Paediatric Ocular Injury A Review of the Literature

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1 BACKGROUND

Trends towards preventative health care have become readily identifiable in federal and state government policy and direction. In 2005 the National Framework for Action to Promote Eye Health and Prevent Avoidable Blindness and Vision Loss was developed. It identified key areas for action including reducing risk of vision impairment by increasing early detection and improving the evidence base available.

The Council of Australian Governments' Meeting held 10 February 2006 developed the Better Health for All Australians Action Plan. Within the Promoting Good Health, Prevention and Early Intervention section of the plan, key elements were identified including promoting healthy lifestyles, supporting the early detection of lifestyle risks and chronic disease; and supporting lifestyle and risk modification.

Discussions with the Primary Health and Community Partnerships Branch of the NSW Department of Health during 2005/6 highlighted the need for an appropriate health promotion package which emphasises the importance of prevention of eye injuries, and early detection and intervention in paediatric eye disease. The NSW Government's Families First Initiative requires all surveillance and screening to be completed prior to school entry, leaving health promotion and education for the school years.

Groups such as the Orthoptic Standing Committee (OSC) of the Statewide Ophthalmology Service (SOS) and the NSW Department of Health have identified the need for improved health promotion and education of children regarding conditions which could place their eye health and function at risk. Currently little age appropriate materials exist. The benefit of health promotion is well recognized and when targeted at paediatric populations, can potentially reduce the incidence of preventable eye injury and disease.

2 AIM

An extensive review was conducted of scientific literature to determine global evidence and trends on the incidence, cause and outcome of paediatric eye injury, and paediatric eye disease related to sunlight exposure.

3 REVIEW OF THE CURRENT LITERATURE ON THE INCIDENCE, CAUSE AND OUTCOME OF PAEDIATRIC EYE INJURY

There is little doubt of the burden of suffering caused globally by eye injury. Pizzarello(1998) stated injury "…is probably the first or second cause of monocular blindness in the world" having an immense impact on the individual, their family and community. Eye injury as a cause of blindness is rather unique as "nearly 90% of this blindness can be prevented by relatively simple measures" (Pizzarello 1998, p. 115).

Negrel & Thylefors(1998) presented a global perspective by stating a total of 1.6 million cases of blindness are due to eye injuries, with some 2.3 million people suffering low vision, and another 19 million people having monocular blindness due to eye injuries. The authors agree with the Pizzarello(1998) estimate of 90% of eye injuries being preventable when "appropriate eye safety practices had been made available and effectively used" (p. 166); Thompson, Kumar, Billson & Martin(2002) also align with this estimate.

Prevention of Blindness America(2004) estimated 2.4 million eye injuries occur each year, about 35% in people aged 17 years & younger. These injuries accounted for 40000 to 50000 new cases of vision impairment and were the most frequent cause of monocular blindness; foreign bodies occurred in 35% of cases of these eye injuries.

3.1 The General Australian Eye Injury Situation

McCarty, Fu and Taylor(1999) reported on eye injury in Australia and stated "it has been conservatively estimated that 29000 eye injuries occur annually in Australia at a total cost of $155 million" (p. 1847). In reviewing Victorian data, it was found that more than 20% of Victorians aged 40 years and over had suffered at least one eye injury in their lifetime, with the major cause being sport related. Eye injuries related to steel-metal, drilling, grinding, sanding and welding were common, with less than 30% of people wearing eye protection at the time of the injury. Gardening was responsible for approximately 10% of eye injuries in this study.

Fong(1995) reported on a 12 month period in Victoria stating the most common location of injuries were at work (44%), home (39%), sport related (5%), travelling (4%), school (2%) and other locations (5%).

Thompson et al(1997) reported on penetrating eye injuries in the rural NSW town of Lismore over an 11 year period. The incidence was 4.72 per 100 000, with 88% being males, at an average age 32.6 years. The most common location was in the home, usually related to fencing wire or hammering metal.

3.2 The General American Eye Injury Situation

McGwin, Xie and Owsley(2005) estimated 1,990,872 United States individuals experienced an eye injury requiring treatment in an emergency department in 2001. In studying a New England adult cohort, Glynn, Sneddon and Berlin(1998) stated "eye injuries are a major cause of vision impairment, accounting for 8-10% of all impairments and 5% of all severe impairments" (p.785).

3.3 Why are eye injuries so common in children?

Children commonly suffer eye injuries, despite the fact that they are a group who should have little access to environments and implements which can cause harm. Society also expects that they are a group who are provided with the highest level of supervision in almost all situations. Soylu, Demircan, Yalaz and Isiguzel(1998) stated "the main cause of ocular injuries which include risks at play, insufficient adult supervision and use of dangerous objects, are universal and exist both in developing and developed countries" (p. 7). Harrison and Telander(2002) suggested reasons why children are predisposed to eye injuries:

> "First, their developing coordination and often daring manner of play render them vulnerable to accidental trauma of all types. Moreover, the eye itself is more prominent and less protected by the eyebrow, the cheekbone and the nose in children. Consequently falls and objects striking the face are much more likely to result in ocular injury in children than in adults. Children are also less capable of identifying their injury. Specifically they are less likely to notice or report a change in vision loss" (p. 33).

MacEwan, Baines and Desai(1999) commented "perhaps factors such as immature motor skills, carelessness and uncontrolled emotions which are inherent in young children may be more important in causing injury than most preventable causes" (p.936).

3.4 The Australian Paediatric Situation

The scientific literature generally classifies individuals as children when they fall in the age range from birth to 15 years; this classification has been used when reviewing scientific literature in this review. The incidence of eye injury in children is high. Thompson, Kumar, Billson & Martin(2002) commented "children account for 20-50% of all ocular injuries" (p. 920).
Fong(1995) reported on paediatric eye injuries in Victoria and found over a 12 month period, children aged less than 15 years comprised 25% of hospitalisations with severe injuries including ruptured globes & hyphaemas.

Bremner(1999) presented the incidence of eye injuries seen at the Princess Margaret Hospital for Children, in Perth from 1983 to 1998. The most common location for an injury to occur was in the home (65%), and

then sport related (10-11%). The most common sports were tennis, soft ball, T ball, football, baseball, cricket, hockey, martial arts, trampolining, basketball, golf and soccer.

Thompson, Kumar, Billson & Martin(2002) described a study on a cohort of full thickness penetrating eye injuries (PEI) presenting to Royal Alexandra Hospital for Children between Jan 1st 1983-Dec 31st 1999. 72 cases were reported with an age range of 7 months to 14 years 8 months. The most common cause of PEI was sharp tool e.g. knives, scissors poked into child's eye by themselves (17%) or objects thrown at the child (17%);
PEI was most common in 3-6 year olds, followed by 6-9 year old group, with the ratio of males to females being 2:1.

Injuries occurred mainly on weekends with the most common location being the home (58%). Only 1% of injuries occurred at school or childcare centres; the authors suggested increased levels of supervision and less access to dangerous objects in these locations resulted in such a low incidence. The authors also discussed the success of the introduction of compulsory seat belt legislation with the incidence of PEI in motor vehicle accidents reducing from previous studies to approximately 6%.

The final visual acuity outcome was 6/12 or better in 36% of children suffering PEI, with <6/60 in 31%; 6 (8%) children required enucleations. The authors noted that the outcome of management of PEI was complicated by "variable cooperation and continuing therapy" (p. 922), e.g. the need for amblyopia management.

3.5 The American Paediatric Situation

Rostomian et al(1998) reported on open globe injuries in children from 0-15 years at Children's Hospital Los Angeles from 1980-1993. 70 children were included in the study, 71% were boys and 21% were girls, with an average age of 5 years. Sharp objects accounted for 67% of injuries, and the most common place for injuries to occur was in the home "where presumably there would be more adult supervision than in other settings" (p. 237). When reporting on outcome, the authors found children who had suffered sharp object injury had a better visual outcome than those with blunt trauma.
Rodriguez, Lavina and Agarwal(2003) stated that more than 40 000 eye injuries in America were related to sports and recreational activities, and that 30% of these injuries in children were sports related (p.1481).

Prevention of Blindness America(2004) reported an incidence of 37 754 injuries in 2002 in children aged 0-14 years. The most common cause of injury was toys excluding bikes & guns (22%). This was followed by pens & pencils, balls, water & pool activities, adhesives, guns, general purpose household cleaners, furniture, table settings, bleaches, cigarettes, cigars, pipes& lighters, hair care, make up, paper & cardboard, petrol & petrol

cans, desk supplies, chemicals, bathroom related – fixtures, soap, bikes and manual hand tools – e.g. screwdrivers and hammers.

3.6 The United Kingdom Paediatric Situation

Luff et al(1993) reported on the aetiology of perforating eye injury in 16 children admitted to the Birmingham and Midland Eye Hospital from 1979-1989. The ratio of males to females was nearly 4:1; with the mean age of the group 9 years & 4 months. The authors commented" perforating ocular trauma is a leading cause of monocular visual loss with about 50% of all perforating eye injuries affecting children…many paediatric eye injuries are potentially preventable" (p.682).

MacEwan, Baines and Desai(1999) reported on a Scottish study of children 14 years or less admitted with eye trauma. There were 93 children in the sample, 70% boys and 30% girls; 84% of children were in the 5-14 age group. The most common injury was blunt trauma (65%), then penetrating injuries without retained foreign bodies (24%); 60% of children had hyphaemas. The most common place for eye injury to occur was in the home, "…accounting for > 50 % of all accidents" (p.934). Participation in sport was also a common cause of injury. There were no motor vehicle related eye injuries in the study.

3.7 The Middle East Paediatric Situation

3.7.1 Turkey

Soylu, Demircan, Yalaz and Isiguzel(1998) reported on the aetiology of pediatric perforating eye injuries in Southern Turkey, in a group of 242 children, aged 14 years & less from August 1988 to August 1995. The mean age of children was 8 years, with 73% boys and 27% girls. The age group with highest incidence of penetrating eye injury was 5-9 years. Eye injuries most commonly occurred whilst in the street in urban locations, next in the home & in fields in rural areas. The most frequent objects causing perforation were knives, scissors & metallic sticks, occurring mainly in unsupervised play, and mostly caused by the child themselves.

The use of seatbelts is not mandatory in Turkey and many eye injuries were reported in motor vehicle accidents, with penetrating eye injuries from glass. Another common cause was from disposable injection needles which were described as " very attractive play objects for children, especially during vaccination campaigns in rural areas…endophthalmitis was detected on admission in all the children injured with injection needles" (p. 11).

3.7.2 Jerusalem

Sarrazin et al(2004) reported between 29% & 35% of eye injuries occurring in children in their study. Retinal detachment occurred in open globe injury in 36 children, with a ratio of males to females 6:1, and an average age of 11 years. Retinal detachment occurred in closed globe injuries in 20 children, with a male to female ratio of 5:1, with an average age of

12.6 years. 25% of detached retinas remained attached post operatively with 17% of children achieving count fingers vision or better.

4 PAEDIATRIC EYE INJURY AND SPORT

Conn, Annest and Gilchrist(2003) reported on the incidence of general sports related injury in the United States using data from the National Health Interview Survey(NHIS), a stratified, multistage probability sample survey of the US non institutionalised civilian population. In a sample of 3.7 million sports related emergency department visits during 1997-1998, 68% of injuries occurred in the 5-24 year old group.

In examining the location and aetiology of paediatric eye injury, sport is the second most common cause in developed countries. Much has been written regarding the prevention of sport related eye injury. The policy statement of the American Academy of Pediatrics & the American Academy of Ophthalmology(AAPO)(2004) reported 42 000 sports & recreational related eye injuries in 2000, with 72% of the injuries occurring in people less than 25 years of age, and 43% occurring in the under 15 year olds. The comment was made "…children and adolescents may be particularly susceptible to injuries because of their aggressive play, athletic maturity and poor supervision in some recreational situations" (p. 619). AAPO cited a success rate of 90% of preventing significant eye injury when properly fitting eye protectors were worn.

The Centre for Disease Control and Prevention reported on the NHIS, in Morbidity and Mortality Weekly Report, June 2005. Information on 12 524 children was gathered in 2002, and 50.9% of children aged 6-17 years were participating in sports, hobbies or other activities that could cause eye injury. Only14.6% reported using protective eyewear during sport all or most of the time and this was not influenced significantly by the child's ethnicity, income or age group. Authors of the report commented "a strategy aimed at teaching children from an early age to use protective eyewear, including sunglasses, might have a lifelong impact on their ocular health" (p. 2852).

Bremner(1999) reported on sport related eye injuries seen at Princess Margaret Hospital for Children, Perth January 1998 to December 1999. The most common eye injury was experienced during tennis, then hockey, soccer, Aussie Rules, cricket, baseball and basketball. Bremner(1999) also monitored severe eye injuries over a 12 year period and found 10% of these were sports related, with 27% of this group suffering permanent visual disability.

Bremner(1999) commented "it is the inexperienced player who gets the eye injuries; elite sport is mostly injury free" (p. 620). It was suggested that high profile players be encouraged to participate in eyewear protection themselves as a role model for children. It was also highlighted that eye protection for sport should be compulsory. Bremner(1999) stated "we

need government legislation for mandatory wearing of head/face/eye protection in sports for under 18 year olds and legislation for a list of Australian Standards products available for consumers and professionals" (p. 620).

Filipe(2004) discussed the increasing incidence of eye injuries from soccer, a game which dominates the world as the most popular sport. The author commented that there was no correlation between the size or level of inflation of the soccer ball, or the "age, sex and type of soccer, level of expertise or player position" (p.160) and the amount of damage that could occur when a soccer ball impacted on the eye. Filipe(2004) stated:

> "Although there is a difference between the opening of the bony orbit and the diameter of a standard soccer ball, the lab experiments carried out confirmed that soccer balls deform significantly on impact, allowing a small "knuckle" of the ball to enter the orbit and impact the globe…the soccer ball is unique among the sports balls tested: orbital penetration is lower, but the time in the orbit is longer, and during rebound a secondary suction effect is produced on the orbital contents. The expansion of the eyeball perpendicularly to the direction of the impact has been proposed as the major cause of the contusion injuries. The suction component most likely adds to the distortion of the globe anatomy, which can explain the findings of the clinical studies showing that soccer injuries were disproportionately severe" (p. 159).

Filipe(2004) concluded that "in this new millennium soccer may become the most common cause of sports eye injury worldwide" (p.160).

Alfaro et al(2005) reported on fishing-related eye trauma, with children making up 16% of this population; 33.3% of these children were bystanders. Alfaro et al(2005) commented "fishing takes place in an environment that includes sharp objects and wet surfaces; the available mechanisms likely to cause trauma to the eye are wide and varied. Aside from the penetrating injuries most often caused by fish hooks, many injuries resulted from weights, lures and rods" (p. 490).

5 MANAGEMENT AND PREVENTION OF PAEDIATRIC EYE INJURIES

The management of paediatric eye injury closely parallels strategies used for adults, but there are noted complications. Coody, Banks, Yetman and Musgrove(1997) commented "evaluation of eye trauma requires a thorough history, preferably from the child. The child may withhold full disclosure of detail if he or she feels responsible for the accident. Likewise, parents may withhold information if they feel that their negligence contributed to the accident" (p.183).

Rostomian et al(1998) agreed with the conclusions of Thompson, Kumar, Billson & Martin(2002) commenting "our study further identifies the amblyogenic age range as an additional risk factor for unfavourable visual outcome because there was no significant difference in type of injuries or number of surgical procedures needed between patients younger than 5 years old and patients older than 5 years, but the younger patients had a significantly worse final visual acuity" (p. 238). This suggests that visual outcome may be improved in some individuals in this age range with aggressive therapy for presumed amblyopia.

Negrel & Thylefors(1998) commented that globally 4 major factors are linked to the final visual outcome for the injured person:

(i) the lesion (especially in case of perforating injury)
(ii) the time elapsed from injury to definitive care
(iii) the quality of care
(iv) the pre-existing eye-health status (p.166).

The two most common global locations for paediatric eye injury to occur are in the home and then whilst participating in sport. In commenting on prevention strategies Luff et al(1993) stated "the overwhelming impression gained from individual case reports is the prime importance of parental care and awareness. Although legislation has a significant role in many aspects of safety, the single most important factor in the prevention of paediatric perforating injury is probably parental education" (p. 683).

Thompson, Kumar, Billson & Martin (2002) provided tips for making the home environment safe which included:

- adequate supervision
- restriction of access to using sharp tools, scissors, knives
- furniture with round corners
- no plants with thorns in gardens
- supervision of children around pets & education of children in how to treat pets (p. 922)

The Lucile Packard Children's Hospital(2004) provided further suggestions for prevention including:

- ensure there are no sharp corners on the edges of furnishings and home fixtures
- keep paints, pesticides, fertilizers and hazardous cleaning supplies properly stored in a secure place
- make sure children wear the recommended protective goggles, helmets and safety gear during the appropriate activities
- make sure children's eyes are protected either by a wide brimmed hat or by UV protective sunglasses
- teach children never to look directly at the sun, especially in an eclipse

- select toys that are appropriate for the child's age and activity level
- provide adequate supervision during activities that use sharp objects, e.g. arts & craft
- do not allow children to play with projectile toys such as pellet guns, bows or arrows
- keep children away from lawnmowers in use, as debris may be projected into the air.

Vasniak et al(2002) suggested "toys that pose a potential eye hazard must be labelled with an 'eye watch' sign like the choking hazard sign on many toys" (p.10).

Authors are in complete agreement about the role protective eyewear plays in prevention of paediatric eye injury whilst participating in sport. Authors collectively report a prevention success rate of around 90% when protective sport eyewear is used. Once a unilateral vision loss is diagnosed it is frequently suggested that children refrain from participating in high risk sports to prevent injury to the visually intact eye. Parents also need to be reminded that contact lenses are not a substitute for protective eyewear.

The American Academy of Pediatrics and the American Academy of Ophthalmology(2004) recommended mandatory protective eyewear for all functionally one-eyed individuals and for athletes who have had eye surgery or trauma. The following advice was offered on prevention of additional eye injury:

> "Physicians should strongly recommend that athletes who are functionally 1-eyed wear appropriate eye protection during all sports, recreational and work related activities. Functionally 1-eyed athletes are those who have a best corrected visual acuity of worse than 20/40 in the poorer seeing eye. Athletes who have had eye surgery or trauma to the eye may have weakened eye tissues that is more susceptible to injury. These athletes may need additional eye protection or may need to be restricted from certain sports" (p. 620).

Bremner(1999) discussed the removal of sales tax on items listed under the
1992 Australian Standard for eye guards (AS/NZ 4066 1992), but many sporting bodies continue to refuse compulsory wearing of eye guards.

6 SUMMARY AND CONCLUSIONS

Many similarities exist globally when the topic of paediatric eye injury is reviewed. All children are at risk of eye injury, but the group with the highest incidence are males aged 5-9 years, who have access to sharp implements or possible forces which cause blunt trauma in their home environment. This is closely followed by those who are involved in sport or

sport related activities. The incidence in this particular group does not vary according to their ethnicity.

Conclusions can be drawn regarding eye safe environments, with schools and childcare centres having a very low risk of approximately 1%. This can be accounted for in design, availability of dangerous objects and the level of supervision of young children (Thompson, Kumar, Billson & Martin, 2002). Simple strategies can be implemented as preventative measures.

Sporting environments account for about 10% of paediatric eye injuries. Authors suggest that protective eyewear when worn properly can reduce the risk of significant eye injury by at least 90%. Unfortunately it is not mandatory for sporting clubs to enforce use of such protective eyewear (Bremner, 1999).
There is a clear need for better education of parents, carers and sporting groups to recognise the risk certain environments pose for children and act to modify behaviours and practices within these environments to minimise risk. Bremner(1999) commented "given that there are so many causes of blindness, not amenable to treatment, which may strike later in life and possibly affect the non-injured eye, it is imperative that we make a strong and ongoing commitment to preventing eye injuries in childhood" (p.618).

7 REFERENCES

Alfaro D, Jablon E, Rodriguez Fontal M, Villalba S, Morris R, Grossman M and Roig-Melo E. (2005). Fishing-related ocular trauma. *American Journal of Ophthalmology, 139*(3), 488-492.

Better Health for All Australians Action Plan Council of Australian Government http://www.coag.gov.au/meetings/100206/attachment_d_better_health.pdf

Bremner M. (1999). Childhood eye injuries 1983 to 1998. *Medical Journal of Australia Letters to the Editor, 170*, 618-620.

Centre for Disease Control and Prevention Morbidity and Mortality Weekly Report June 2005 *Journal of the American Medical Association, 293(23), 2851-2852.*

Conn J, Annest J and Gilchrist J. (2003). Sports and recreation related injury episodes in the US population, 1997-1999. *Injury Prevention, 9,* 117-123*.*

Coody D, Banks J, Yetman R and Musgrove K. (1997). Eye trauma in children: epidemiology, management and prevention. *Journal of Pediatric Health Care, 11*(4).

Filipe J. (2004). Soccer (football) ocular injuries: an important eye health problem. *British Journal of Ophthalmology, 88*, 159-160.

Fong L. (1995). Eye injuries in Victoria, Australia. *The Medical Journal of Australia, 162*, 64-67.

Glynn R, Sneddon J and Berlin, B. (1998). The incidence of eye injuries in New England adults. *Archives of Ophthalmology, 106*, 785-789.

Harrison A and Telander D. (2002). Eye injuries in the young athlete: a case-based approach. *Pediatric Annuals, 31*(1), 33-40.

Lucile Packard Children's Hospital https://www.lpch.org/DiseaseHealthInfo/HealthLibrary/poison/avoideye.html

Luff A, Hodgkins P, Baxter R, Morrell A and Calder I. (1993). Aetiology of perforating eye injury. *Archives of Disease in Childhood, 68*, 682-683.

MacEwan C, Baines P and Desai P. (1999). Eye injuries in children: the current picture. *British Journal of Ophthalmology, 83*(8), 933-936.

McCarty C, Fu C and Taylor H. (1999). Epidemiology of ocular trauma in Australia. *Ophthalmology, 106*(9), 1847-1852.

McGwin G, Xie A and Owsley C. (2005). Rate of eye injury in the United States. *Arch Ophthalmol, 123*, 970-976.

National Framework for Action to Promote Eye Health and Prevent Avoidable Blindness and Vision Loss, November 2005 http://www.health.gov.au/internet/wcms/publishing.nsf/Content/ageing-eyehealth-framework.htm

Negrel A and Thylefors B. (1998). The global impact of eye injuries. *Ophthalmic Epidemiology, 5*(3), 143-169.

Pizzarello L. (1998). Ocular trauma: time for action. *Ophthalmic Epidemiology, 5*(3), 115-116.

Policy Statement Protective Eyewear for Young Athletes. American Academy of Pediatrics and American Academy of Ophthalmology (2004) *Pediatrics, 113*(3), 619-622.

Prevention of Blindness America http://www.preventblindness.org/resources/fact_sheets.html

Rodriguez J, Lavina A and Agarwal A. (2003). Prevention and treatment of common eye injuries in sports. *American Family Physician, 67*(7), 1481-1488.

Rostomian K, Thach A, Isfahani A, Pakkar A, Pakkar R and Borchert M. (1998). Open globe injuries in children. *Journal of AAPOS, 2*(4), 234-238.

Sarrazin L, Averbukh E, Halpert M, Hemo I and Rumelt S. (2004). Traumatic paediatric retinal detachment: a comparison between open and closed globe injuries. *American Journal of Ophthalmology, 137*(6), 1042-1049.

Soylu M, Demircan N, Yalaz M and Isiguzel I. (1998). Etiology of pediatric perforating eye injuries in Southern Turkey. *Ophthalmic Epidemiology, 5*(1), 7-12.

Thompson C, Griffits R, Nardi W, Tester M, Noble M, Cottee L and Weir P. (1997). Penetrating eye injuries in rural New South Wales. *Australian and New Zealand Journal of Ophthalmology, 25*, 37-41.

Thompson C, Kumar N, Billson F and Martin F. (2002). The aetiology of perforating ocular injuries in children. *British Journal of Ophthalmology, 86*, 920-922.

Vasniak A, Vasu U, Battu R, Kurian M and George S. (2002). Mechanical eye (globe) injuries in children. *Journal of Pediatric Ophthalmology and Strabismus, 39*(1), 5-10.