plastic surgeons were used to prefer Stack splint in our institute, possibly because it provides great convenience for an intensive workload. However, we observed that patients had a tendency to frequently remove the Stack splint, most often because of skin complications. Moreover, some patients were taping the splint, including the proximal interpha-

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langeal joint, in full extension, which was previously reported to be unnecessary.[12] We thought that simple splinting regime instructions to "wear it for 24 hours a day every day for 6 weeks and never remove" would possibly result in poor patient compliance and suboptimal treatment outcomes.

In this study, we formulated a doctor-patient teamwork scheme to increase patient collaboration in the treatment of mallet fingers with Stack splint. We hypothesized that comprehensive instructions for splinting regime and correct taping would improve patient compliance and lead to favorable outcomes with fewer skin complications. Therefore, the aims of this study were to assess the patients' compliance and to evaluate outcomes with that particular splinting regime for conservative treatment of mallet finger.

METHODS

This prospective study was conducted in an outpatient hand surgery clinic. The study design was approved by the local ethics committee. The patients were informed about the study and gave their informed consent before enrollment. Forty-six consecutive patients with closed mallet finger injuries were enrolled in the study in a period of six months. The inclusion criteria for the patients were that they had been suffering from a Doyle type 1 mallet finger injury for less than 28 days and their agreement to collaborate with the described splinting regime. The exclusion criteria were; being < 18 years old, open mallet injuries, and injuries with subluxated distal interphalangeal (DIP) joints. History of another accompanying injury or previous surgical treatment on the involved finger were also considered to be exclusion criteria. The follow-up period was planned for at least three months.

After checking for the appropriate size, patients were instructed to wear the Stack splint for 24 hours a day every day for the first 6 weeks. Our splinting regime was modified from the report by Richards et al.[13] and had two major concerns. The first concern was the prevention of skin irritation. For this, the patients were advised to remove the splint once a day and leave the finger out of the splint for 10 minutes to vent, in a supported position on a table. They were strictly told to support the DIP joint volarly (e.g., on a table) both while wearing the splint and when it was removed (Fig. 1). The patients were advised to support their drop finger from the volar side with their thumb during cleansing procedures. The second concern addressed by our regime was the prevention of the proximal interphalangeal (PIP) joint stiffness that originates from immobilization. For this, special attention was placed on the taping of the Stack splint to the finger. The patients were instructed to affix the splint on the finger while keeping the PIP joint out of the taping. Free movement of the PIP joint within the splint was checked by the patient after each application (Fig. 2). Patients visited the outpatient clinic twice; first, at the end of the third week and second, at the end of the sixth week. At the former visit, the instructions for splinting regime were again emphasized. Following the whole-day regime for 6 weeks, at the latter visit, only night splinting for 2 more weeks was advised. Patients were called for a final assessment, and the assessments were performed by a physiotherapist who was blinded to the treatment phase. Age, sex, follow-up period, and



Fig. 1. The hand was supported volarly on a table during both while wearing the splint and when it was removed.



Fig. 2. Free movement of proximal interphalangeal joint within the splint was checked after each application against any restriction by taping.

the injured finger were recorded. Flexion range of PIP joint and extensor lag of the DIP joint were measured by a finger goniometer. Patients were verbally asked about any skin complaints due to splint use, compliance with the treatment, and PIP stiffness. The injured finger was also inspected carefully for skin irritation. Patient satisfaction was evaluated with a numeric analog scale (NAS) (0–10). Satisfaction ratings ≥ 8 were considered to show patient satisfaction.

Age, follow-up period, flexion range and extensor lag, and patient satisfaction were given as mean ± standard deviation. Categorical variables (gender, injured finger, compliance with the treatment) were given in numbers (n) or as percentage (%).

RESULTS

We were able to contact 38 of the 46 patients by telephone. However, 12 patients did not arrive at the clinic on the prescheduled date for assessments, and a total of 26 patients were assessed and analyzed for the study.

The mean age of the patients was 39.8 ± 15 (range; 18–72), and the mean duration of follow-up was 6.7 ± 3.9 (range; 3–18) months. Half of the patients (n = 13) were female. Six patients (23%) were injured on their middle finger, ten patients (38.5%) were injured on their ring finger, and ten patients (38.5%) were injured on their small finger.

All patients reported that they followed the wearing and removal instructions throughout the splinting period, and no patients reported skin complications or PIP stiffness. However, despite the comprehensive instructions given for the splinting regime and taping, nine patients (34.6%) declared that they wore the splint constantly for ≤ 4 weeks, the compliance rate to our regime was 65.4% (17/26). The results of these nine semi-compliant patients were excluded from the outcome analysis. For the 17 fully compliant patients, the mean extension lag of the DIP joint was 12.4° ± 9.5°, and the PIP joint had full flexion range. In total, nine (52.9%) of the fully compliant patients were satisfied (NAS ≥ 8) with both the treatment and the final outcome of the treatment.

DISCUSSION

This study was designed after clinical observation of skin complications and PIP stiffness as a result of Stack splinting during the conservative treatment of mallet finger. We found that patients could avoid those two complications of prolonged immobilization by following daily splint removal and taping instructions. However, more than one third of the patients did not adhere to the long-term immobilization instructions given with the Stack splint. Moreover, our secondary hypothesis of expecting favorable outcomes after following detailed instructions for the use of the Stack splint has failed as extensor lag and satisfaction rate results were average.

Conservative treatment of mallet finger generally necessitates six to eight weeks of strict immobilization of the DIP joint in extension; however, full-time immobilization without any splint removal has been reported to cause complications.[6,9,14-17] In a prospective, randomized, controlled trial, O'Brien et al.[6] instructed their patients to wear all splints continuously for eight weeks and compared dorsal aluminum and custom thermoplastic splints to the Stack splint. They reported that 90.4% of Stack splint patients reported some sort of complications, such as skin maceration, poor splint fit, and dissatisfaction with the splint. Additionally, Richards et al.[13] clearly demonstrated a protocol for splint wearing and removal during the conservative management of mallet finger which was used by subsequent studies.[6,18] In this study, we observed that the instructions of Richards et al.[13] worked for our patients, and none of them reported skin complications. Moreover, no stiffness was observed in our patients due to the instructions to avoid PIP joint taping, which allowed the joint to move freely. We think that the protocol of Richards et al.[13] is fundamental for avoiding skin complications during the conservative management of mallet finger injuries.

Patient compliance is composed of several parameters for any treatment, and compliance has been emphasized as being essential for favorable outcomes.[6,7,9,19] In this particular study, patient compliance to the Stack splint consisted of not only obeying the instructions regarding wearing and removal of the splint, but also adhering to the strict splinting regime throughout the whole six-week period. However, more than one third of our patients removed the splint before 6 weeks. In parallel to our results, adherence rate was reported to vary between 59% and 70% for mallet finger splinting regimes.[3] Tocco et al.[18] compared two different immobilization techniques regarding the effects on the clinical outcomes in their study. They found that only half of the splint group removed their orthosis daily as instructed, and nearly 25% of the cast group removed their device during the immobilization phase, even though they were instructed not to. Likewise, Botero et al.[20] have reported that some patients remove or reposition the splint or give up the treatment altogether despite strict instructions to

wear the splint for a prolonged period of time. We think that, although the splinting instructions are fundamental for the conservative management of mallet finger, they do not guarantee the adherence of the patients to the time frame, at least for the Stack splint. It is possible that the patients observe their finger's posture during daily splint removal and seeing the improvement, tend to get rid of the splint earlier than the advised schedule.

Conservative treatment of mallet finger has been reported to result in a slight extensor lag in several studies, with the average lag values varying between 2.8° to 14° for different orthosis types.[6,16,21-23] However, the average extensor lag of our patients (12.4°) was somewhat higher. One possible explanation for this finding could be that the patients could not strictly support the DIP joint during cleansing and interrupted the full extension position of the joint. Similarly, Tocco et al.[18] also reported that the ability of patients to correctly maintain the DIP joint extension during the wearing and removal periods has not been well documented. It was clear that our comprehensive instructions avoided skin complications, however, our detailed instructions could not achieve favorable outcomes in extensor lag. This result was considered relatively important as the extensor deficit, i.e., drop finger, is the main complaint patients have when consulting a physician for mallet finger injury. This result was also used to explain patient satisfaction scores, since a patient with a significant extensor lag should not be expected to be satisfied with the result.

This study has limitations. The major limitations were the small sample size and the lack of a comparison group. Future research with larger sample sizes and a comparison group, with improved documentation of patient compliance, may provide more evidence in this field. Furthermore, we included injuries up to 28 days. This might led a difference in outcomes between a fresh injury and one that is four weeks old, which could be a confounder in a small sample size. Finally, we did not measure the extension lag of the injured finger at the time of the injury but we included only Doyle type 1 mallet finger injuries.

In conclusion, we agree that low adherence to strict splinting regime is the main drawback of the conservative treatment of mallet finger, but it is not an easy task for treatment involving such a prolonged immobilization.[20] The results of this study showed that comprehensive instructions for the splinting regime and taping did not improve patients' compliance satisfactorily, nor did it lead to favorable outcomes. Therefore, although the Stack splint has some practical points, we no longer use it for the conservative treatment of mallet finger. Future research for closed mallet injuries can address a comparison of pin transfixation of the DIP joint with an orthosis that does not necessitate removal during cleansing.

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