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Pediatric Treadmill Burns: Assessing the effectiveness of prevention strategies

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ABSTRACT

Purpose: Legislative changes in 2008 in Australia mandated that all new treadmills display a warning sticker about the risk of friction burns in children. This was accompanied by a health promotion campaign advising of the risks of treadmills to children.

Methods: Analyses of pediatric burns data identified all cases of treadmill burns occurring between 2005 and 2014. The incidence of treadmill burns, associations with age and gender, characteristics of the burns and the adequacy of first aid provided immediately after the burn was examined.

Results: There were 298 cases of treadmill burns over the 10-year period (3.5% of all pediatric burns). The incidence rose until the introduction of legislation and health promotion in 2008, and then declined over the remaining study period. The majority of treadmill burns in children were inflicted on the upper limbs (91%), and 93% involved the hands. Most burns were full thickness (62%, $n = 182$) and 49% ($n = 148$) required skin grafts. Approximately one-third of treadmill burns (35%, $n = 105$) occurred while someone else was using the treadmill. In the vast majority of treadmill burn injuries (74%, $n = 223$), there was either no first aid or inadequate first aid provided immediately after the injury.

Conclusion: A significant number of treadmill burns occur in children, and these often result in serious injuries that are not treated with appropriate first aid. A reduction in the incidence of these burns was associated with the introduction of legislation and health promotion targeted at child safety around treadmills.

1. Introduction

Home fitness has increased in popularity over recent decades due to reduced leisure time and rising gym membership costs. In the US, it has been estimated that 40 million Americans use treadmills [1], and that treadmills accounted for over 90% of all home fitness equipment sold [2]. Similar trends have been documented in Australia with expenses on recreational and sporting equipment [3]. Although positive from a chronic disease prevention perspective [4,5], the increased presence of treadmills in the home has resulted in an increase in

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treadmill-related injuries in children, especially treadmill-related burn injuries.

Several mechanisms contribute to treadmill-related injuries. The rotating belt moving at low or high speeds can cause friction burns. Limbs, fingers or toes can become trapped between the conveyor belt and the base, resulting in extensive and penetrating friction burns. Recent studies have outlined this emergent mechanism of friction burns which occur when young children crawl up behind a treadmill whilst it is on and place their hand into the rotating belt [6,7], which often produces a significant burn to the hand. Blunt trauma is another form of injury that can be sustained by children falling off the machine.

A significant proportion of treadmill-related burns are of such a depth that they often require multiple operations, wound care, physical therapy and complex reconstructive surgery to release contractures [8,9]. In early studies of friction burns, Chait et al. (1975) postulated that a developmental feature in children compared to adults places them at greater risk for friction (and other) burns. Children were found to have a slower withdrawal reflex and also had a thinner volar epidermis [10]. In the instance of a moving conveyor belt on treadmills, it can thus be inferred that children have a greater exposure time when in contact with the machine, and anatomically are more prone to more serious burns.

The number of patients sustaining friction burns from domestic treadmills in New South Wales (NSW) has increased over recent years. Statistical analyses from recent years highlighted a rising incidence in 2008 and 2009. Although there are several studies on the topic of treadmill burns in the pediatric population, no studies have discussed or assessed an approach to eliminating these injuries. Suggestions have been made that protective modifications need to be implemented, however none have followed through with making such changes or assessing their impact.

2. Intervention

Burn clinicians in NSW have been examining treadmill burns for a number of years, with the aim of developing an effective awareness and prevention campaign. The NSW Agency for Clinical Innovation Statewide Burn Injury Service (SBIS) presented the issues related to domestic treadmills to the NSW Office of Fair Trading (OFT) Product Safety Committee. This committee made recommendations that mandatory warning labels be displayed on all new domestic treadmills, and that a media campaign highlighted this danger.

The recommendations led to the creation of a prescribed product safety standard for treadmills being created through the *Fair Trading Amendment (Treadmills) Regulation* 2008, made under section 92 of the *Fair Trading Act* 1987, which states that all domestic treadmills sold must have a prominently-displayed warning stating, "**WARNING:** Keep young children away from this machine at all times. Contact with the moving surface may result in severe friction burns" (see Fig. 1). This came into effect for NSW and Queensland from 1 June 2009.

An awareness campaign also outlined the new safety standard and raised the understanding of the issue. Pamphlets were developed by the Australian Competition and Consumer Commission (ACCC). Posters were developed by the OFT

Fig. 1 – Example of warning label to be displayed on all domestic treadmills.

entitled "*Treadmills and kids don't mix!*" in collaboration with the SBIS, and were delivered to child care centers and playgroups (see Fig. 2). Information was delivered through media in print, television and radio formats.

The current study examines the epidemiology of treadmill burns in the community, identifying trends in presentation and the severity of these burns. Secondly, the study examines whether the legislative changes with respect to treadmill warnings were associated with a reduction in treadmill burns in children. Thirdly, the study attempts to raise the awareness of this growing problem and, as a first step towards reviewing a pilot awareness campaign, identify areas for improvement.

3. Materials and methods

3.1. Data

Data were obtained from the NSW Agency for Clinical Innovation Statewide Burns Injury Service (SBIS) Data Registry for the 10-year period 2005–2014. The SBIS has a centralized statewide registry of burns cases admitted to all burn injury units in NSW, and has been approved for usage by the Human Research Ethics Committee, HREC reference number 2008/11/113. Adult burn patients are cared for at Concord Repatriation General Hospital (CRGH) and Royal North Shore Hospital (RNSH), while pediatric burns are cared for at CHW. As these data only included patients treated at one of these burn units, no data were available on less severe burns that did not require treatment at any of the units. Hence, burns treated by General Practitioners or Emergency Departments in the community, which did not require the services of one of these burns units were not included in this registry. All friction burns caused by treadmill incidents were identified from this database. The SBIS data consisted of 298 such cases recorded over the 10-year period. The following variables were available for each burn case: patient demographics (including residential postcode), mechanism of burn, body part burnt, and extent of the burn.

3.2. Analyses

A retrospective review was conducted on the data obtained from the SBIS. Two groups were isolated to compare the rates