

Pediatric Hand Treadmill Injuries

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The great popularity of physical fitness in modern society has brought many pieces of exercise equipment into our homes for convenience and privacy. This trend has come with an increasing rate of injuries to children who curiously touch moving parts, including treadmill belts. Experience with a recent series of treadmill contact burns to children's hands is described in this article. A retrospective chart review at a tertiary referral center from June 1998 until June 2001 found six children sustaining hand burns from treadmills. The patients' ages at presentation ranged from 15 to 45 months (average of 31 months, three boys and three girls). All injuries occurred in the home while a parent was using the treadmill. Burns involved the palmar aspect of the hand, mostly confined to the fingers, and the severity ranged from partial- to full-thickness burns. All patients were initially managed with collagenase and bacitracin zinc/polymyxin B powder dressings to second- and third-degree burns, along with splinting and range-of-motion exercises. Two patients required skin grafting at 2 weeks and 2 months for full-thickness tissue loss and tight joint contracture, respectively. At an average follow-up of 12 months, all patients had full range of motion and no physical limitation. The rate of children injured by exercise equipment is expected to increase. Friction burns to the hands remain a concern, although early recognition and appropriate management are associated with excellent functional outcomes. Protective modification of exercise machines seems to be the best approach to eliminating these injuries.

Key Words: Pediatric, hand, burns, treadmill, exercise

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The great popularity of physical fitness in modern society has brought many pieces of exercise equipment into our homes for convenience and privacy. With this trend, however, has come an increasing rate of injuries to children in the household, frequently from playing on these devices or touching moving parts. In 1999, there were estimated to be more than 47,000 injuries to children under 15 years old involving exercise equipment, with 9,200 occurring in those under 5 years of age.¹ The US Consumer Product Safety Commission estimates that 20% of these injuries involve either a fracture or an amputation.² A large proportion of patients present with contact burns to the hands from touching moving belts, particularly on treadmills. Initially it is difficult to assess the depth; these burns may eventually require skin grafting to prevent significant impairment from scarring and contractures. We described our experience with a recent series of treadmill injuries, their management, and outcomes.

MATERIALS AND METHODS

After Institution Review Board approval was obtained, a retrospective chart review from June 1998 until June 2001 was conducted at a tertiary referral center, which identified six children with hand burns caused by treadmills. The hospital and office records of these children were obtained for study.

RESULTS

The patients' ages at the time of injury ranged from 15 to 45 months, with the average age being 31 months old. There were three boys and three girls. All injuries occurred in the home while a parent was using the treadmill. The initial evaluation was performed by a pediatric surgeon, either in the emergency department or the office.

All burns involved the palmar aspect of the hand and were mostly confined to the fingers. The severity ranged from partial- to full-thickness burns, although some areas initially estimated as partial-thickness burns turned out to contain some degree of full-thickness loss. This evolution of appearance developed over the course of the first 1 to 2 weeks of

evaluation. One child also sustained a laceration to the affected area, with exposure of the uninjured flexor tendon, necessitating suture closure of the skin (Table 1).

Initial management in all cases consisted of application of collagenase and Polysporin powder to second- and third-degree burns and antibiotic ointment to first-degree areas. All patients were treated on an outpatient basis, with the parents performing the dressing changes at home. Dressings were changed twice daily, and patients were seen in the office every 3 to 5 days for the first 2 weeks and then several more times over the ensuing months based on clinical improvement. Most patients were evaluated by both physical and occupational therapists, who applied external splints to maintain the digits in extension and taught range-of-motion exercises to the parents, who also performed massage and dressing changes at home.

Patient 5, with the most severe burn, required split-thickness skin grafting to the affected fingers 2 weeks after the injury when the significant area of full-thickness loss became evident (Fig 1). Patient 1, whose wounds healed, eventually developed a metacarpophalangeal joint contracture and a tight interdigital web that required surgical excision and split-thickness skin grafting (Fig 2). This was performed 2 months after initial presentation.

The time from injury to last follow-up ranged from 3 to 25 months and averaged 12 months. At the time of last follow-up, all patients had full range of motion of the affected fingers, with variable amounts of scar tissue. There were no physical limitations.

DISCUSSION

With the increasing popularity of home exercise equipment, higher numbers of pediatric injuries have been observed, particularly those involving

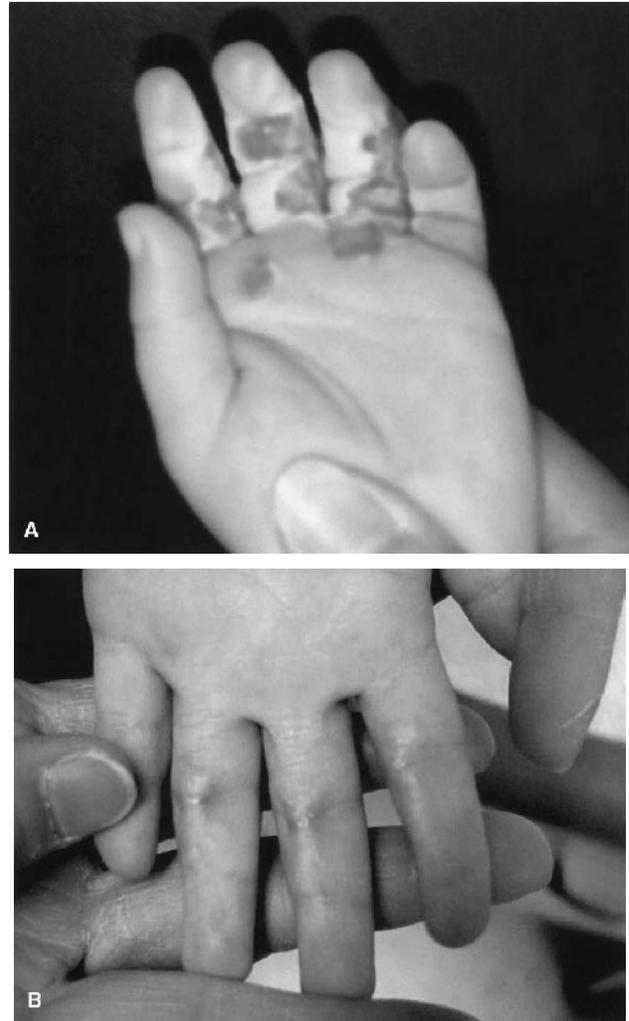


Fig 1 Patient 5 at initial presentation (A) and at 6-month follow-up (B), exhibiting adequate extension despite mild scar tightness, which resolved by 11 months.

Table 1. Injury Severity, Surgical Management, and Hand Function at Last Office Visit

Patient Number	Age (mos.)	Injury/burn Depth	Outcome
1	27	2° left 3 rd , 4 th digits 2° left 4 th digit	Contracture of left 4 th digit after 2 months requiring split thickness grafting Full function at 11 months
2	37	2° right 2 nd through 4 th digits small laceration right 3 rd digit	Full function at 3 months
3	15	2° left 4 th digit	Full function at 4.5 months
4	45	2° left 1 st digit, 2° right 2 nd , 3° right 3 rd digit	Full function at 25 months
5	28	2° left 2 nd to 4 th digits 3° left 4 th digit	Full thickness injury to left 2 nd to 4 th digits requiring split thickness grafting at 2 weeks Full function at 10.5 months
6	33	2° right 2 nd , 3 rd digits 3° right 2 nd digit	Full function at 19 months

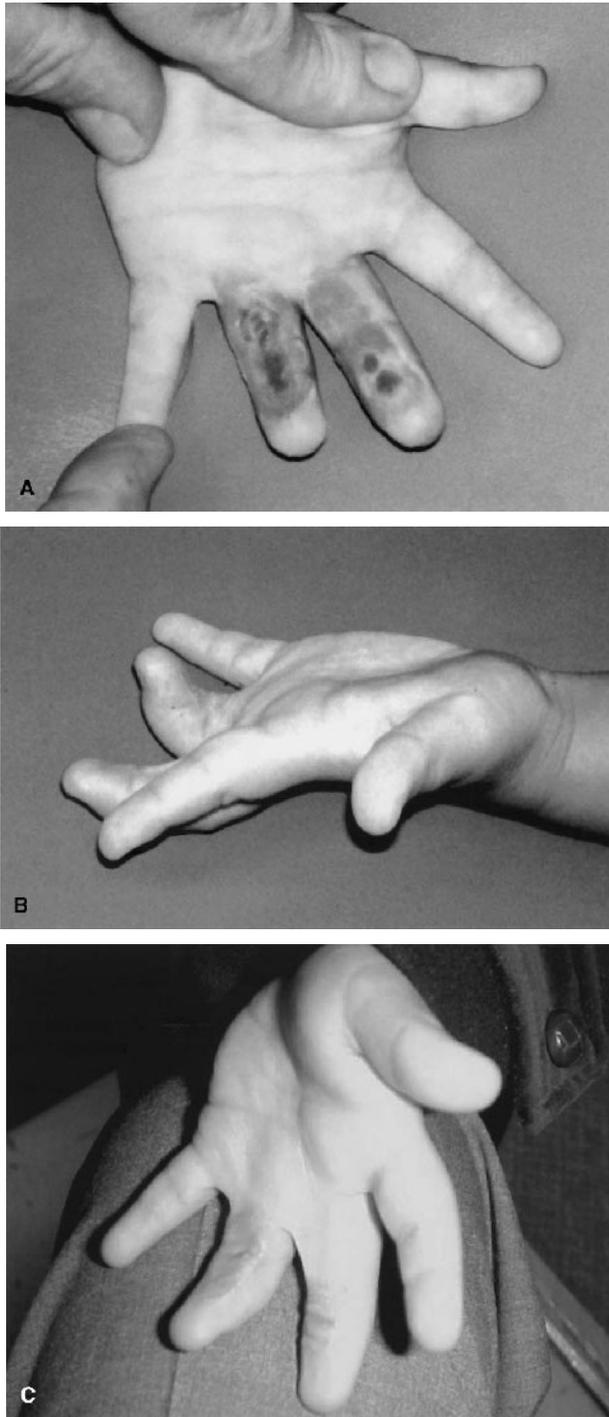


Fig 2 Patient 1 at first visit (A), at 8 weeks (B) with contractures, and 10 months after injury (C), showing minimal scarring and full extension of the affected digits.

curious toddlers. To our knowledge, there have been only two previous reports of treadmill injuries to children. A group from Qatar described three children with treadmill injuries involving dorsal hand burns.³ All our patients sustained volar injuries, perhaps related to the differing designs of the equipment. Another group recently reported 12 children with an injury pattern similar to our patients, with comparable results.⁴

The approach to managing treadmill injuries in our series is based on the difficulty in assessing the depth of a hand burn initially. This is particularly true of the more unusual friction and electrical burns. Because the skin of the volar surface of the hand is thick, it is relatively resistant to full-thickness injury. In a large review of pediatric hand burns, only 106 (15%) of 480 palm burns required grafting compared with 65% of all hand burns seen because of the greater thickness of skin.⁵ A 2- to 3-week period of conservative observation, involving dressings and enzymatic debridement, can separate out those patients who require skin grafting (Fig 3). This approach has been shown to provide good functional results, avoiding unnecessary surgical intervention.^{4,6,7} This is in contrast to the practice of aggressive early excision and grafting.⁸

All six patients in this study, representing varying degrees of injury, demonstrated full hand function when seen at last follow-up, and these results support our initial conservative management strategy. The patients require close follow-up in the office combined with access to physical and occupational therapists to ensure that the multiple care needs of these children are met.

These injuries represent a continuum of the historical pattern of burns encountered during the first half of the twentieth century, when electric clothes-drying wringing machines were in common household use. These devices contained rollers that could entrap a child's arm, causing a burn from compression and friction in addition to crush damage. Determination of injury depth was difficult initially and became more evident over the course of several days. These burns were managed with dressing changes and, occasionally, with reconstructive surgery.⁹

Protective modification to exercise machines seems to be the best approach to eliminating such injuries. This may include installing guards to shield the belt in areas where entrapment could occur, particularly at the rear end of the machine. Also, parents who use such equipment in the home should be instructed to prevent their toddler's access to the machine while it is in use. This may be done through the use of gates around the equipment or a wall mirror

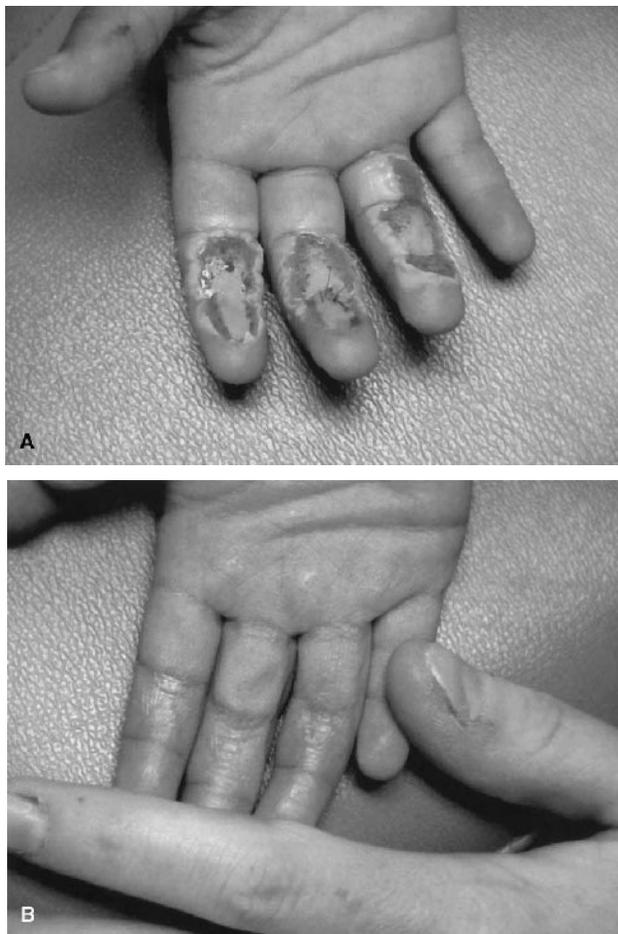


Fig 3 Conservative management of Patient 4; injury at first visit (A) and at 8 weeks (B).

to watch for children behind the machine's operator. The rate of children injured by exercise equipment is expected to continue to rise. Friction burns to the hands will likely remain a concern, although the early recognition and appropriate conservative management of these can be associated with an excellent functional outcome.

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