Fingertip traumatic amputations in children. Treatment with semiocclusive foil dressings-preliminary results

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Abstract

Introduction: Traumatic fingertip amputations in childhood constitute 2% of all hand injuries in individuals under the age of 14. These injuries have a significant impact on the psychological and emotional well-being of both the children and their parents. The treatment is multifactorial, dependent on the severity and location of the injury, and can involve both conservative and surgical approaches.

Materials and Methods: The study involved 6 patients between the ages of 8 and 15 with fingertip amputations of the hand. The average duration of treatment with semi-occlusive dressings was between 3-4 weeks. The dressing was changed once a week, and after the final dressing, the border between the wound surface and healthy skin was treated with epithelializing ointments.

Results: The average duration of treatment was 20-30 days. On average, dressings were changed 3-5 times throughout the treatment period. After the completion of treatment, the pulp had a normal shape, and the cosmetic outcome was excellent. No contractures were observed in the adjacent joints, and the two-point discrimination test had an average value of 2.5 mm.

Discussion: Fingertip amputations present challenging injuries with multiple available treatment strategies. The presented technique is relatively simple to apply, reduces pain and discomfort, and allows direct visualization of the wound surface without the need for frequent dressing changes. Treatment with semi-occlusive dressings is a minimally invasive method, particularly suitable for the pediatric age group.

Conclusion: Treatment of fingertip amputations with semi-occlusive foil dressings offers several advantages in childhood. Regular patient follow-up and cooperation from both the child and the parents are essential prerequisites for successful treatment.

Keywords —fingertip traumatic amputations, semiocclusive foil dressings, minimally invasive treatment method

1 Introduction

Fingertip traumatic amputations are common injuries of the hand in children, constituting up to 2% of all hand injuries in individuals up to 14, with 25% of these injuries being more severe requiring surgical management, often with general anesthesia[1]. These injuries have profound effect in the psychoemotional well-being of the children and on the parents. There is no clear consensus in the literature regarding the treatment of these injuries, and therapeutic options range from conservative treatment with regular epithelizing dressings or surgically-local, regional flaps and even in some cases-replantation[2]. The treatment of fingertip amputations in children is multifactorial and depends on the extent of tissue damage and location of the injury[1,2]

The aim of the current study is to present an innovative method of treating fingertip traumatic amputations in children, using semiocclusive foil dressings. The following objectives have been set:

- Detailed description of the application process and the advantages of using this technique in children
- Presenting our experience in the treatment of fingertip amputations, using semiocclusive foil dressings.

2 Materials and methods

Our study consists of 6 patients, admitted to the emergency traumatology department of MBAL "St. Anna"-Varna between November 2022-June 2023, with distal fingertip amputations. The participation of each patient in this study was done with the consent of the parents. We made no destinction between soft-tissue trauma only and patients with bone damage. The inclusion criteria that had to be met were all injuries in zones 1-4 according to the Allen classification, and injuries in zones 1-3 according to the Ishikawa classification (Table 1,2).

Table 1. Allen classification

Zone	Description
I	Distal to the nail bed, pulp defect
II	Distal half of nail bed, no bone involvement
III	Proximal half of nail bed, involvement of the distal phalanx.
IV	Proximal to the lunula

Table 2. Ishikawa classification

Zone	Description
I	Distal to midnail
II	Between midnail and nail base (eponychium)
III	Between midnail and DIJ

At presentation in the emergency department the wound was inspected thoroughly under local anesthesia, followed by thorough lavage, debridement of non-viable tissues and disinfection with polyhexanide (Fig. 1).



Fig. 1. Pulp defect, without bone involvement, after door-crush trauma, after initial wound treatment

X-ray examination was performed according to patients' history. After the initial surgical treatment of the wound surface the semiocclusive dressing was applied. A total of two strips were placed both volarly and dorsally on the injured finger, leaving a small reservoir around the wound to collect wound exudate. (Fig. 2).



Fig.2. After application of the semiocclusive dressing, a small reservoir is left around the wound. Proximally an adhesive tape is placed to avoid slippage of the foil.

In cases of profuse bleeding that could not be stopped during the initial examination, the application of the semiocclusive dressing could be delayed for 24-48 hours during which time a regular compressive dressing was applied.

After application of the semiocclusive foil we encouraged full use of the injured finger and a return to school. We omitted the use of antibiotics in all cases, relying on thorough lavage and disinfection of the wound. We didn't observe any infectious complication in any of our cases.

Dressing changes were performed weekly, because each removal of the foil results in a loss of the wound exudate in the reservoir. During dressing changes, an unpleasant odor was observed, which needed to be communicated with both patients and parents clarifying that it didn't represent a treatment complication. In cases in which the smell was problematic for patients an activated charcoal bandage was applied over the semiocclusive foil dressing which neutralized the smell.

The average duration of the treatment was 3-4 weeks, and after removal of the dressings, the border between the unaffected skin and the wounds surface was treated with epithelizing unguents until complete epithelization was achieved.

3 Results

The time to complete healing in our cases ranged from 20-30 days, depending on the severity of the injury. On average dressing changes were performed 3-5 times during this time.

After wounds surface healing following the described technique, the pulp had normal bulk and shape. Due to the improved quality of the epithelium, and the normal shape and size of the pulp, the function of the affected finger was excellent.



Fig.3. First row-primary trauma, with late presentation (24hours), results at week 3. Second row-final results at 3 months follow-up.

In our series all of our patients achieved full range of motion of the affected finger without contractures in neighboring joints. The two-point discrimination test, conducted on patients we were able to follow-up for a period of at least 3 months after complete healing had an average result of 2,5mm which is close to normal and aligns with the results reported in the literature.



Fig.4 First row – primary trauma, results at 3 week. Second row – final results at 3 months follow-up.

The drawbacks of the presented method, as presented in our study, are the unpleasant odor and the cold-sensitivity which subsides upon the complete healing of the wound.

4 Discussion

Fingertip traumatic amputations in children represent a traumatic loss of tissue in the distal phalanx area and present challenging injuries with multiple available treatment strategies[3]. The most common mechanism of trauma are cuts with sharp objects, avulsions, crush injuries, or combinations of them all[4]. Lack of parent supervision and some high-risk activities are the main risk factors for these injuries. The long-term consequences of these injuries affect the child's ability to perform daily activities such as writing, grasping objects, participation in recreational activities, and also have a lasting impact of the emotional well-being of the patient[5].

Semiocclusive foil dressings represent a thin, breathable, transparent polyurethane foil, that create a semiocclusive environment and acts as a superficial skin, preserving normal pH levels, temperature, accumulation of polymorphonuclear cells, Ig concentration, and optimal moisture that prevents wound surface desiccation[6].

The described technique is simple, provides a barrier for contamination, reduces pain and discomfort and provides the ability to directly visualize the wound surface without the need of frequent dressing changes[7].

The described method provides a convenient alternative to well-known surgical treatment methods, sparing children and parents the stress of surgical intervention[8].

We acknowledge the limitations of our study, including the lack of a control group, and the small number of patients, which hinders the generalization of conclusions, compared to larger studies.

4 Conclusion

Treating fingertip traumatic amputations using semiocclusive foil dressings has several advantages in pediatric age: it reduces the stress for both children and parents, decreases pain and discomfort, achieves excellent cosmetic results. A necessary condition to the success of the treatment is regular patient follow-up and cooperation from both the child and the parent.

5 References

1. Macgregor DM, Hiscox JA. Fingertip trauma in children from doors. Scott Med J. 1999 Aug;44(4):114-5. doi: 10.1177/003693309904400406. PMID: 10533210.
2. Muneuchi G, Tamai M, Igawa K, Kurokawa M, Igawa HH. The PNB classification for treatment of fingertip injuries: the boundary between conservative treatment and surgical treatment. Ann Plast Surg. 2005 Jun;54(6):604-9. doi: 10.1097/01.sap.0000158066.47194.9a. PMID: 15900144
3. Hoigné D, Hug U, Schürch M, Meoli M, von Wartburg U. Semi-occlusive dressing for the treatment of fingertip amputations with exposed bone: quantity and quality of soft-tissue regeneration. J Hand Surg Eur Vol. 2014 Jun;39(5):505-9. doi: 10.1177/1753193413489639. Epub 2013 May 21. PMID: 23695151.

4. Muneuchi G, Tamai M, Igawa K, Kurokawa M, Igawa HH. The PNB classification for treatment of fingertip injuries: the boundary between conservative treatment and surgical treatment. Ann Plast Surg. 2005 Jun;54(6):604-9. doi: 10.1097/01.sap.0000158066.47194.9a. PMID: 15900144.
5. Pastor, T., Hermann, P., Haug, L. *et al.* Semi-occlusive dressing therapy versus surgical treatment in fingertip amputation injuries: a clinical study. *Eur J Trauma Emerg Surg* **49**, 1441–1447 (2023). https://doi.org/10.1007/s00068-022-02193-6
6. Mennen U, Wiese A. Fingertip injuries management with semi-occlusive dressing. J Hand Surg Br. 1993 Aug;18(4):416-22. doi: 10.1016/0266-7681(93)90139-7. PMID: 8409649.
7. Georgoulis D J, Melissaridou D, Zafeiris I, et al. (August 10, 2021) Nail Regeneration of an Allen III Fingertip Amputation After a Dog Bite Using the Semi-occlusive Dressing Technique: A Case Report and Literature Review. Cureus 13(8): e17068. doi:10.7759/cureus.17068
8. Peterson SL, Peterson EL, Wheatley MJ. Management of fingertip amputations. J Hand Surg Am. 2014 Oct;39(10):2093-101. doi: 10.1016/j.jhsa.2014.04.025. PMID: 25257490.

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