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Hand

A Prospective Follow-up Study of Fingertip Amputation Treatment With Semi-occlusive Dressing

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Background: The aim of this prospective cohort was to evaluate the conservative treatment of fingertip amputation with exposed bone, with a semi-occlusive dressing.

Methods: Ten patients with an amputation distal to the distal interphalangeal joint were treated via secondary healing under a semi-occlusive film dressing. We followed up the patients weekly until the fingertip had healed, then a final clinical visit at 6 months, and a patient-reported outcome assessment at 2 years after the injury.

Results: All 10 patients completed the 6-month clinical follow-up, and seven patients completed the final patient-rated outcome assessments at 2 years. There were no complications during the study period, all the patients were satisfied with the results, and all answered "fully agree" on choosing the same treatment method again in a similar injury.

Conclusion: Our results show that conservative treatment of fingertip amputation is feasible and can provide good results. *(Plast Reconstr Surg Glob Open 2023; 11:e5407; doi: 10.1097/GOX.0000000000005407; Published online 16 November 2023.)*

INTRODUCTION

Traumatic fingertip defects are common, and the injuries vary from small lacerations to amputations of the fingertip.[1,2] The amputation may include soft tissue or soft tissue with a part of distal phalanx, and it can be treated conservatively via secondary healing or surgically. Conventional conservative treatment consists of cleaning of the wound and application of a gauze dressing. Surgical treatment is usually recommended if bone is exposed or if soft tissue loss is more than 1 cm^2.[3–10] However, although not an established practice, conservative treatment of such injury with semi-occlusive dressing has been suggested.[3,11–14] The dressing preserves, for example, moisture, warmth, and an optimal immunoglobulin concentration, and prevents contamination.[3,13,14] The moist environment has been proven to stimulate angiogenesis, collagen synthesis, and growth factor expression, which promote, among other things, cell proliferation.[15,16] In addition, a moist environment enhances keratinocyte migration, on which re-epithelialization is dependent.[15,16] Clinical data on the long-term outcomes of secondary healing in wounds with exposed bone are scarce.

Because fingertip injuries are common, and many hand functions depend on the fingertips, a feasible and successful treatment of fingertip amputations is important. Based on the previous findings,[12,13] we hypothesized that fingertip amputations can be treated conservatively with a semi-occlusive dressing regardless of bone exposure. The aim of this study was to determine the feasibility and results of fingertip amputation treatment with semi-occlusive dressing.

MATERIALS AND METHODS

The study design was a prospective observational cohort with a 2-year follow-up of patients receiving care for fingertip amputation. We included a consecutive cohort of all adult patients (≥18 years) with a fingertip amputation distal to the distal interphalangeal joint and soft tissue defect with bone exposure. Patients were treated between April and July 2019 at Tampere University Hospital, which is a secondary and tertiary referral hospital with a hand surgery unit.

We inspected and debrided the amputation wound in local anesthesia in the emergency department. Exposed bone was left intact, except if the bone was protruding from the soft tissue. In those cases, we shortened the bone to the soft tissue level without any intention to cover it with soft tissue. After this, we covered the fingertip with

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semi-occlusive film dressing (OPSITE; Smith & Nephew, Watford, United Kingdom) and a soft compressive dressing to protect the film dressing. X-rays of all patients were taken to exclude fractures proximal to the amputation zone. Antibiotics were not prescribed. We instructed the patients not to immobilize the injured hand and to use it freely.

The patients were followed up weekly in the outpatient clinic at Tampere University Hospital until the fingertip injury had healed. At each visit, the semi-occlusive dressing was changed, and the wound was cleaned. Superficial debridement was done, if necessary, but without aiming for granulation tissue removal. Hypergranulation tissue was removed if it was extending outside the wound edges. After the fingertip was clinically healed, dressings were not further used, and patients were instructed to contact the clinic if there were any issues with the injured finger. We conducted a final clinical follow-up examination at 6 months after the injury. At each visit, we documented all the details and photographs into the medical record.

Our primary outcomes were patient satisfaction at 2 years after the injury and incidence of complications during the 2-year follow-up period. We evaluated patient satisfaction with global questions about injured hand function (*How satisfied have you been regarding the injured finger's function during the last week?*) on a numerical rating scale (NRS) from 0 to 10 (0 = *very unsatisfied*, 10 = *very satisfied*) and whether the patients would choose the same method of treatment again in a similar injury (*Would you choose the same treatment in a similar injury?*) on the NRS from 0 to 10 (0 = *completely disagree*, 10 = *completely agree*). Treatment-related complications were assessed at every follow-up contact with questions and from the medical record. Secondary outcomes were the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire, the Cold Intolerance Symptom Severity (CISS) questionnaire, EQ-5D-5L, the domain on hand aesthetics of the Michigan Hand Outcomes Questionnaire (MHQ) as patient-rated assessment of the treatment outcome at 2 years after the injury. In addition, we included questions about the appearance of the hand: *How important is the appearance of your hand to you?* (NRS from 0 to 10; 0 = *not important at all*, 10 = *very important*) and *How much has the appearance of your hand bothered you during the last week?* (NRS from 0 to 10; 0 = *not at all*, 10 = *very much*). Open questions were asked about any symptoms during and after the treatment. We also asked questions regarding the patient's dominant hand, the use of a finger prosthetic, and whether the patient has been able to return to their regular work, is unable to work altogether, or has retired. Data on patients' age, sex, and the injured side and which finger(s) were involved were collected from the medical record.

DASH (Hudak et al, 1996) is a questionnaire to assess symptoms and physical function in patients with musculoskeletal issues of the upper limb.[17] DASH contains 30 questions, which are scored with a separate scoring formula, with the highest possible score being 100, meaning a severe disability. The minimal important difference for DASH has been evaluated to be between 10.83 and 15 points,[18] and normative values for the general population have been published.[19]

Takeaways

Question: Our aim was to evaluate the conservative treatment of fingertip amputation with exposed bone with a semi-occlusive dressing.

Findings: Ten patients with an amputation distal to the distal interphalangeal joint were treated with a semi-occlusive dressing. Patient-reported outcome assessment was done at 2 years after the injury. There were no complications during the study period. All the patients who completed the outcome assessment at 2 years were satisfied with the results, and all would choose the same treatment method again in a similar injury.

Meaning: Conservative treatment of fingertip amputation is feasible and can provide good results without major complications, even with exposed bone.

CISS (Irwin et al, 1997) is a standardized questionnaire used in describing the symptoms of cold sensitivity.[20] Symptoms may contain pain, stiffness, weakness, skin color changes, swelling, and numbness. The CISS contains six sections with multiple questions, which assess the symptoms and the effect these symptoms have on daily activities. The sections are scored with the possible total score ranging between 0 and 100. The maximum score of 100 points indicates an extremely difficult cold intolerance.[21] A CISS result of 50 points has been considered a cutoff for abnormal cold sensitivity, in a recent study of 1239 participants.[22]

The EQ-5D-5L (EuroQol Group, 2009) is a standardized measure of health-related quality of life. It contains five dimensions of health (mobility, self-care, usual activities, pain/discomfort, and anxiety/depression). The maximum score from each of the five sections is five points, which indicates the most severe difficulties in the different aspects of health. The EQ-5D-5L also contains a visual analogue scale to estimate self-experienced health on a scale between 0 (*The worst health you can imagine*) and 100 (*The best health you can imagine*).

The MHQ (Chung et al, 1998) was developed to measure outcomes for patients with hand disorders regardless of the type of the disorder. It contains six domains which are scored and evaluated independently (overall hand function, activities of daily living, pain, work performance, aesthetics, and patient satisfaction with hand function). We used only the questions from the aesthetics domain in this study because the other domains are covered by DASH questionnaire, and full inclusion of both questionnaires was deemed too laborious for the participants. The used aesthetics domain consists of two sections (right-hand appearance and left-hand appearance) both with four questions. The questions in the MHQ aesthetics section are scored from one to five, and the section has a maximum score of 20, indicating full satisfaction with the appearance of the hand.[23] Minimal important difference or normative values for the MHQ are not available.

We sent the questionnaire to the patients 2 years after the injury, and in addition to the questionnaire, possible complications of the treatment were searched broadly from the medical record. All results are reported as count data or average values (with SD). A paired *t* test was used to determine statistical difference in MHQ aesthetics domain results between the injured and uninjured hand, and a *P* value less than 0.05 was considered significant.

RESULTS

The 10 patients were between 28 and 84 years of age (mean age 59.8 years). Two of the patients were men, and eight were women. Altogether, the 10 patients had 13 injured digits, of which 11 were treated with the film dressing. Two remaining injuries were small soft tissue amputations, which were treated with standard gauze dressing. The mechanism of injury was laceration with a lawn mower blade in four of the 10 patients, log splitter in two patients, circular saw in two patients, a sharp object in one patient, and crushing between objects in one patient (Table 1).

The injured digit was on the right hand in four patients and on the left in six patients. The thumb was the injured digit in two patients, the index finger in two patients, the middle finger in three patients, the ring finger in three patients, and the little finger in three patients. The geometry of the defect was transverse in five of the 10 patients, volar oblique in two patients, radial oblique in two patients, and ulnar oblique in one patient (Table 1). One fingertip required a 2-mm bone resection in the emergency department, in which the protruding bone was resected to the level of soft tissue defect.

Weekly dressing changes were continued until the fingertip had healed, which took 5–6 weeks in all patients. Figures 1 and 2 represent the appearance of the fingertip during the healing period. All 10 patients completed the treatment as planned and attended the 6-month clinical follow-up visit. During the follow-up period, there were no infections, no issues with pain management, and no stiffness in the interphalangeal joints of the injured fingers. Two-point discrimination (2PD) in the treated fingertip was not regularly measured at the clinical follow-up visits, but in those where measured, static 2PD was between 3 and 5 mm.

Seven patients fully completed the questionnaires at 2 years after the injury (Table 1), and in addition, one patient returned only a note that they are satisfied with the outcome and have no symptoms but declined to complete the long questionnaire. Between these seven patients, there were 10 amputated fingertips, of which eight were treated with the film dressing. The injured digit was in the dominant hand in four patients. The mean satisfaction with the function of the injured digit was 7.7 (SD 2.93), and all patients answered 10 (*completely agree*) on whether they would choose the same method of treatment again in a similar injury.

The mean DASH score was 5.0 (SD 7.25), and for each patient, the score was within, or below, the age-matched normative DASH score 95% confidence interval. The mean CISS was 30.3 (SD 16.14), and for each patient, the score was within the normative value range for CISS.

The mean NRS for the importance of the appearance of was 3.3 (SD 3.90), and for the harm caused by the appearance of the hand, 0.43 (SD 0.79). From the aesthetic domain of the MHQ, the mean score was 16.1 for the injured hand and 17.4 for the uninjured hand (SD 3.58 and 3.64, respectively; $P = 0.679$) for comparison between injured and uninjured hand.

For the EQ-5D-5L, the answers ranged from 3.0 to 5.0 [mobility score mean, 5.0 (SD 0.0); self-care mean, 5.0 (SD 0.0); usual activities mean, 4.67 (SD 0.52); pain/discomfort mean, 4.20 (SD 0.84); and anxiety/depression mean, 4.83 (SD 0.41)]. The experienced health today from 0 to 100 ranged from 60 to 90 [mean 77.86 (SD 10.75)].

Five patients reported symptoms during the follow-up period: three patients mentioned altered fingertip sensation; one, cold intolerance; one, pain; one, weakened grip strength; and two, altered function in precision tasks. All these symptoms were minor and did not warrant any action. When asked about the current working situation, three patients were already retired before the injury, and three patients had returned to their previous job after the treatment. One patient was not working, but not due to the hand injury. Return-to-work time was between one week and six weeks (Table 1). One patient returned to work after 4 months as a consequence of other injuries.

DISCUSSION

We found that the patients were satisfied with the treatment of fingertip amputations with semi-occlusive dressing, and there were no complications during the 2-year follow-up. Some patients reported symptoms, including cold intolerance, altered sensation, or difficulty with precision tasks, which are all common issues after a fingertip injury, but all patients would choose the same method of treatment again in a similar injury.

A major limitation of our study is the small cohort size, and a larger cohort would reduce the influence of chance and give more data on the possible complications. Originally, this study was intended as a pilot study for a randomized trial, but based on the results, we have since used this treatment as routine practice for all fingertip amputations, and during the regular clinical follow-up, we have not detected any more complications. Furthermore, a minor issue in patient-rated outcome measures was the variation in the direction of rating scales, which may have affected the answers: most of the questions had a scale in which the highest number or the left side indicated the most favorable alternative, whereas in some questions, the highest number indicated the worst alternative. This may have caused patients to answer incorrectly and skew the results. For example, the patient who was least satisfied based on the global question about functional outcome had the best possible score in DASH, and unfortunately, we were unable to contact the patient and confirm the answers.

The credibility of our results is increased by a consecutive cohort of patients, which were treated according to

Table 1. Injury Details and Treatment Outcomes for Each Patient

Patient	Injured Side	Injured Digit	Details of the Defect	Allen Classification	Mechanism of Injury	Satisfaction (0–10)	DASH (0–100)	CISS (0–100)	MHQ Aesthetic Domain (5–20) Injured/ Noninjured	Importance of Hand Appearance (0–10)	Hand Appearance Interference (0–10)	Return-to-Work (Time)
1	Right hand (dominant)	V	Transverse, at DIP joint	IV	Laceration (log splitter)	2	0	32	11/20	10	1	Retired before injury
2	Left hand (nondominant)	III	Transverse, just distal to nail fold	III	Laceration (circular saw)							Retired before injury
3	Left hand (nondominant)	IV	Radial oblique, from tip to nail fold	III	Crush							2 weeks
4	Left hand (dominant)	IV + V	Transverse, at the level of nail fold	IV	Laceration (lawn mower)	8	6	49	12/20	7	2	1 week
5	Right hand (dominant)	Thumb	Ulnar oblique, from tip to nail fold	III	Laceration (log splitter)	6	21	47	20/11	4	0	1 week
6	Right hand (dominant)	II	Transverse, proximal nail intact	III	Laceration (sharp object)							6 weeks
7	Left hand (nondominant)	IV	Volar oblique, from middle of nail (dorsal) to DIP joint (volar)	III	Laceration (lawn mower)	8	3	4	19/20	0	0	Retired before injury
8	Right hand (dominant)	Thumb	Radial oblique, from tip to nail fold	III	Laceration (lawn mower)	10	3	37	19/20	0	0	4 months
9	Left hand (nondominant)	III	Transverse, proximal nail intact	III	Laceration (lawn mower)	10	0	26	15/14	1	0	Retired before injury
10	Left hand (nondominant)	II	Volar oblique, from middle of nail (dorsal) to distal to DIP joint (volar)	III	Laceration (circular saw)	10	3	17	17/17	1	0	Retired before injury

Allen classification of amputation level[24]; Patient satisfaction from 0 to 10 (=best); Disabilities of the Arm, Shoulder and Hand (DASH) from 0 to 100 (=worst); Cold Intolerance Symptom Severity (CISS) from 0 to 100 (=worst); Michigan Hand Outcomes Questionnaire (MHQ) domain of hand aesthetics for both injured and noninjured hand; Importance of hand appearance from 0 to 10 (=very important); Hand appearance interference from 0 to 10 (=very much).

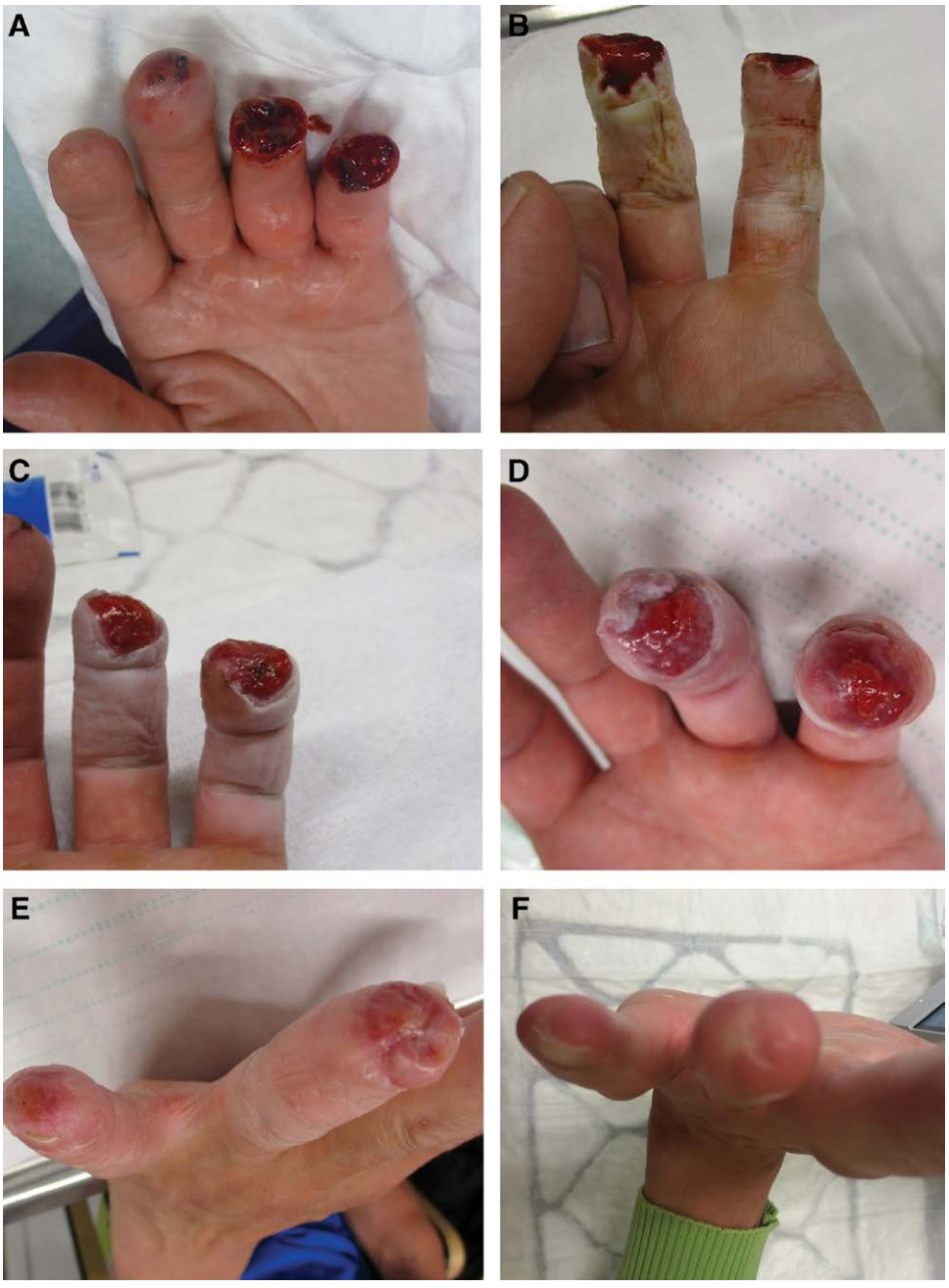

Fig. 1. Appearance of ring and little finger distal transverse amputations after the injury (A–D), at each dressing change until healed and at 6 months after the injury (E, F).

the same prospectively planned protocol, and we conducted both a systematic clinical follow-up and a long-term patient-rated outcome assessment. In addition, the good adherence to follow-up years increases the reliability of the results because any short-term or long-term effects on the patients' daily life should have been noted.

Our results contradict the common recommendation for surgical treatment of fingertip amputations with exposed bone but agree with prior reports on conservative treatment with semi-occlusive dressing.[4–10]

Mennen et al[13] reported conservative treatment with semi-occlusive dressing of 200 patients with fingertip injuries. The outcome assessment was very limited, and there was no systematic follow-up, but they recommended the method for management of all fingertip injuries. In a retrospective study comparing reconstruction, bone shortening and primary closure, and conservative treatment, van den Berg et al[25] reported no differences in the sensibility, aesthetics, or function between the groups. Their study used a wide range of tests to determine the function of the treated fingertip, but they did not use any patient-rated assessment of hand function, apart from CISS to assess cold intolerance. The conservative group was small (n = 11) compared with the other groups (n = 25 and

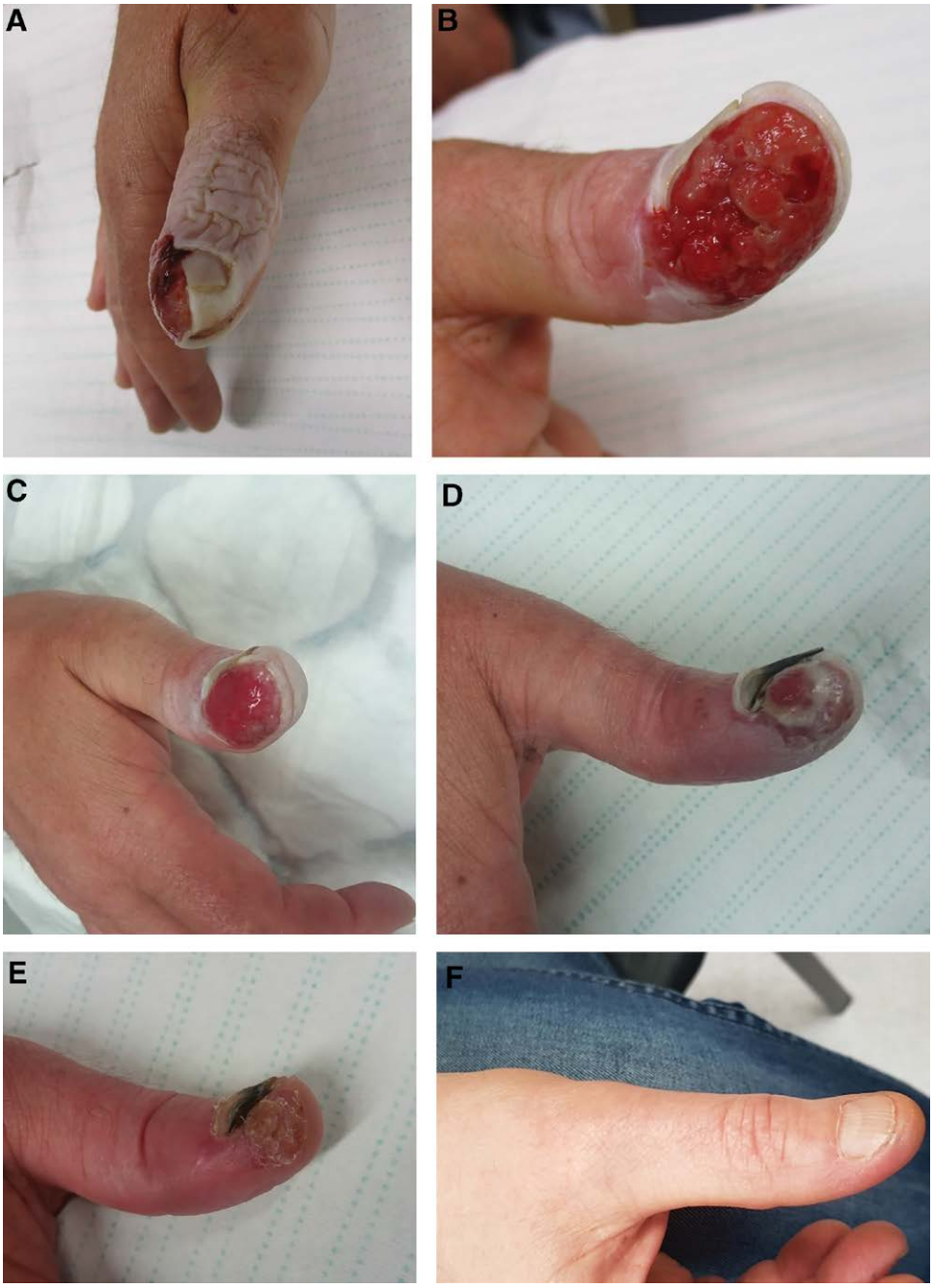

Fig. 2. Appearance of thumb tip ulnar oblique amputations with exposed bone after 1 week of treatment with semi-occlusive treatment (A–D), at each dressing change until healed and at 6 months after the injury (E, F).

n = 23), and all the patients in the conservative group were not treated with the same method. In our prospective study, all patients were treated according to the same conservative protocol.

We did not measure 2PD systematically, because meaningful recovery of fingertip sensation is reflected in global satisfaction and DASH scores. Objective measures of fingertip sensation recovery have been reported previously in a study by Hoigné et al,[11] which focused on measuring the regenerative process of the injured fingertip, but it also mentioned that conservative treatment with semi-occlusive dressing provided good results, even in wounds with exposed bone; soft tissue thickness (measured with ultrasonography) and 2PD were similar to that on the uninjured side. Boudard et al[26] conducted a study with 19 patients with Merle and Dautel zone 1, 2, or 3 amputations that were treated with semipermeable dressing. The healing took 4–5 weeks, and 16 patients recovered normal sensitivity (2PD); the mean QuickDASH score was 5.5. In the study by Hoigné et al,[11] three of the 17 patients mentioned symptoms during

the follow-up: one horn nail, one increased sensitivity, and one neuroma. In the study by Boudard et al,[26] one of the 19 patients was not satisfied with the outcome, and all four patients with proximal zone 3 amputations presented nail dystrophy. In our study, none of the patients had signs of horn nail or neuroma formation.

In our study, we did not compare conservative treatment with surgical treatment methods (revision amputation, full-thickness skin grafting or flap reconstruction). van den Berg et al[25] compared the outcomes of surgical reconstruction, bone shortening, and conservative treatment. They reported no differences between the treatments in outcomes, including skin sensation, grip strength, range of motion, cold intolerance, complications, or time off from work. A study by Ma et al[27] compared conservative treatment, split-thickness skin graft, full-thickness skin grafts, V-Y advancement flaps, Kutler flaps, revision amputation, and cross-finger flaps. In their report, conservative treatment had excellent results with better sensation and fastest average return to work time, but conservative treatment had longer overall healing time and more scar tenderness, and in their study, surgical methods had less complications than conservative treatment. Based local flaps or other surgical treatment options may be considered in some fingertip injuries, for example, if fast recovery is the most important treatment goal.

The heterogeneity of the reviewed studies and their outcome measures affect the comparability of the treatments, and to show whether one treatment provides superior outcomes in specific measures, a prospective direct comparison would be needed. Considering any type of conservative treatment of fingertip amputations, in a literature review of 30 studies with a total of 1592 conservatively treated fingertip injuries,[12] conservative wound management was considered to have good results in terms of tip durability, sensibility, cold intolerance, and an early return to work. Compared with conservative treatment, surgery was associated with reduced range of motion, donor site morbidity, longer return to work time, and more infections. In our study, the objective was to determine from the patients' perspective if treatment with semi-occlusive dressing is a suitable option for all fingertip amputations.

Our results add to the existing evidence that conservative treatment of amputated fingertips with semi-occlusive dressing can provide good results without major complications. Patients were also satisfied with the treatment process, which can also be fully implemented outside hospitals in outpatient clinics. Patients reported minor symptoms during the follow-up, such as cold intolerance and altered sensitivity, which are common in all fingertip amputations regardless of the treatment method.[1,4–9,25] Several proximal injuries seem to be more prone to complications,[12,26] but that was not evident in our study.

A randomized comparative trial with patient-reported outcomes would be needed to evaluate the superiority of any treatment option for a fingertip amputation, but the current evidence suggests that conservative treatment with semi-occlusive treatment is feasible, provides good results, and may be used for all fingertip amputations instead of surgical treatment.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

ETHICAL APPROVAL

Ethical approval for this study was waived by Tampere University Hospital because a study permit was sufficient and full ethical approval was not needed. This study was completed in accordance with the Declaration of Helsinki, as revised in 2013. Verbal informed consent was obtained from all subjects before the study. Written informed consent was obtained from patients whose photographs are included in the article.

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