

Ocular Injuries by Elastic Cords in Children

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ABSTRACT. *Background.* Elastic cords hitting the eyeball as high-speed projectiles can severely damage ocular structures and can produce permanent visual function impairment.

Objectives. To evaluate the frequency, mechanics, and severity of eye injuries caused by elastic cords in children to adopt the most appropriate preventive measures.

Methods. A retrospective medical records review of hospital admissions secondary to ocular trauma between 1991 and 1997 in a pediatric ophthalmology unit at an urban tertiary care pediatric hospital was performed to select all children admitted for ocular injury caused by an elastic cord.

Results. Eight children fulfilled the inclusion criteria; the prevalence ratio was 2% of all pediatric trauma admissions. In all cases the mechanics of trauma was a combination of blunt and high-speed projectile injury. The mechanism of trauma in younger patients was typically a cord that was misused during unsupervised playtime, whereas cord slipping from car roof racks was noted in older patients. One patient suffered a severe permanent visual impairment caused by retinal detachment. All other children regained full visual acuity at the time of discharge and maintained it through a mean follow-up of 22 months (range: 18–29).

Conclusion. Circumstances of injury in younger children are different from those found in older children, the latter being similar to those reported for adults. Prevention is the primary measure to be taken to reduce the prevalence of this injury and to lower the risk for ocular severe anatomic damage as much as possible. This can be achieved primarily by modifying the design of the hooks, intensifying educational campaigns, and keeping elastic cords out of children's reach. *Pediatrics* 2000;106(5). URL: <http://www.pediatrics.org/cgi/content/full/106/5/e65>; *ocular traumatology, pediatric age, elastic cord, prevention.*

Ocular trauma is a leading cause of severe anatomic and functional impairment of the visual system^{1,2}; various reports emphasized the high occurrence and frequent severity of eye injuries in children.^{3–8} The greatest number of eye injuries occur during playtime or sports activities, primarily attributable to falls and to free projectiles hitting the globe at high velocity.⁹ Among potentially dangerous ocular injuries, those caused by elastic cords with attached metal or plastic hooks deserve special attention (Fig 1). Adults commonly use these

devices for securing luggage on car roof racks. Ophthalmic literature previously described epidemiologic and clinical characteristics of this injury among adults, but in these reports children are very rarely encountered.^{10–14} Unfortunately, elastic cords represent an intriguing attraction for younger children, who misuse them during playtime, with a lack of proper adult supervision. Even if injuries causing severe anatomic and functional impairment are not frequent, the ability to prevent them by modifying the design of the elastic cord and by educating children and their supervisors represents a realistic goal.

This article reports a summary of circumstances, clinical course, and visual outcome in pediatric patients who came to our observation after suffering eye trauma caused by elastic cords.

METHODS

The files of all subjects <16 years of age who were hospitalized between 1991 and 1997 directly on decision of the emergency department pediatrician who judged the ocular trauma to be sufficiently severe at the Ophthalmology Unit of the Children's Hospital of Trieste, an urban, tertiary care, pediatric hospital, were retrospectively reviewed. Independent from hospitalization length (range: a few hours through 16 days), all medical records regarding eye injury caused by elastic cords were selected. For each patient, the following details were recorded: age, sex, circumstances of trauma, extent of eye injury, and visual acuity at admission and at the time of discharge. All children were followed for a mean time of 22 months (range: 18–29).

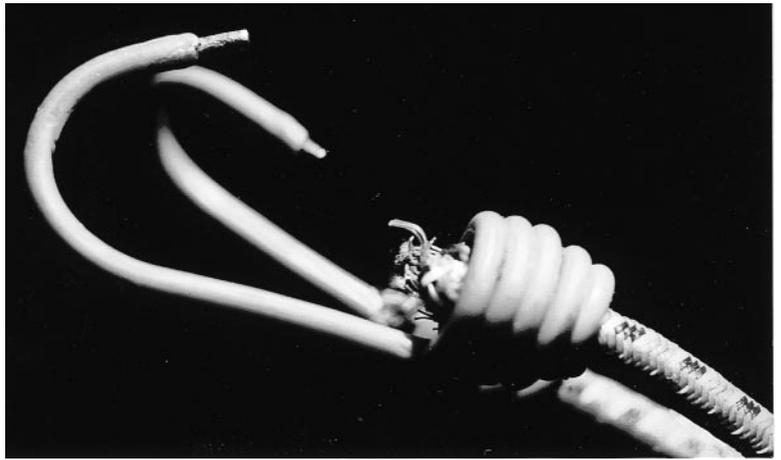
RESULTS

During this 7-year period, 409 pediatric admissions secondary to ocular trauma were recorded and 8 patients with eye injury attributable to elastic cords were identified. This accounts for 2% of prevalence ratio. Demographic and clinical findings are summarized in Tables 1 and 2. Visual acuity at admission and on discharge is shown in Table 2. None of the subjects wore eyeglasses or contact lenses at the time of the trauma.

Reviewing the circumstances of injury, 5 occurred while the child was playing alone or with other children; the elastic cord was first stretched and then slipped out of hands (case 5) or one of its ends was untied from where it was secured (cases 1, 2, 4, and 6). These 5 patients were among the youngest of the present series (Table 1). In 2 patients (cases 7 and 8, the oldest among our patients), the injury occurred while they were securing luggage on car roofs, when the hook attached on the car roof rack slipped as the strap was tightened. Case 3 occurred during holidays while the child was helping his father to pitch a tent. The hook attached on one of trailer tent's end slipped as he tried to unfasten the strap.

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Fig 1. A metal hook placed on the extremity of an elastic cord.



The majority of injuries in our series were nonpenetrating. Only in case 7 was the trauma partially penetrating; it produced a superior lid penetrating wound with small conjunctival laceration. The sclera and anterior segment of the eye were not involved. In the other 7 cases, the spectrum of anterior and posterior globe injuries and of their severity was very broad (Table 2). The most common clinical findings were retinal edema (5 cases), followed by corneal abrasion, hyphema, reactive iridocyclitis, and traumatic mydriasis (each noted in 4 cases).

Visual acuity on admission ranged from 20/20 (in 3 patients) to light perception (1 eye). At the time of discharge from hospital, all of the patients but 1 (case 2) recovered full visual acuity. For patient 2, visual acuity on admission was light perception and the severity of trauma was corroborated by the presence of 4-mm hyphema and a small vitreous tuft into the anterior chamber. No scleral rupture was present. Vitreal hemorrhage precluded the fundus examination. On A-B scan echography, the retina appeared totally attached. In the following days, vitreal hemorrhage slightly cleared and visual acuity improved up to 4/200, but the lens appeared slightly subluxated nasally and superiorly. On the eighth day, suddenly a total funnel-shaped retinal detachment appeared. Surgery comprised of pars plana lensectomy, vitrectomy with silicone oil tamponade, and scleral buckling was performed. A satisfactory anatomic outcome for the superior hemiretina was achieved, but the inferior half still appeared detached. At the time of discharge, visual acuity was light perception.

The final follow-up examination was made for all patients after an average interval of 22 months (range: 18–29); at the last control, all patients but case 2 retained a full visual acuity and no major ocular complication was detected.

DISCUSSION

Elastic cords with attached plastic or metallic hooks are a diffuse and commonly used method to secure luggage or other objects to car roofs. Eye injuries from these devices may occur when, during cord tightening, one of the hooks slips from the site of attachment and hits the globe with high velocity and energy. This mechanism of trauma is common in

adults and young adults, as previously reported^{10–13}; in these articles, however, only adult patients were observed, whereas only Nichols et al¹⁴ described a case occurring in a 7-year-old boy.

Our report considered only children, and it seems that among children injury occurs as a consequence of different activities. As has been already reported by Nichols et al¹⁴ for patient 1 of their study, children like to tie the hook placed at one cord end to a variety of sites, such as trees, branches, gates, chairs, and tables. These dangerous games can take place when parental supervision is lacking. This situation was noted in 4 cases of the present series; patients 1 and 4 hurt themselves playing alone while at home, after the hooks slipped from furniture edges where it was previously attached. Patients 2 and 6 were injured while playing alone in the home garden and in the street, respectively. In the first case the hook was tied to a bush, and in the second it was attached on a gate. Both children were injured after they strengthened the cord. One more possible mechanism is the involvement of another child holding the other end of the cord. This situation occurred for patient 5 of this report, while playing with his brother.

These 5 patients were the youngest among those described in this report.

Similarly to other studies on eye injuries in children, the vast majority of our patients were males (7 of 8). In their reports, both Gray et al¹² and Nichols et al¹⁴ noted that all of the patients were male, whereas Cooney and Pieramici¹¹ had 82.4% male patients.

Considering previous reports on adults, visual outcome is not simply influenced by the perforating nature of the trauma. Poor visual outcome is sometimes described even for injuries without globe perforation but with posterior segment damage. In 1988 Gray et al¹² found a globe perforation in only 1 of 6 patients, while in other 4 cases final visual acuity was impaired by vitreo-retinal damage or by secondary cataract. In 1991 Nichols et al¹⁰ reported 2 perforating cases out of 5 patients with poor visual outcome attributable to retinal detachment.¹⁴ In 1998 in their series, Chorich et al¹⁰ had no case of globe perforation, but 3 patients required surgery because of posterior segment involvement. In our case-record all children suffered a combination of blunt and projectile trauma without eyeball

TABLE 1. Demographic Summary: Circumstances of Injury and Hospitalization Length of Eight Patients With Ocular Injuries by Elastic Cords

Case No.	Age (Years)	Sex	Circumstances of Injury	Involved Eye (R/L)	Hospitalization Length (Days)
1	4	M	Playing alone at home	R	3
2	6	M	Playing alone in the garden	R	16
3	6	M	Fastening strap on trailer tent at camping	L	3
4	7	F	Playing alone at home	R	2
5	8	M	Playing with brother in the street	R	5
6	9	M	Playing alone in the street	L	4
7	13	M	Securing luggage on car roof	L	1
8	14	M	Securing luggage on car roof	R	4

TABLE 2. Clinical Summary: Initial and Final Visual Acuity of Eight Patients With Ocular Injuries by Elastic Cords

	Cases							
	1	2	3	4	5	6	7	8
Lid hematoma	-	-	-	+	+	-	-	-
Lid wound	-	-	-	-	-	-	+	-
Conjunctival wound	-	+	-	-	-	-	+	-
Subconjunctival hemorrhage	-	-	-	-	-	-	-	+
Corneal abrasion	+	-	+	+	-	-	-	+
Iridocyclitis	-	-	-	+	+	+	-	+
Iridodialysis	-	+	-	-	-	-	-	-
Hyphema	-	+	-	+	-	+	-	+
Traumatic mydriasis	-	+	-	+	+	+	-	-
Lens subluxation	-	+	-	-	-	-	-	-
Retinal detachment	-	+	-	-	-	-	-	-
Retinal edema	+	+	+	+	+	-	-	-
Vitreo-retinal hemorrhage	-	+	-	-	+	-	-	-
Initial visual acuity	20/20	LP	20/20	20/30	20/40	20/60	20/20	20/60
Final visual acuity	20/20	LP	20/20	20/20	20/20	20/20	20/20	20/20

perforation; this is a possible explanation for the generally good visual outcome for children in this series, except for patient 2 who sustained the most severe injury. The remaining patients retained or regained full visual acuity at the time of discharge and maintained it throughout the entire follow-up. An additional reason for this positive outcome may be the fact that younger children are not strong enough to stretch cords as far as adults can.

As previously suggested for all kinds of ocular injuries, prevention is the primary goal. The prevalence of these injuries is probably underestimated, because less severe forms of injury probably do not come to medical observation. In our case studies, 2% of all pediatric admissions secondary to eye injuries are caused by elastic cords. Parents and teachers have the responsibility to instruct children about the potentially devastating nature of elastic cord injuries and to keep them out of children's reach to reduce the risk of their misuse. This task could be assigned also to family physicians and to pediatricians who probably represent the ideal educators for children and their parents.

Manufacturers should also be encouraged to play their part. We agree with Gray et al¹² who suggested that the design of the hooks used to secure elastic cords should be modified. A spring-loaded, metal-gate clip, similar to those used for dog leashes, would probably reduce the risk of hook accidental release from car roof

racks. Furthermore, printed warnings on the packaging of bungee cords can also be valuable.

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