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Paediatric fingertip composite grafts: Do they all go black?

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Summary *Background:* Fingertip injuries are amongst the most frequently seen hand injuries in the paediatric population. The present study evaluated the composite graft survival rate in distal digital amputations with respect to injury type, amputation level and time to surgery.
Methods: We performed a retrospective review of patients who underwent composite grafting of fingertip injuries over an 11-year period at a paediatric hospital. All children who underwent non-vascularized replantation of amputated fingertips were included. Patients were excluded if they failed to attend at least one follow-up appointment. Demographic information was recorded. The nature and level of injury and time to surgery was also recorded. Graft viability was characterized as no take, partial take, or complete take. The number of secondary procedures and number and duration of follow-up appointments were recorded.
Results: A total of 105 patients underwent fingertip composite grafting, of whom 96 were suitable for inclusion in this study. The median age was 2.4 years (0–16 years); there were 48 boys (46%) and 57 girls (54%). Thirty-one patients had no graft take (32%), 50 patients had partial take (52%) and 15 patients had complete take (16%). Only two patients underwent secondary revision (2%). The median number of follow-up appointments was 4, and the mean follow-up time was 68 days. Time to surgery or level of amputation did not have a statistically significant influence on outcome.
Conclusions: Over two-thirds of composite grafts in children showed some degree of take, albeit partially in the majority. Morbidity was low, and most children did not require further surgery.

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Introduction

Fingertip injuries are common and account for approximately two-thirds of hand injuries in children.[1] The most common problem is a crush injury of the distal phalanx, often with a coincident nailbed and/or pulp laceration and fracture and occasionally amputation of the fingertip.[2] The fingertip is the segment distal to the insertion of the flexor and extensor tendons on the distal phalanx and is a specialized structure that participates in the sensibility and dexterity of the hand.

With amputation of the fingertip beyond the trifurcation of the digital arteries, replantation with restoration of vascular flow is technically challenging and often impossible in children. Non-vascularized replantation, commonly referred to as composite grafting, is an alternative procedure that has variable success rates quoted in the literature.[2–6]

Composite grafting has found limited success in adults, with reports demonstrating graft survival rates of less than 50%, with smoking status negatively correlated with graft take.[4,7–9] In children, however, the increased capacity to heal, less comorbidities and the absence of smoking may lead to improved outcomes with fingertip composite grafting. Moiemen and Elliott reported 52% partial graft take and 22% complete graft take in their series of 50 children.[10] Their study compared the results in composite grafts that were replaced within 5 h post injury with those where surgery was delayed beyond this arbitrary time point. In this paediatric study, 61% of the composite grafts that were replaced within 5 h of injury survived completely, compared to 0% in the over 5 h group.

Equivocal results with this technique and seemingly better take in children led Lemmon et al. to conclude in their review article that composite grafting should only be attempted in children and young adults and should never be performed in smokers or diabetics or in the setting of crush injury.[11] Yeo states that children below the age of five do well with composite grafting, but no evidence is provided to support this assertion.[12]

This study reports our experience with almost 100 composite graft fingertip re-plantations in a paediatric population.

Methods

The surgical treatment of 105 consecutive children, with 105 completely amputated digital tips replaced as composite grafts during the period from January 2003 to December 2014, was reviewed. The electronic operating room database was searched for all cases of nailbed and/or fingertip repair, and the operative record was examined to determine whether composite grafting was performed.

Patients were included if they presented with a fingertip injury distal to the distal inter-phalangeal joint or inter-phalangeal joint of the thumb and underwent composite grafting of the amputated part. All children had detailed operation notes describing the composite graft technique. Patients were excluded if they failed to attend the follow-up or outcome was not documented.

All of the amputated parts and the digital stumps were cleaned and debrided under general anaesthetic. Small bony fragments in the amputated parts, debris and clearly devitalized tissue were removed before application of the graft; primary 'defatting' was not performed. Bleeding was arrested before replacement by a combination of elevation, pressure and minimal use of diathermy. The tip was accurately replaced with absorbable skin sutures under loupe magnification. When the nail plate was present, it was removed to allow nailbed repair. Patients were placed in a cast or splint and discharged with a 5-day course of antibiotics.

Demographic information was recorded, including patient's age, gender, laterality, specific digit involved, level of injury, presence of fracture, nailbed injury, mechanism of injury, time to surgery and presence or absence of pre-operative cooling of amputated part. Composite graft viability was evaluated by retrospectively reviewing the post-operative notes. Graft take was characterized as complete take (95–100% take), partial take (5–95% take) or no take (<5% take) through clinical assessment at the first post-operative dressing clinic visit 10–14 days after surgery. Secondary outcome measures were requirement for secondary surgery and time to discharge from dressing clinic.

Data analysis was performed using Fisher's exact test for categorical data and one-way ANOVA for continuous data, both performed on SPSS v22. A p-value of <0.05 was considered significant.

Results

A total of 105 patients underwent fingertip composite grafting, of whom 96 were suitable for inclusion in this study. The median age was 2.4 years (range 0–16 years); there were 48 boys (46%) and 57 girls (54%). The right hand was injured in 46 patients (48%), and the left hand was injured in 50 patients (52%). There was almost equal distribution of involvement of index (n = 25), middle (n = 26) and ring fingers (n = 25), with the thumb (n = 2) and little finger (n = 18) less commonly involved.

Thirty-one patients had no graft take (32%), 50 patients had partial take (52%) and 15 patients had complete take (16%). Using Moeimen's modification[10] of Ishikawa's classification[13] for distal amputations, 14% of patients were Level 1a, 54% Level 1b, 30% Level 2 and 2% Level 3 (Table 1). There was a trend towards better outcome in lesser amputations, but this did not reach statistical significance.

The most common mechanism of injury was crush, quite often in a door (n = 89, 93%), followed by sharp laceration (n = 4, 4%), and in three cases, the mechanism was not

Table 1 Level of injury did not affect the outcome. There was non-statistically significant trend towards more distal amputations having a better chance of success. Both Level 3 amputations failed.

		Level of injury				Total
		1a	1b	2	3	
Outcome	Failure of graft	2	4	3	2	11
	Partial take	7	15	8	0	30
	Successful take	7	17	2	0	26
Total		16	36	13	2	67

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