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A MULTIDISCIPLINARY APPROACH TO THE MANAGEMENT OF TRAUMATIC FINGER AMPUTATIONS

MULTIDISCIPLINARNI PRISTUP U ZBRINJAVANJU TRAUMATSKIH AMPUTACIJA PRSTIJU

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Abstract
Hand injuries are among the most common musculoskeletal injuries, predominantly affecting working-aged males under 40 years. Traumatic finger amputation refers to the loss of part or all of a finger due to mechanical trauma. The most common injury mechanisms include sharp-cut injuries, contusions, and avulsions. Prompt and thorough assessment is crucial to achieve optimal functional recovery. This narrative review aims to present contemporary treatment concepts, their outcomes, and the specifics of multidisciplinary cooperation among the patient, their family members, and healthcare professionals. A literature search was conducted in January 2026 across *ScienceDirect, Scopus, PubMed*, and *Google Scholar* to identify peer-reviewed articles on traumatic finger amputations and their management. Treatment selection for traumatic finger amputation must be individually tailored to each patient, taking into account the complexity of the wound healing process, the functional specifics of the hand, and the patient's aesthetic and functional expectations. Close collaboration among healthcare professionals, patients, and family members enhances patient-centred care and improves treatment outcomes.
Key words: Finger Injuries; Amputation, Traumatic; Replantation; Wound Healing; Plastic Surgery Procedures; Patient Care Team; Rehabilitation; Treatment Outcome

Sažetak
Povrede šake predstavljaju jedne od najčešćih muskuloskeletnih povreda i obično se javljaju kod radno aktivnih muškaraca mlađih od 40 godina. Traumatska amputacija prsta predstavlja delimičan ili potpun gubitak prsta usled mehaničke traume. Najčešći mehanizmi povređivanja uključuju povrede nastale oštrim predmetima, kontuzije i avulzije. Pravovremena i detaljna procena predstavlja osnov za postizanje optimalnog funkcionalnog oporavka. Cilj ovog preglednog rada bio je da prikaže savremene terapijske pristupe, njihove ishode, kao i značaj multidisciplinarne saradnje između pacijenta, članova porodice i zdravstvenih profesionalaca. Pretraga literature sprovedena je u januaru 2026. godine u okviru baza *ScienceDirect*, *Scopus*, *PubMed* i *Google Scholar* sa ciljem identifikacije recenziranih publikacija koje se odnose na traumatske amputacije prstiju i njihovo zbrinjavanje. Izbor terapijskog pristupa kod traumatskih amputacija prstiju mora biti individualizovan, uzimajući u obzir složenost procesa zarastanja rane, funkcionalne karakteristike šake, kao i estetska i funkcionalna očekivanja pacijenta. Bliska saradnja između lekara, medicinskih sestara, fizioterapeuta i članova porodice pacijenta može značajno unaprediti pristup usmeren na pacijenta i doprineti postizanju povoljnijih ishoda lečenja.
Ključne reči: povrede prstiju; traumatska amputacija; replantacija; zarastanje rana; procedure plasti;ne hirurgije; multidisciplinarni tim; rahabilitacija; ishod lečenja

Introduction

Hand injuries represent a substantial epidemiological burden, accounting for 6.6% to 28.6% of all musculoskeletal trauma, and predominantly affect working-aged males under 40 years [1].

The hand is one of the most functionally important parts of the human body, making it particularly susceptible to injury [2].

Traumatic finger amputation refers to the loss of part or all of a finger as a result of mechanical trauma [3]. The most common mechanisms of injury include sharp-cut, crush, and avulsion injuries, which can be distinguished by the severity of damage to soft tissue structures [4]. Finger injuries commonly occur in occupational settings, predominantly during contact with metal objects and bladed hand tools [5].

Since the thumb, index finger, and middle finger are crucial for grip strength and precision, injuries to these fingers are considered severe. The unique anatomical and functional significance of each affected finger, along with the level of amputation, determines the surgical approach and potential outcomes [6].

Early, structured assessment shapes every subsequent decision about preserving a finger. In high-income countries (HICs), rapid diagnostics, appropriate treatment (conservative or surgical), and long-term rehabilitation are available. In low- and middle-

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Abbreviations

ATLS – advanced trauma life support
BSSH – British Society for Surgery of the Hand
DIP – distal interphalangeal joint
ED – emergency department
HICs – high-income countries
IV – intravenous
LMICs – low- and middle-income countries
MCP – metacarpophalangeal joint
MIU – minor injury unit
NCLF-US – noncontact low-frequency ultrasound
NPWT – negative-pressure wound therapy
PIP – proximal interphalangeal joint
PTSD – post-traumatic stress disorder
LWCA – local wound care alone

income countries (LMICs), access to such standards of care is often limited [7]. Treatment options include replantation, revision amputation, and reconstructive procedures. The goals of replantation are to achieve optimal functional and aesthetic results; however, replantation is not feasible for all patients. Suitability for surgery depends on the patient characteristics, the mechanism of injury, the level of injury, and the duration of ischaemia [4].

Replantation and reconstructive techniques are generally preferred when definitive amputation would result in functional deficits. Unsuccessful primary replantation may necessitate surgical revision, potentially resulting in secondary amputation of the affected finger [6].

Treatment selection depends on the level of amputation and other injury-related factors, which determine the choice between revision amputation and attempted replantation. Patients tend to prefer replantation of the amputated finger, which is thought to lead to better functional outcomes, improved quality of life, and reduced pain [8].

In addition to surgical treatment, conservative options include the application of semi-occlusive wound dressings. These dressings provide a favourable local microenvironment for wound healing and preservation of function, and are characterised by ease of application and cost-effectiveness [9]. Amputation is an extremely traumatic experience for the patient, owing to the injury itself, the surgical treatment, and its consequences. Violation of bodily integrity and pain trigger or exacerbate several psychological difficulties that impair the patient's well-being. Physical disability can lead to despair, depression, anxiety, low self-esteem, and social isolation [10].

Given the epidemiological pattern of injury, the complexity of treatment selection, and the psychological impact on the individual, this narrative review aims to present contemporary treatment concepts, their outcomes, and the specifics of multidisciplinary cooperation among patients, their relatives, and healthcare professionals.

Material and Methods

This study is a narrative review. A literature search was conducted in January 2026 across *ScienceDirect, Scopus, PubMed*, and *Google Scholar* to identify peer-reviewed publications on traumatic finger amputations and their management.

The search was conducted using keywords including "finger amputation", "digit amputation", "fingertip amputation", "hand trauma", "replantation", "reconstructive surgery", "wound healing", and "functional outcome", combined with additional descriptors like "rehabilitation", "psychosocial impact", "epidemiology", and "surgical management".

In this review, the term "finger amputation" was used as an umbrella term.

The review focused on English-language articles published between 2016 and 2026, including clinical and observational studies, books, and systematic and narrative reviews that analysed traumatic finger amputation, replantation procedures, or rehabilitation, and that reported functional, clinical, or psychosocial outcomes. Conference abstracts, letters to the editor, non-peer-reviewed publications, and studies not directly related to traumatic finger amputation or hand trauma were excluded. Professional guidelines were included in the description of clinical management principles. Classic articles were included as they describe classification systems for traumatic finger amputations that remain clinically relevant.

Ethical considerations

As this study analysed previously published articles, ethical approval was not required.

Epidemiological aspects

Understanding the patterns and aetiology of traumatic finger amputations is fundamental to developing targeted prevention strategies, improving rehabilitation services, and optimising outcomes [11]. A bimodal age distribution of incidence has been observed, with the highest rates in children aged 0 to 4 years (door crush injuries) and in adults aged 65 to 74 years, most often during chainsaw operation [12].

In a recent retrospective study conducted at a German trauma centre, the highest incidence of injuries was recorded in male patients; work-related injuries were predominant. A seasonal pattern was observed, with the highest frequency in July and September; the index finger was most commonly injured. Multiple amputations were recorded in 17.5% of cases, predominantly during leisure activities [6].

Risk factors

Many traumatic situations, including workplace accidents, road traffic accidents, and sports injuries,

can lead to finger amputation. Risk factors include insufficient occupational safety training, exposure to hazardous machinery, and improper handling of tools and equipment. Participation in recreational activities involving high speed or working at height also increases the risk of traumatic injury [13].

Classification of traumatic finger amputations

Finger amputation classification is primarily based on amputation level [14].

Several classification systems have been described, including those by Tamai, Allen, Ishikawa et al., and Hirase [5]. Traumatic amputations can also be classified as complete (total) or incomplete (subtotal). In a complete finger amputation, there is no connecting tissue between the amputated segment and the stump. In an incomplete amputation, a soft tissue bridge remains, involving less than one-quarter of the finger circumference [15].

Treatment of Traumatic Finger Amputation

Treatment selection for traumatic finger amputation depends on patient-related and injury-related factors. **Table 1** summarises the algorithm for the initial management of traumatic finger amputations, as outlined in the British Society for Surgery of the Hand (BSSH) guidelines [16].

Available treatment options include both conservative and surgical modalities. Conservative options include semi-occlusive dressings and innovative approaches such as negative-pressure wound therapy (NPWT), whilst surgical options include flap and stump surgery.

Conservative treatment

Patients managed non-operatively typically demonstrate rapid recovery with minimal long-term functional deficits. In healing by secondary intention, the wound is left open to heal through granulation. This approach is recommended for amputations smaller than 2 cm, owing to its simplicity and effectiveness [5].

Occlusive and semi-occlusive film dressings are safe and effective in carefully selected patients. Compared with surgical treatment, they are associated with significant pain reduction, better sensory outcomes, less pronounced cold intolerance, improved aesthetic results, reduced limitations in activities of daily living, and shorter work absence. These characteristics make them an effective alternative in the contemporary management of traumatic fingertip amputations [9,17,18].

In a recent study, NPWT was used as a treatment option for six traumatic finger amputations in five patients in whom replantation was not possible. Mean

Table 1. Algorithm for the management of traumatic finger amputations (according to BSSH guidelines)*

Phase	Procedures/Activities
The first steps in the Emergency Department (ED) and Minor Injury Unit (MIU)	- Bleeding Control (ATLS) - Ring removal - Tetanus prophylaxis according to national guidelines - IV antibiotic administration, according to local protocols - Analgesia, consider nerve block - Treatment and photographing of the wound - Radiography of the wound and amputated part
Handling the amputated part	- If amputated part is available: wrap it in gauze soaked in saline, place it in a sealed plastic bag; put the bag on ice and water - If amputated part is not available: irrigate the wound, prepare for terminalisation
Specialist assessment	- Emergency referral/transfer to a specialist hand surgery unit if indicated - Decide between: replantation, composite grafting, revision amputation - Considering the location of the injury and the feasibility of stable fixation - Shared decision-making with the patient
Timeframes	- Composite graft: up to 12 hours after injury - Replantation: With muscle → up to 4 hours Fingers → up to 24 hours.
Peri- and postoperative care	- Antibiotics according to the open fracture protocol - Vascular status monitoring - Dressing for 5–7 days, then considered individually - Multidisciplinary follow-up for complex cases - Referral to hand therapist and prosthetic service - Consider pharmacological pain management

*Local protocols may vary. The amputated part should be preserved appropriately in accordance with BSSH recommendations. Reported timeframes reflect guideline recommendations and may vary depending on warm- and cold-ischaemia conditions.

healing time was 22.7 days, with complete recovery of sensibility within three months, preserved range of motion and grip strength, and high patient satisfaction with aesthetic outcomes. Slight deformity and nail shortening were observed, with no other complications. In this small series, NPWT led to reliable healing when replantation was not possible, though larger studies are needed to confirm these findings [19].

Combined treatment incorporating semi-occlusive dressings with surgical intervention provides good regeneration of the fingertip across all levels of amputation and necrosis [20].

In addition to standard occlusive dressings, other conservative methods have been described. Gomez et al. demonstrated that non-contact low-frequency ultrasound (NCLF-US), combined with topical wound care, accelerates healing of fingertips without exposed bone compared with local wound care alone (LWCA), even in initially larger amputations [21].

Surgical treatment

Several surgical techniques are available, and the choice of technique depends on the nature of the initial trauma. Their aim are to restore function, optimise aesthetic outcomes, and minimise sensory loss [22].

Composite grafting

Composite grafting is a non-microsurgical method intended for distal fingertip amputations. Its advantages include preserving finger length without donor-site morbidity and restoring motor and sensory function. Adverse events following composite graft application include poor sensibility, tissue colour mismatches, necrosis, and infection [23].

Studies investigating composite grafts in distal fingertip amputations have reported good functional and aesthetic outcomes. Idone et al. [24] reported the effectiveness of the cooling composite graft (Hirase technique) in eight patients. Near complete graft survival was achieved in six cases; in two cases partial necrosis occurred as a consequence of inadequate therapy adherence (inconsistent cooling of the amputated segment during the recommended period). The authors concluded that the cooling composite graft represents a reliable alternative to microsurgical replantation when venous anastomosis is not possible. Similarly, Şener et al. [25] examined the use of composite grafts in the emergency department and operating theatre in 36 patients (22 paediatric). They found no differences in complications, additional interventions, or functional outcomes between the two settings. Emergency department use was significantly less costly and required shorter hospitalisation. At the same time, patient satisfaction did not differ, confirming that composite grafting is a reliable and cost-effective method for distal fingertip amputations.

Replantation

Finger replantation has become the standard treatment for carefully selected patients, particularly with advances in modern microsurgical techniques. Limitations to its wider application include the need for intensive rehabilitation, prolonged work absence, high costs, extended hospital stays, technical complexity, and an insufficient number of highly specialised centres [26].

Favourable treatment outcomes following thumb replantation are well documented in the literature, and thumb amputation is therefore considered a strong indication for replantation [27,28].

Replantation is associated with better functional scores than revision amputation, particularly for amputations above the proximal interphalangeal (PIP) joint in fingers other than the little finger. For the little finger, replantation does not offer a significant functional advantage [29].

According to Lu et al., the overall successful replantation rate is 86.4%. Incomplete amputations are more common than complete amputations, and the mechanism of injury and degree of amputation are the principal factors affecting replant survival [30].

Sharp-cut injuries have significantly better outcomes than crush-degloving injuries. Comminuted fractures and tuft injuries significantly reduce the finger survival rate. Functional outcomes are more unfavourable with high-energy fractures, subzone 4 fractures, and base fractures, as reflected in the reduced range of motion at the distal interphalangeal (DIP) joint [31].

The interaction between adjacent fingers across amputation patterns must be considered when accurately comparing functional outcomes across therapeutic options [29].

Revision amputation

Revision amputation can lead to satisfactory outcomes, particularly with respect to sensibility. The principal disadvantage of this method is the potential for cold intolerance, a consequence of nerve damage, rather than the procedure itself [5].

In severe traumatic injuries between the PIP and metacarpophalangeal (MCP) joints, ray amputation or amputation of the proximal phalanx is considered. Ray amputation is indicated when there is bone loss of the proximal phalanx or loss of PIP joint function. Phantom pain may be more pronounced following stump preservation, whereas patients who undergo ray amputation experience lower pain intensity, but reduced sensitivity. Both procedures have a similar return-to-work time of approximately two months. The choice between the two approaches is primarily based on individual aesthetic and functional considerations [32].

Complications

Complications of traumatic finger amputations are classified as early and late.

Early complications include arterial and venous insufficiency and infection. These typically arise soon after trauma and can significantly affect outcome if not treated promptly. Prevention requires avoiding vasoconstriction, maintaining adequate hydration and normothermia, ensuring adequate analgesia, and careful monitoring for changes in skin colour, turgor, or capillary refill time.

Late complications include cold intolerance (which usually resolves within two years), tendon adhesions, bone malunion (particularly in children), and altered sensory perception. Tenolysis is indicated in severe cases of tendon adhesion, with careful consideration of the risk of devascularisation [3,15].

Although fingertip necrosis may occur early in the postoperative course, secondary reconstructive procedures combined with intensive, long-term rehabilitation can lead to satisfactory functional recovery. Despite a good range of motion and preserved grasp strength, cold intolerance may persist for more than two years [33].

Pang and colleagues identified surgical and anatomical factors as the most important predictors of replant necrosis. Prolonged surgical duration is an independent risk factor for partial or complete necrosis. The level of amputation had a significant impact on outcome, with worse results reported for more distal amputations, attributed to the limited availability of adequate vascular and soft tissue structures for reconstruction [34].

Pain following finger amputation manifests as residual pain and, less commonly, phantom pain, which can be difficult to distinguish from residual pain. Conventional conservative treatments have shown limited efficacy, while secondary surgical interventions do not guarantee lasting relief. Attention is therefore increasingly directed towards surgical techniques that prevent the development of neuropathic pain at the time of amputation – an approach that, in addition to reducing pain, avoids the need for subsequent surgery and analgesia. Such techniques include neurovascular insular lobes, centro-central nerve union, and epineural techniques [35]. A retrospective study by Harris et al. [36] found that bite and sharp-cut injuries were associated with an increased risk of secondary revision. At the same time, the index, middle, and little fingers had a higher risk compared with the thumb. Work-related injuries were also identified as a significant risk factor, and no difference in the frequency of secondary revisions was observed between patients treated in the emergency department and those treated in the operating theatre.

Rehabilitation and orthopaedic devices are essential complements to surgical treatment, optimising return to function and enabling occupational activities. As they form an integral part of management, close collaboration between medical and paramedical teams is of great importance [22].

Nursing interventions

Nursing interventions directly influence treatment outcomes in patients with traumatic finger amputation. Nursing staff play a key role in the initial assessment, which includes taking a history covering the mechanism and timing of injury, the type of force involved, and the patient's medical background. Initial examination of the injured digit allows assessment of potential underlying structural damage [37].

Primary clinical evaluation must promptly identify vascular perfusion disorders, as inadequate blood flow leads to endothelial damage, platelet aggregation, and intravascular fluid loss, thereby impeding neovascularisation and further compromising tissue integrity [38].

Appropriate wound care is essential in preventing infection. Nurses are responsible for ongoing wound management, including correct dressing application and continuous monitoring. This is particularly important for the early recognition of signs of infection in injuries sustained in contaminated environments [37].

An understanding of the psychosocial needs of patients with traumatic finger amputation enables the identification of priorities, appreciation of the patient's subjective experience of the injury, and timely implementation of supportive interventions, thereby improving the quality of care.

Patients initially have a pronounced need for clear information about the functional and aesthetic outcomes and potential treatment complications. Effective communication reduces anxiety, facilitates the expression of emotions, and improves cooperation and trust in healthcare professionals. Family members make a significant contribution to supporting the patient following traumatic amputation; their active involvement in care helps reduce the psychological burden and facilitates the recovery of independence [39].

The application of Orem's self-care deficit theory is particularly relevant in patients with traumatic finger amputation, as impairment of hand function directly affects the ability to perform self-care tasks and activities of daily living. Nurses have an important role in educating patients about self-care behaviours. Patient education should be tailored to cultural context and individual abilities, using plain language and visual aids where applicable. Based on the patient's level of self-care ability or deficit, nurses should conduct individual assessments and adjust these in response to changes in the patient's condition or treatment plan [40].

Rehabilitation and functional recovery

Rehabilitation of patients with complex hand trauma requires a multidimensional approach integrating physical, emotional, and psychological aspects [41].

Rehabilitation should commence as early as possible after surgery, with close collaboration between the patient, surgeon, and physiotherapist. Exercises performed in the early postoperative period, before adequate bone healing has occurred, may lead to undesirable consequences such as pseudoarthrosis. Patients who receive limited physiotherapy in the early postoperative phase, with further rehabilitation initiated once bone healing begins, rarely require secondary reconstructive procedures [42].

Occupational therapy plays a key role in restoring the functions required for daily activities, including dressing, personal hygiene, and eating. An individualised treatment plan includes exercises to improve fine motor skills, assistive devices to compensate for weakness or loss of upper limb function, and education on energy-saving techniques for managing daily activities [41].

Patients who actively participate in the rehabilitation process have a lower incidence of depressive symptoms, clearly indicating the importance of motivation during postoperative recovery [42].

In a comparative study, Bott et al. [43] demonstrated that the long-term range of motion of replanted thumbs shows a degree of recovery comparable to that of the unaffected hand - sensory function after replantation was satisfactory, similar to that following amputation. Patients after replantation reported lower pain both at rest and under load, with no significant differences in overall functional abilities.

Prostheses

Prostheses replace a lost or missing body part in terms of appearance, functionality, or both [44]. Individually designed, customised silicone elastomer prostheses have proved to be the most acceptable option, owing to the faithful reconstruction of the anatomical shape, surface texture and uniformity of skin colour. Silicone elastomers (polysiloxanes) are considered the material of choice for their durability, comfort, stain resistance, and ability to reproduce fine surface details. Additional benefits include protection and desensitisation of hypersensitive amputation sites through constant, gentle pressure [45].

Psychological aspects and mental health outcomes

Traumatic finger amputation affects not only physical function but also psychological well-being. Psychological and emotional support is important immediately after injury, as it helps the patient engage in the rehabilitation process [46].

Psychotherapy helps patients develop coping skills and manage symptoms of anxiety and depression. A multidisciplinary approach enables adequate attention to psychological factors that may adversely affect the course of physical therapy [41].

Approximately 39% of patients with traumatic finger amputation develop prolonged grief reactions or post-traumatic stress disorder (PTSD). Risk factors include absence of replantation, thumb amputation, multiple or proximal amputations, subjective sense of mutilation, and concern about the aesthetic appearance of the hand [47].

Patients frequently report anxiety regarding functional hand impairment and the prospect of becoming dependent on relatives; conversely, they often demonstrate strong intrinsic motivation to engage in rehabilitation and return to daily activities. Uncertainty about functional recovery and the ability to work further intensifies feelings of anxiety and helplessness [48].

Depressive symptoms are common in the first two years after amputation, and both depression and anxiety frequently intensify again during readjustments to daily life following hospital discharge. The role of the mental health professional primarily involves normalising emotional reactions, enhancing communication within the multidisciplinary team, and providing ongoing psychological support. Through this approach, the patient's psychological adaptation to and coping with finger loss can be effectively improved [49].

Patient education and injury prevention

A significant proportion of hand injuries are preventable. Prevention strategies are applicable across all age groups and both sexes, and their implementation is recommended globally, though effective development requires comprehensive knowledge of the epidemiological characteristics of these injuries.

Because traumatic finger amputations are often associated with machinery-related injuries, prevention strategies should address both environmental and behavioural risk factors [50].

The 3E safety concept is an effective prevention framework for most hand injuries:

– Engineering (application of protective hand equipment in the workplace, at home, and in sport; improvement or development of new protective equipment)

– Education (public awareness campaigns; supporting behavioural change)

– Enforcement (guidelines for the safe use of machinery; state regulation of machinery; legislative measures) [50].

The risk of traumatic injury is significantly reduced by occupational safety training and the use of protective equipment such as safety gloves. The in-

stallation of physical barriers and marking of risk zones also help reduce the incidence of injuries [13].

Conclusion

Hand injuries, and traumatic finger amputations in particular, represent a significant clinical and psychological challenge, as patients frequently face fear and anxiety and have many questions about the course of their recovery. Treatment selection for traumatic finger amputations must be tailored to each patient, taking into account the complexity of the wound-healing process, the hand's functional specifics, and the patient's aesthetic and functional expectations. Despite the availability of various conservative and surgical treatment options, further prospective multicentre studies are needed to define therapeutic algorithms more precisely, whilst accounting for the numerous constraints of contemporary clinical practice. Investment in preventive and educational programs to raise awareness of specific occupational risks and the mandatory use of personal protective equipment can significantly reduce the incidence of these injuries. Effective collaboration among surgeons, nurses, physiotherapists, and psychologists, together with the patient and their family members, can greatly enhance the patient-centred approach and contribute to the most favourable treatment outcomes.

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