

## Highchair accidents

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In order to establish guidelines for highchair accident prevention we investigated causes, mode and complications of highchair accidents by the following methods: The charts of 103 children attending our Accident & Emergency department for highchair related injuries were studied retrospectively. Questionnaires were sent to the parents to obtain detailed information about the mode of accident. They were also asked to suggest preventive measures. In addition, a random sample survey was performed with 163 families inquiring about the rate of highchair use and the incidence of highchair related accidents. Of the 103 infants, 15.5% had sustained a skull fracture, 13.6% a brain concussion, 2.0% limb fractures and 68.9% a simple contusion of the head or lacerations to the scalp or face. The questionnaires were fully completed by 61.2% of parents. Every second family reported that their infant had tried to stand up in the highchair before falling off (only one child had been wearing a restraint). In a further 14.3% of accidents the highchair tipped over. Eighty-seven percent of parents would appreciate a pre-installation of restraints, 54.0% requested more informative instructions for users, and 33.3% asked for products with better stability. The random sample survey revealed a highchair use rate of 92%; 18% of families used highchairs equipped with restraints, and 6% reported highchair accidents sustained by their children. We conclude that most highchair accidents occur when unrestrained infants try to stand up. Pre-installed child restraints, better manuals for users and increased highchair stability should be recommended as promising accident prevention strategies. □ *Accident prevention, child, head injury, highchair, restraint*

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Highchairs are frequently used in European households to render feeding of infants more comfortable and to enable infants to join the family when sitting around the table. An analysis of Australian injury data collected by the Injury Surveillance and Prevention Program (NISPP) indicates that highchair accidents account for 2.6% of all injuries in the first year of life (1). One death resulting from a fall from a highchair is also reported in this study (1). In 1989, approximately 3700 infant seat accidents were recorded in the United States (2). In Massachusetts, highchair-related accidents accounted for 1.1% of all emergency room visits in children aged 0–5 years (3, 4).

The lack of detailed publications on the nature and circumstances of highchair accidents makes it difficult to adequately analyse the risks involved, so that technical safety standards can be set. To this end, the study was planned in collaboration with the Austrian Standards Institute.

### Patients and methods

The study population was raised from patients and their families attending the casualty department of the

paediatric surgical unit at the University Hospital in Graz, which serves as the central paediatric trauma unit treating approximately 50% of all paediatric accidents registered in the county of Styria—which has 1 million inhabitants, 13 000 births/year, and a paediatric accident rate of roughly 12 000/year.

The study is divided into three parts: Part (a) Over a 3-month period we asked 163 randomly selected families with children 2–6 y of age who attended our Accident and Emergency department for non-highchair-related injuries whether they had used a highchair for their youngest child, with or without child restraints, whether they had modified the highchair to improve safety, and whether the child referred to had suffered any highchair accident.

Part (b) In addition, we retrospectively analysed the records of 103 children who had sustained a highchair-related injury between April 1992 and March 1997. The patients were classified by age, gender, mechanism, type of injury, and outcome. A cranial CT scan was performed if the Glasgow coma score adapted for infants and toddlers was 13 or less (5). Children who had sustained a skull-fracture or cerebral concussion defined by unconsciousness or recurrent vomiting after the accident were admitted to the ward for observation.

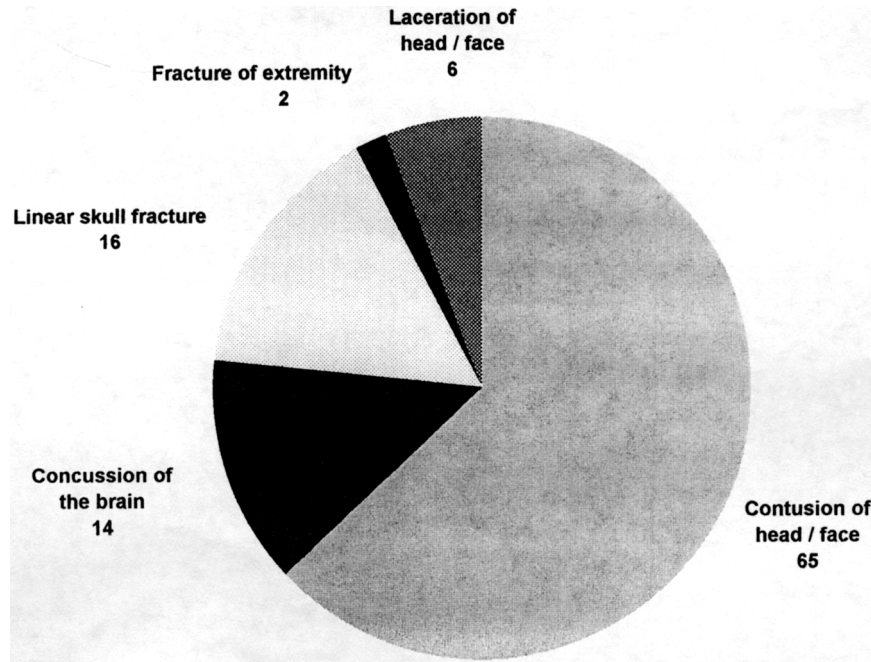


Fig. 1. Main diagnoses in 103 highchair accidents.

These patients were reviewed as outpatients 2–5 months after the accident and their parents asked about behavioural changes in between.

Part (c) Questionnaires were sent to all parents of the children identified in part (b) asking for the mode of accident, for the type of highchair, whether child restraints had been used, when parents had started and discontinued use of the highchair and for the age of onset of free walking of their child. We further asked for consequences or sequelae of the accident.

*Statistical analysis*

Differences between groups were evaluated using the chi-square test. Values are reported as mean (range).

**Results**

*Random sample survey*

The group of 163 families included 84 boys and 79 girls; 79 of the boys (94%) and 71 of the girls (90%) had used highchairs. Infants were placed in highchairs for the first time at an age of 8 mo (5–12 mo). The use of highchairs was continued until the age of 24 mo (12–48 mo). Of nine infants (6%) who had sustained a highchair-related accident, 7 were boys and 2 were girls. In 5 cases no physician was consulted, but 4 infants (44% of those injured) were taken to a surgery or an Accident and Emergency department for minor injuries.

Out of the 150 families who had used highchairs, 18% of families had equipped their highchairs with child restraints (usually child restraints were removed from strollers and attached to the highchair) to prevent their child from standing up in the highchair, and 7.3% of families had fixed the highchair to a table to prevent the highchair from tipping over. None of the families who had equipped the highchair with child restraints or who had fixed it to a table reported highchair accidents sustained by their children.

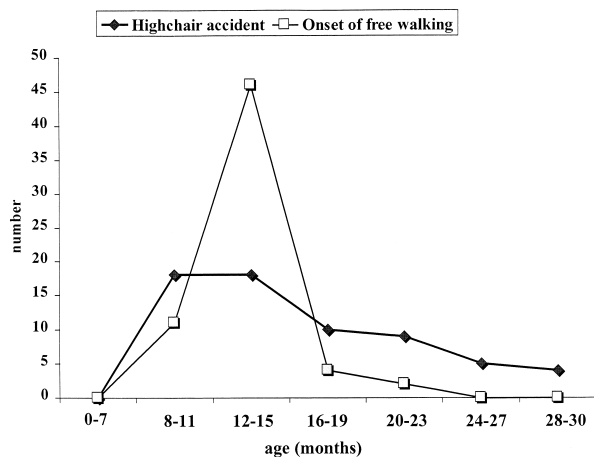


Fig. 2. Comparison of the age at occurrence of accident and onset of free walking in 63 children injured in highchair-related accidents.

Table 1. Suggestions by parents ( $n = 63$ ) for prevention of highchair accidents.

Preventive measure	No.	%
Highchairs equipped with pre-installed infant restraints	55	87.3
More informative manuals for users, bold warnings on the back support	34	54.0
Increased stability to avoid tipping-over	21	33.3
Higher / adjustable armrests	11	17.5
Adjustable / removable playing table or front hand rail	10	15.9

### Retrospective analysis

The 103 infants injured in highchair accidents comprised 60 boys and 43 girls. Their mean age was 13 mo (7–30 mo). The type and location of their main injuries are presented in Fig. 1. All children had sustained a head injury, which was the main injury in 98%. Thirty-one (30%) had to be admitted for observation. Follow-up examinations of infants who had sustained brain concussion or a fracture of the skull did not reveal any behavioural changes, neurological deficits or growing skull fractures.

### Results of questionnaires

Sixty-three of 103 parents (61.2%) returned a fully answered questionnaire. Age distribution of infants at the time of injury and of onset of free walking is shown in Fig. 2.

**Mode of accident.** Thirty-two of 63 families (50.8%) reported that their child had tried to stand up in the highchair shortly before the fall. Of these 32 children, 28.1% fell forward, 53.1% to the left or right, and 18.8% backwards over the backrest (height of backrest: 20–35 cm). Two of the 63 infants (3.2%) aged 23 and 30 mo fell when trying to climb a highchair equipped with a playing table. Only 2 (3.2%) of the families had highchairs equipped with child restraints. One of these did not use the restraint. In the other, the restraint was not tightened sufficiently. Both children were therefore able to stand up in the highchair and lose their balance.

The use of highchairs equipped with child restraints was significantly higher among the families in the random sample survey (27 of 150 [18%]) compared with the families whose children had been admitted for highchair accidents (2 of 63 [3.2%]) ( $p < 0.01$ ).

Nine children (14.3%) with a mean age of 16 mo (9–30 mo) were injured when their highchair tipped over, and one infant, aged 11 mo, was injured when the seat part of a highchair (consisting of a seat part and a table) fell off.

In all tipping-over accidents the highchair had been placed close to a table. Parents reported that the mechanical contact between the rim of the table and the upper edges of the highchair, or the border of the

highchair playing table, precluded positioning the highchair closer to, or under, the table to prevent the infant from placing his feet on the rim of the table and pushing the highchair back. None of the highchairs involved in these 63 accidents had been fixed to a table.

One child slid under the playing table of the highchair when a crotch strap tore off.

Eighteen of 63 parents (28.5%) did not observe the accident but found the child on the floor in front or beside the highchair.

After the accident, 90.5% of families continued to use the highchair. Only 10.5% of the families who continued to use the highchair attached child restraints to the highchair and 4.8% fixed the highchair to a table to overcome instability problems.

### Suggestions of parents to increase highchair safety.

Parents were asked in the questionnaire to write down ideas for highchair accident prevention which they considered effective and acceptable. Most of them would welcome highchairs equipped with pre-installed child restraints and more informative instructions for use as well as adequate warnings (Table 1).

## Discussion

In the random sample survey a highchair accident rate of 6% was found for infants seated in highchairs. Almost half of these necessitated consultation of a physician. The retrospective analysis demonstrates that all infants suffering a highchair accident sustained head injuries. This is in agreement with the findings of Watson et al., who reported that such falls entail a high potential for serious injuries, most of which affect the head (1). The majority of accidents in younger infants occur when infants try to stand up in the highchair. Such behaviour can occur as early as 2–3 months before the onset of free walking.

Most highchairs are equipped with back supports which were at least 5 cm higher than the arm rests. This explains the lower rate of falling backward compared with sideways.

Fifty-five of 63 parents (87.3%) whose infants have sustained highchair accidents stated that they would prefer highchairs with *pre-installed infant restraints* to prevent the infant from standing up. Parents fear that restraints installed later will not be accepted by the children.

We recommend that highchairs be manufactured with adjustable safety belts in combination with a crotch strap and a proper locking mechanism. These features should be readily adjustable and easy to clean. Regarding the type of highchair restraint we agree with Watson et al. that a full harness provides more effective prevention of highchair accidents than a lap-belt type restraint (1). A reasonably priced, transferable full

harness (e.g. transferable between stroller, highchair and supermarket trolley) and development of equipment with standard attachment points could increase the willingness of parents to use this type of restraint (1). Circular lap-belt type restraints (using a 3- or 4- point fixation technique) should be designed allowing easy adjustment and safe fixation.

Parents need to be warned by drawings and warnings on the back support such as "never leave your child unattended in the highchair" and "use child restraint".

Parents should also be made aware that their child will try to climb out of the highchair towards the end of the second year of life. At this time parents should either remove the front playing table or front handrail to allow their infant easy access to the seat or discontinue the use of the highchair.

Technical measures to reduce the number of tipping-over accidents would include widening the distance between the legs of the highchair and increasing the weight of the highchair together with lowering the centre of gravity. An alternative would be a solid fixation of the highchair to a stable table. The height of the back rest and arm rest should not be reduced—against tendencies in present discussions.

The height of the playing table should be adaptable to the length of the growing child and playing tables as well as front hand rails should be detachable to be

removed as soon as the infant makes attempts to climb the highchair.

## Conclusions

Highchairs are widely used in Central Europe, and highchair accidents mainly cause head injuries. Highchairs pre-equipped with infant restraints, more informative safety instructions, and increased highchair stability could lower the number of highchair accidents. These aspects should be taken into consideration in the development of product safety standards.

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