

## Successful Delayed Amputated Split-Thickness Dermis Reattachment of a Fingertip Injury in the Home Setting without Sutures

M. Waterstone<sup>1</sup>, S. Keogh<sup>2</sup>, E.J. Kelly<sup>3</sup>

1. Monash Medical Centre, Calyton, VIC 3168, Victoria, Melbourne, Australia.
2. Department of Plastics and Reconstructive Surgery, Royal Melbourne Hospital, 300 Grattan St, Parkville VIC 3052, Australia.
3. Department of Plastic Surgery, Cork University Hospital, Wilton, Co. Cork, Ireland.

### Abstract

#### *Presentation*

This case reports details a fingertip amputation injury. The patient was vitally stable post-injury and blood loss was controlled with direct pressure.

#### *Diagnosis*

The injury was inspected and found to involve the finger pulp and nailbed, without exposure of the terminal phalanx (Allen 2).

#### *Treatment*

The avulsed tissue was initially placed in situ at the site of the injury. At day 3 the viable dermis from the avulsed tissue was dissected away and a split-thickness dermal graft was performed. The graft was held in place with antibacterial dressings. Epithelialisation was complete at two weeks, sensation returned to normal at five months and progress was tracked with interval photography. Overall there was an excellent cosmetic and functional outcome.

#### *Discussion*

Split-thickness grafting of the dermis has been previously described, but there are no reports of this technique being applied to fingertip injuries. De-epithelialisation may enhance the likelihood of graft survival when compared to composite grafting techniques.

### Introduction

Finger lacerations account for more than half a million emergency department visits annually in the US, and approximately 4.8 million per year worldwide<sup>1</sup>. These injuries are most commonly as a consequence of knife use, and the overwhelming majority (99.7%) are treated conservatively and released without admission<sup>2</sup>. Amputations are a complex subset of these

injuries for which there is no standardised treatment. They are classified using the Allen classification, with Type 1 and Type 2 injuries involving the pulp and/or nail bed, and Type 3 or 4 injuries involving the phalanx. Treatment options include conservative management and healing by secondary intention, skin/composite grafting and advanced surgical techniques such as microvascular replantation or use of advancement flaps<sup>3</sup>. Specialised techniques are usually reserved for Allen 3 or 4 injuries and are well-described, although increasing numbers of Allen 3 amputations are being managed solely through healing by secondary intention (with good outcomes)<sup>4</sup>. The management of Allen 1 or 2 injuries when the amputate is available for reattachment, although overwhelmingly more common, are not as well described or documented, resulting in minor injuries being potentially sub optimally managed without specialist input in the emergency department. There is therefore potential for service improvement in this area, as altered sensation, deformity, persistent pain and cold intolerance as well as prolonged healing times are commonly reported outcomes following these injuries.

### **Case Presentation**

A 25-year-old right-hand dominant surgical intern and first author of this paper sustained a fingertip amputation injury when his left thumb was injured with a knife while cooking. His medical history was unremarkable, he was a non-smoker and non-diabetic. Upon inspection, the injury involved both the finger pulp and the nailbed, but without exposure of the terminal phalanx (Allen 2)[Fig.1,2]. Blood loss was controlled by direct pressure. Simple analgesia was adequate for pain relief. As he opted not to attend the emergency department urgently due to restrictions during the COVID-19 pandemic, he replaced the amputated portion at the wound site and dressed it with a simple compressive dressing. Further intervention detailed below was undertaken in the home setting without specialist equipment.

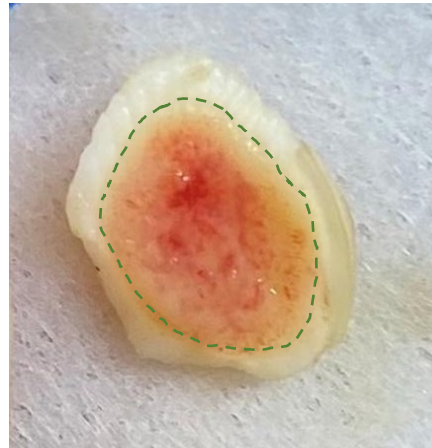
On day three post-injury the dressings were changed at home and the wound re-inspected. The amputated portion was examined in order to decide whether or not it should be discarded and was found to contain a layer of dermis which appeared vital, with granulation tissue forming [Fig.3,4].

Following informal consultation with an experienced hand surgeon, the decision was taken to use the amputate to cover the defect. It was recommended to him to trim the circumferential epidermis that did not have dermis attached to it to allow closer apposition to the wound. The amputated portion was cleaned and prepared using alcohol swabs. Inspecting it, a clear border was seen dividing the white, devitalised epidermis from the pink, vital dermis [Inset 1, 2]. Having identified the dermal-epidermal layer, two sterile 22G cannulas were used to dissect the dermis from the epidermis, with one being used to stabilise whilst the sharp edge of the bevel from the

other was used to separate the two aforementioned layers from each other [Fig.5]. This freshly-prepared



***Inset 1: Magnified amputate***



***Inset 2: Visualisation of the dermal-epidermal junction.***

amputate was then carefully placed on the wound defect [Fig.6]. An Inadine™ non-adherent antiseptic dressing was cut to an appropriate size and secured using Steri-strips™, without need for sutures [Fig.7]. These were applied with reasonable pressure so as to ensure maximal graft-site contact. Wound care continued with careful daily dressing changes for six days. At this stage, dressings were converted to dry padded dressings for comfort only. The wound was soundly healed at 2 weeks [Fig.12,13]. The fingertip remained residually painful, but this pain tapered over approximately 3 months. Sensation had returned to normal at 5 months. There were no complications such as infection or cold intolerance and the patient was able to work as normal.

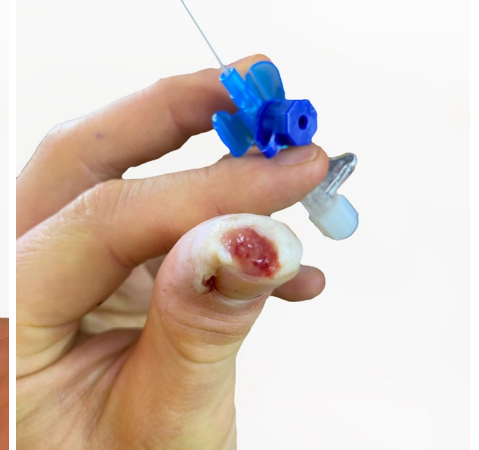
At 11-month follow up the finger contour and tissue bulk were normal [Fig14,15].



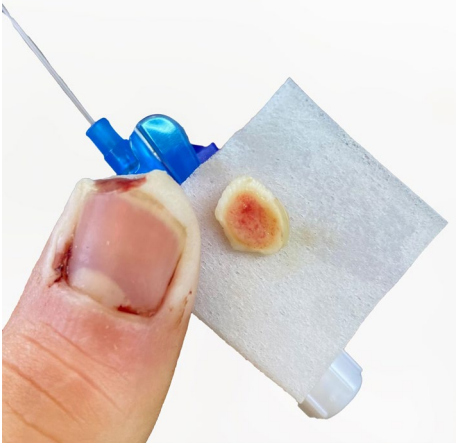
**Fig.1:** Initial injury (dorsal)



**Fig.2:** Initial injury (palmar)



**Fig.3:** Granulation tissue evident D3 post-injury



**Fig.4:** Vital dermis visible (D3 post-injury)



**Fig.5:** Dermal graft dissected from epidermis



**Fig.6:** Dermal graft in situ



**Fig.7:** Dressing with Inadine / Steri-strips



**Fig.8:** D1 post grafting (inadine in situ)



**Fig.9:** D2 post-grafting



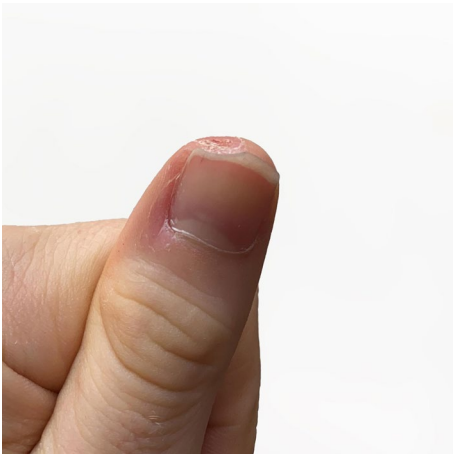
**Fig.10:** D3 post-grafting (superior)



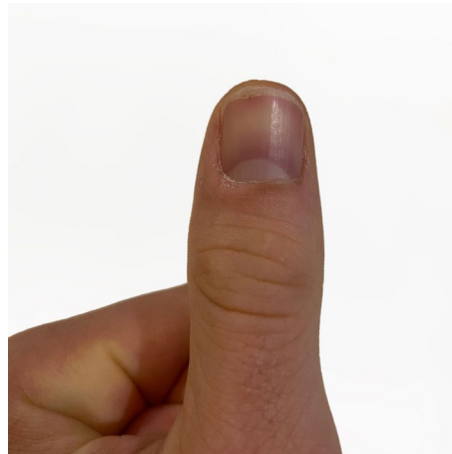
**Fig.11:** D3 post-grafting (dorsal)



**Fig.12:** D14 post-grafting (palmar)



**Fig.13:** D14 post-grafting (dorsal)



**Fig.14:** 11 months post-grafting (dorsal)



**Fig.15:** 11 months post-grafting (superior)

## Discussion

The therapeutic options for distal fingertip injuries are composite grafting or healing by secondary intention, while microvascular re-implantation or advancement flaps are considered for more proximal or extensive injuries. Composite grafting has been traditionally favoured over split-thickness grafting due to its increased durability, cosmetic superiority, absence of a donor site and improved sensation. The outcomes from composite grafting are unpredictable, however, for many potential reasons and possibly due to the thickness of the

digital epidermis especially in adults<sup>5,6</sup>. This leads to significant risk of partial or complete graft necrosis and the need for secondary procedures and delayed healing. There are reported methods of enhancing reattachment which have never gained popularity<sup>7-9</sup>. Commonly employed methods employed to reduce the risk of composite graft failure are well-described and include timely - less than four hours - and absolute precise anatomical reattachment with prior debulking of any bone remnant as well as some pulp fat from the amputate, but no reports exist of simple trimming of non-vital visible epidermis from the edges to enhance graft take<sup>10</sup>. Standardisation of technique is difficult due to the heterogeneous nature of this group of injuries, with huge variability in wound size, Allen grade and co-morbidities; therefore the more surgical techniques available to be employed, the better these treatments can be personalised to the specific injury at hand.

Healing by secondary intention has a good success rate, but is associated with a longer healing time of 6-10 weeks – with many patients having difficulty returning to work until comprehensive soft tissue coverage is achieved<sup>11</sup>. Cold intolerance and reduced fingertip sensation may also occur. In this case, complete healing is demonstrated by day 14, no cold intolerance was reported and there was no time taken off work. Reattachment of the recently-detached tissue as a graft therefore bridges the gap between autologous graft procedures and healing by secondary intention and, if successful, reduces the total healing time without the need for operative grafting or suturing. It can give a superior cosmetic or functional result.

Of note, this novel, low-tech approach can be performed in the emergency department without specialised equipment, and represents a valuable tool for the outpatient management of minor fingertip injuries. Trimming of non-vital epidermis (and maybe fat) from the amputate in a treatment room setting may also be utilised to reduce the risk of graft failure, where suitable. Although rare, grafting of the dermis alone has been previously described, and has been reported to be superior to traditional split-thickness grafting in terms of recipient site cosmesis and cosmesis<sup>12,13</sup>. There are no previous reports of this technique being applied to fingertip injuries, where it is uniquely advantageous as there is no need for a donor site. Three day delay between injury and de-epithelialisation allowed time for granulation tissue to develop both on the stump and the amputate which clearly optimises the chances of graft take with obvious evidence of abundant angiogenesis and fibroblastic proliferation. It is emphasised that while this technique was successful, this single case does not allow comparison of the outcome of this technique with that of healing by secondary intention, which would also have been an acceptable approach. Further research is required to answer this question. The arbitrary intervention at three days appears not to have harmed the graft take and may well have enhanced it.

There is an understandable belief that skin grafting is a specialised technique that is reserved for severe injuries. Here, it is demonstrated that a traumatically amputated piece of skin can be relatively easily prepared and applied to assist wound healing, without any specialist training, outside of the hospital setting, with good short and long-term results. The authors acknowledge that the injury concerned is a relatively minor one but, given the success of this arbitrary technique in a novel application, believe it warrants publication. Obtaining high-quality evidence in this field is difficult due to the heterogeneity of these injuries; it is hoped that this case report will add to the current knowledge of treatment options for fingertip amputations - to be considered alongside current techniques in managing such injuries in the emergency (and even first-aid) setting, and that the observation of the granulation tissue at day three on both wound beds and the rapid healing that ensued when the wound was manipulated at that time may be explained scientifically and help contribute eventually to enhanced wound healing.

**Declarations of Conflicts of Interest:**

No conflicts of interest declared.

**Corresponding author:**

Max Waterstone,  
Monash Medical Centre, Clayton,  
Melbourne.  
VIC 3168, Australia.  
E-Mail: waterstm@tcd.ie

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