The role of two-sided splinting for recalcitrant paediatric post-burn hand flexion contracture: a case report

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ABSTRACT

A 2-year-old boy presented to the plastic and reconstructive surgery outpatient clinic with bilateral post-burn hand flexion contracture. The contracture had been released twice elsewhere. The third surgical repair on one hand at a time was conducted by the author (TOHP). However, inadequate compliance to the postoperative splinting and exercise led to the recurrence of the contracture in the following year. A customised two-sided splint was therefore created to ensure proper placement and compliance. Reinforcement to the parents to encourage the boy to practise active exercise on demand was also an integral part of the management. Good functional and cosmetic outcome were presented at 1-year follow-up. This case highlights the value of a two-sided splint for the management of post-burn hand flexion contracture in children whose compliance is inevitably cannot be guaranteed.

KEYWORDS

Burns – Child – Hand – Splints

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Background

Post-burn hand flexion contracture is managed by contracture release, secondary defect coverage, splinting, exercise and physiotherapy. It is essential for every step in the process to be conducted effectively. Improper management could cause the contracture to recur, especially in children, whose flexor musculature is naturally bent at rest and natural downside of compliance of splinting and exercise. The splint should thus be modified to be comfortable for children yet still provide optimal positioning. This report highlights the use of a customised two-sided splint for paediatric post-burn hand flexion contracture.

Case history

A 2 year-old boy presented with limited function in both hands. He had suffered from a scald burn injury to his palms when he was 7 months old. On physical examination, flexion contracture was seen; full extension of the proximal interphalangeal joints of all digits of both hands could not be achieved despite passive extension of the metacarpophalangeal joints. Previously, contracture release had been performed twice elsewhere. However, recurrent contracture

occurred, so the third contracture release was conducted by the author (TOHP).

The contracture release was conducted on one hand at a time under tumescent technique without tourniquet (Figs 1A and 1B). The fingers were then placed in extension using intramedullary K-wires and the defects were resurfaced with split-thickness skin graft. Subsequently, a palmar extension splint was applied. After 2 weeks, the wires were removed and the splint continued to be used at rest for another week before applying it as night splinting. On demand active exercises for both hands were encouraged in daily playing. Unfortunately, compliance with the splinting was inadequate and diffuse bilateral hand flexion contracture recurred within 1 year following the third surgery.

Secondary contracture release was performed once again for both hands. The raw surface was covered with split-thickness skin graft for the left hand and full-thickness skin graft for the right hand. K-wires were placed following the grafts and palmar extension splints were applied. During the following 3 weeks, the wires were released and the patient commenced exercise and physiotherapy, and was introduced to a pressure garment (Fig 2) to be worn during the day and a customised two-sided splint to be used at night (Fig 3). Both were used for 6 months. Range of motion

Figure 1 Preoperative presentation of the post-burn hand flexion contracture: (a) the right hand after injection with tumescent solution for surgery with no tourniquet. The degree of contracture seems to be lessened by the massive amount injected into the subcutaneous tissue; (b) the left hand.

Figure 2 Pressure garment used by the patient during the day.

Figure 3 Two-sided (sandwich) splint used at night.

exercises were taught to his parents to help in achieving optimal management.

The splint was constructed from thermoplastic material under full cooperation of the child when moulding it. It was edged with brown leather and connected with straps, including one on the distal phalanges in addition to one on the wrist and mid-forearm. The distal strap was needed to keep the two-sided splint in a good 'kissing' position so that the parts would not loosen (Fig 3).

Most of the fingers of both hands could obtain full extension at 1-year follow up (Figs 4A and 4B). However, there were five-degree flexion contractures of the distal interphalangeal joint of the right ring finger and left middle finger and on the proximal interphalangeal joints of the left thumb and little finger. Despite a few hyperpigmented areas, the appearance and contour of the hands were acceptable. Overall, the parents were satisfied and, most importantly, the patient was able to do daily chores.

Discussion

Recalcitrant contracture, as illustrated in this case, was an unexpected result, despite standard management. It is debatable whether the type of skin grafts influenced the outcome. Split-thickness skin grafting is associated with secondary contracture; however, it is concluded that full-thickness skin grafting is not superior to split-thickness skin grafting in terms of defects coverage after contracture release on paediatric palms.² In fact, in this report, full-thickness skin grafting was used for the right hand because the secondary defect was smaller compared with that of the left hand. In terms of cosmetic outcome, the mismatch in skin colour from non-glabrous skin will always give a less favourable result. On the other hand, the area of available glabrous skin is always limited when the donation needed is relatively large. In addition, taking skin from the sole may prevent the patient from having full mobility during the healing time. Bilateral severe hand contracture would be the most challenging to treat with limited like for like skin donated from the plantar foot, as in this case. Thus, a poor aesthetic outcome seems to be unavoidable.

Figure 4 Postoperative presentation of the hands at 1-year follow-up; (a) palmar view; (b) lateral view.

The greatest potential underlying problems that should be highlighted from this case are the postoperative splinting and exercise. The most common type of splint used is a palmar extension splint^{3,4} but the splint can slip off.⁵ Since it is difficult to guarantee the compliance of children,¹ the splint should be modified to ensure a splint with proper positioning that is comfortable to use. The use of a two-sided splint had been described in some studies.^{1,5} It is applied as a nocturnal splinting to promote two-handed activities during the day. As expected, an almost full range of movement was achieved. This splint was tolerable for an antagonistic child, as in this case. The palmar side of the splint is the same as the usual one-sided splint; positioned in neutral wrist, with the metacarpophalangeal joints at almost zero degrees, the proximal interphalangeal joints fully extended and the thumb abducted. The setting of the splint was different from the position for a long immobilisation where the metacarpophalangeal joints are in 70–90-degree flexion. In fact, positioning the metacarpophalangeal joints in extension at night was simply to prevent the contracture from recurring, while still allowing active movement during the daytime.

Conclusion

A two-sided splint should be considered for the postoperative management of recalcitrant post-burn hand flexion contracture in children, who may come with very low compliance. However, it cannot be viewed in isolation from other important factors, including exercise and physiotherapy. Further randomised controlled studies are required to prove whether the two-sided splint is superior to the single-sided splint.

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