Can changing the rules and providing adequate face protectors reduce — even eliminate — eye and facial injuries in hockey players?

In 1974, a committee of the Canadian Ophthalmological Society (COS) was formed to study the incidence, types and causes of hockey eye injuries and to devise means of reducing such injuries. A retrospective study of the 1972-73 hockey season revealed eye injuries to 287 players, 20 of whom were legally blinded in one eye (unpublished brief to the COS Council). In 75% of cases the hockey stick was the cause of injury. Subsequently, a prospective study[1] during the 1974-75 hockey season identified a further 253 players with eye injuries, 42 of whom were legally blinded in one eye; the hockey stick accounted for 62% of these injuries.

Presentation of a report on that study (phase I) to the COS annual meeting, in June 1975 was followed by a panel discussion with nonmedical experts. This aroused interest in the news media (see appendix), and publication of the study resulted in further publicity. The COS hockey eye injury committee recommended that all amateur hockey players wear face protectors and that parents be urged to provide adequate protective equipment and proper coaching for their children. Concurrently, Dr. Paul Vinger, in Boston, recommended that all hockey players wear a full-face protective mask affixed to an adequate helmet.[2]

The Canadian Amateur Hockey Association (CAHA) introduced new, high-sticking rules for the 1975-76 season,[3] and the Canadian Standards Association (CSA) technical committee on protective equipment for hockey and lacrosse players intensified efforts to

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Eye injuries in Canadian hockey. Phase II

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introduce standards for face protectors. A standard[4] will be available in print for the 1977-78 hockey season. Officials of the federal Department of Consumer and Corporate Affairs, have proposed new regulations under the Hazardous Products Act whereby a necessary requirement for the sale of masks would be that they meet the CSA standard.

Face protectors have become popular with young players, although they are not mandatory here as they are in the US (Fig. 1); by May 1977, 300 000 had been sold in Canada. Approximately 600 000 players are registered with the CAHA, and it is estimated that there are another 300 000 not registered. Thus it appears that one of every three amateur players now wears a face protector. It is estimated that by October 1977 two-thirds of all players will be wearing them. The cost of wire-mesh masks starts at $10; combination wire and Lexan masks cost from $18; replacement Lexan portions cost $5.

Changing and enforcement of rules by the Canadian Amateur Hockey Association (CAHA) and provision of adequate face protectors by the Canadian Standards Association (CSA) technical committee have resulted in a marked reduction in the number of eye injuries suffered by amateur hockey players in Canada. This is evident from comparison of the types, severity and causes of eye injuries, their effect on vision and the age distribution of the patients during the 1974-75 and 1976-77 hockey seasons. (Rule changes and the use of face protectors became effective in the intermediate season.) Dental and other facial injuries also can be reduced; in particular, injuries in goaltenders should be greatly reduced, if not eliminated, by a change to the CSA-approved wire-mesh mask. It seems certain that face protectors will become compulsory for all amateur hockey players registered with the CAHA. The cost of the necessary equipment and the inconvenience of wearing it are a small price to pay for the protection afforded.

To determine the efficacy of face protectors and whether the new hockey rules are having any effect, data of eye injuries reported to the COS during the 1974-75 and 1976-77 seasons (1 Sept. to 15 May) were compared. The new CAHA rules penalizing high-sticking were introduced in time for the season between the study periods.

Study data

Comparison of eye injuries during the two seasons showed a decline in reported eye injuries from 253 to 90 (Table I); only one type of injury (ruptured globe) did not decrease in incidence. Assessment of visual acuity after injury showed an encouraging reduction in both the number and the incidence of legally blinded eyes, from 37 (1 in 7 injured eyes) to 11 (1 in 8), as shown in Table II. Details of the injury were reported for eight players, seven of whom were wearing face protectors (non-CSA-approved models) at the time (Table III). Legal blindness was reported for no masked players other than goaltenders.

The hockey stick was the main injuring weapon, accounting for 54% of the 1974-75 injuries and 45% of those in 1976-77 (Table IV); this slight decrease was countered by an increased proportion of puck-induced injuries.

The age distribution of players with eye injuries (Table V) demonstrated a significant shift from younger to older age groups. This shift was even more dramatic in relation to players rendered legally blind in one eye, from 33% to 9% in children up to 15 years old.

Discussion

Almost certainly the reduction in incidence of hockey eye injuries is great-

Table I—Types of reported eye injuries sustained while playing hockey

	1974-75 (253 reports)	1976-77 (90 reports)
Soft-tissue damage	180	65
Orbital fracture	15	6
Corneal abrasion	49	15
Corneal laceration	13	1
Iris damage	75	25
Hyphema	106	34
Traumatic glaucoma	17	5
Lens damage	26	4
Vitreous hemorrhage	25	9
Macular damage	31	12
Choroidal damage	16	3
Retinal damage	19	7
Optic-nerve damage	2	0
Ruptured globe	4	4
Total	576	181

Table II—Visual acuity after eye injury

Visual acuity	1974-75	1976-77
20/20	122 (67%)	49 (67%)
20/40	41 (23%)	21 (29%)
20/60	10 (5%)	1 (1%)
20/100	9 (5%)	2 (3%)
Subtotal	182	73
Legal blindness (unilateral)		
20/200	6	3
<20/200	24	4
No light perception	7	4
Subtotal	37 (15%)	11 (12%)
Total reported/total cases	219/253	84/90

Table III—Injuries sustained by amateur hockey players wearing non-CSA-approved face protectors* during the 1976-77 season

Player	Mask	Cause of injury	Injury	Visual acuity
Goaltender	Molded	Puck	Cataract	20/200
Goaltender	Molded	Puck	Hyphema	LP
Goaltender	Molded	Puck	Macular edema	20/20
Goaltender	Molded	Puck	Malar fracture	20/20
Skater	Large aperture	Stick	Soft-tissue injury	20/20
Skater	Large aperture	Fell	Broken tooth; cut lip	20/20
Skater	Large aperture	Stick-blade	Facial laceration	20/20

*One additional goaltender, who was not wearing a mask, sustained hyphema and glaucoma as a result of injury with a stick; his visual acuity is 20/200.

Table IV—Causes of eye injuries

	1974-75		1976-77	
Cause	Total	Unilaterally legally blind	Total	Unilaterally legally blind
Stick	137	20 (54%)	50	5 (45.5%)
Puck	68	13 (35%)	32	5 (45.5%)
Other	15	1 (3%)	6	1 (9%)
Not stated	33	3	2	0
Total reported	253	37 (15%)	90	11 (12%)

Table V—Age distribution of the injured players

	1974-75		1976-77	
Age (yr)	Total	Unilaterally legally blind	Total	Unilaterally legally blind
< 11	28	5	10	0
11-15	76	6	18	1
16-20	56	9	29	5
> 20	69	13	33	5
Not stated	24	4	0	0
Total	253	37	90	11

er than recorded in this study: in view of the COS members' increasing awareness of the problem, there is no doubt that a far greater percentage of injuries was reported for the second season. The small but definite reduction in stick-induced blinding injures may reflect the introduction and enforcement of new CAHA high-sticking rules during the 1975-76 season. The shift of injury incidence from the younger to the older group of players almost certainly reflects the readier acceptance of face protectors by younger players, either by choice or parental persuasion.

The overall trend to lower incidence of eye injuries in hockey players has been paralleled at The Hospital for Sick Children, Toronto (Table VI), but in some other centres the toll is still high. Ophthalmologists at the University of Montreal report 14 eyes rendered legally blind as a result of retinal detachment during amateur hockey; none of the players was wearing a face protector. However, the authors state that vision in most of these eyes could have been saved had treatment been instituted sooner, emphasizing the need for intraocular examination of players with extraocular injuries.[5]

Proof of the value of face protectors in preventing facial injury is provided by Dr. David Dickson (personal communication), president of the Brampton Minor Hockey League. This league provides hockey for 2200 boys aged 8 to 20 years, who are required to wear an adequate face protector. All hockey injuries suffered at the Brampton Arena that require hospital attention are directed to Peel Memorial Hospital. Between 15 Sept. 1976 and 5 Jan. 1977

Table VI—Eye injuries treated at The Hospital for Sick Children, Toronto, 1973-75

	Total	Sustained during hockey	
1973	453	52	(11.5%)
1974	574	48	(8.4%)
1975	699	38	(5.4%)

FIG. 1—Adequate face protectors now in use in Canada and the US: combination Lexan and wire mesh, left; wire mesh, right.

138 hockey injuries were treated there — including 65 facial injuries to players wearing no facial protection, but none among the 2200 (masked) boys. A further benefit relates to the teeth. Two dental surgeons (A.W.S. Wood and F. Pulfer) who are active members of the CSA technical committee for protective equipment for hockey and lacrosse players have helped to establish standards for dental protection with the new full-face protectors. This has overcome the inadequacy of some of the old-type tooth protectors. A report by otolaryngologists at the universities of Michigan and Minnesota detailed the numbers of lacerations, fractures and broken teeth in four age groups;[6] the players were members of three amateur associations and the National Hockey League (NHL). All the injuries were much more numerous in the NHL players — for example, the incidence of broken teeth was 3 per 100 players in the youngest league but 2.2 per player in the NHL.

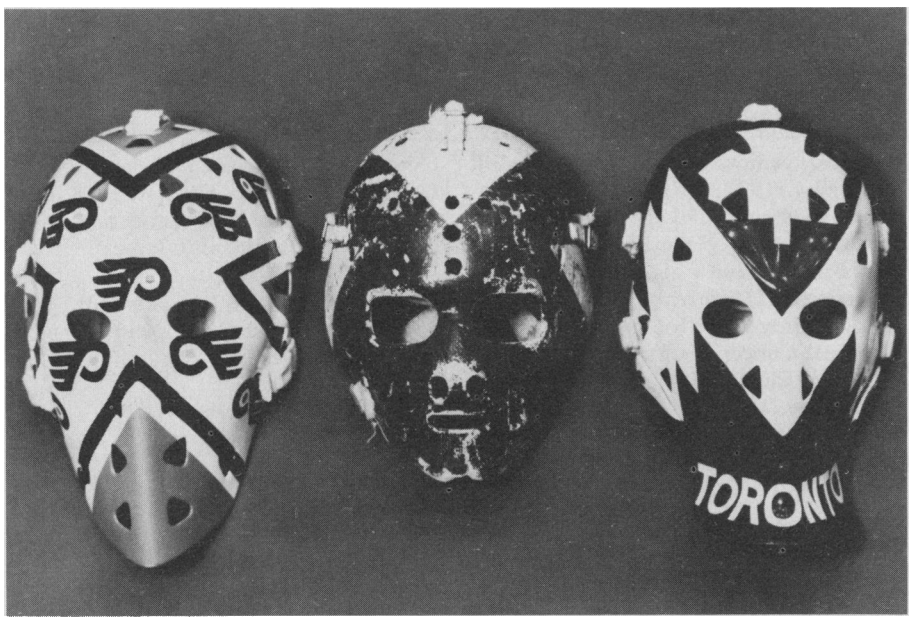

FIG. 2—Professional goaltenders' masks: an older model with large apertures at centre; newer, modified models with smaller eye apertures, left and right.

Conclusion

Obviously, goaltenders are at the greatest risk of serious eye injury (Table III). The CSA-approved wire-mesh masks provide much better protection for these players, and the professionals seem to be coming around to this opinion (three NHL goaltenders wearing molded masks suffered severe eye injuries during the 1976-77 season). At present, some molded models are being modified by reducing the size of the eye openings (Fig. 2). This is a sound safety measure pending wider acceptance of the greater protection afforded by wire-mesh masks.

If all players are introduced to face protectors at an early age they will become accustomed to them as part of their hockey equipment. It is hoped that protectors that do not meet the

new CSA penetration standard will disappear from the market.

Acknowledgements

Credit is due to the CAHA for rule changes, to the CSA for its work in evaluating the need for protection and to members of the Canadian Ophthalmological Society who submitted reports on eye injuries they treated. Credit is due also to the manufacturers who modified and produced protectors that the CSA committee considers safe.

The author thanks Miss Helen Haffey, director of medical records, for providing data on hockey injuries treated at The Hospital for Sick Children and medical publications department for help in preparing this report.

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Support for the campaign to make approved face-protectors compulsory for amateur hockey players has come from all segments of the community. Particularly outstanding contributions have been made by the following.

Nonmedical participants in the panel discussion at the 39th annual meeting of the COS in Ottawa in June 1975 were George Armstrong (Toronto Maple Leaf Hockey Club), Robert Nadin (referee-in-chief, CAHA), Thomas Lawson (CAHA), George Lynn (associate professor, school of industrial design, Carleton University) and Nora McCabe (sports writer, *The Globe and Mail*, Toronto).

Special mention is due to the Canadian Broadcasting Corporation for its national network television interview on "Hockey Night in Canada", arranged by Al Stewart and introduced by David Hodge; to Jenny Meldrum (CBC) on "Sports Beat", to Douglas Hall (CKVR, Barrie) on "Day Beat", to Skyline Cablevision and CJOH-TV, Ottawa, for their interview that has been shown across Canada and to Henry Viney (CFCN, Calgary). Radio exposure was enthusiastically supplied by John Campbell (CKFM, Toronto), Harvey Mock (CFRW, Winnipeg), Bill Brady (CFPL, London) and Jan Hawton (CKLC, Kingston). Several newspaper articles appeared; two of these, by Jim Proudfoot (Toronto *Star* sports editor), created especially widespread interest and greatly stimulated the demand for safety measures. Support came from doctors across the country, including Drs Pierre Labelle, Darryl Green, David Dickson, Frank Buffam, Gordon Harris and B.D. Gain; also Donald Hayes, Ph D, department of kinesiology, University of Waterloo, and Drs Paul Vinger (Boston) and Earl Hoerner (Livingston, New Jersey), on the CSA technical committee on protective equipment for hockey and lacrosse players (chairman, Robert Smith; secretary, Linda LaVecchia).

OBITUARIES

Brown, John Reginald, Toronto; University of London (Eng), 1953; FRCP[C]; preventive medicine; professor of environmental health, preventive medicine and biostatistics, University of Toronto. Died July 30, aged 57; survived by wife Mahnya and son David.

Calder, Gordon, London, Ont.; University of Western Ontario, 1930; immunology/allergy and rheumatology. Died July 12, aged 70; survived by wife Glenna and daughter Mary Glenna.

Campbell, Sampson Hardie, Windsor, Ont.; McGill University, 1923; general practice. Died June 23; survived by wife Grace, daughter Cynthia, sister Florence and one grandson.

Cantero, Antonio, Montreal; McGill University, 1927; FRCS; FRCP[C]; internal medicine and gastroenterology; consultant, Notre Dame Hopital; Canadian Broadcasting Corporation, medical department (Montreal); research professor, University of Montreal and Montreal Cancer Institute; senior member, Canadian Medical Association. Died June 16, aged 74; survived by wife Fernande Kent, daughters Victoria and Michaeli.

Clow, Laurence Roberts, Kingston, Ont.; Queen's University, 1945; FRCS[C]; attending staff, obstetrics and gynecology department, Kingston General Hospital; courtesy staff, Hotel Dieu Hospital; associate professor, department of obstetrics and gynecology, Queen's University. Died June 18, aged 55; survived by daughters Susan, Ann, Cathy, sons Robin and James.

Curtin, Agnes Ann, Rexdale, Ont.; University of Toronto, 1920; public health and general practice. Died May 28.

Goldstein, Dorothy A., Calgary; University of Edinburgh, 1958. Died June 22.

James, A. Ronald, Port Perry, Ont.; University of London, 1942; MRCS; LRCP; general practice. Died May 16, aged 61; survived by wife Marguerite Jean, daughters Lydia and Diana, sons Stephen, Tim, Adrian and Noel.