

Biosocial profile of New Zealand prosthetic eye wearers

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Abstract

Aim To describe the biosocial profile of New Zealand (NZ) artificial eye wearers and establish a basis for future research and international comparison.

Methods This retrospective study surveyed 431 NZ artificial eye wearers to investigate their ethnicity, gender, age, causes of eye loss, age of current prosthesis, ocular prosthetic maintenance regimes and the extent and severity of discharge associated with prosthesis wear.

Results Approximately 3000 people wear artificial eyes in NZ. Accidents were the main cause of eye loss prior to 1990 and medical conditions have been the main cause since. In the 1960s, the ratio of men to women losing an eye from accidents was 5:1, but during the past decade the ratio was 1.4:1. Socket discharge occurred at least twice daily for one-third of the study group.

Conclusions Approximately 1 in 1440 people wear artificial eyes in NZ. Decline of eye loss due to accidents is consistent with decreasing workplace and traffic accidents and may be due to improved medical management, workplace safety standards and safer roads. Mucoïd discharge is prevalent in the anophthalmic population of NZ and an evidence based treatment protocol for discharge associated with prosthesis wear is needed. Research into this distressing condition is planned.

The prosthetic eye literature has a limited number of published studies describing artificial eye wear over time,¹⁻³ however, with the exception of a study carried out in Dallas, Texas from 1973 to 1977 and repeated in 1990 to 1994,⁴ no information about the epidemiology of eye loss appears to be available. Furthermore, mucoïd discharge is wearers' second highest concern after health of the remaining eye,⁵ but the incidence and severity of this problem in the anophthalmic population is unknown.

This retrospective study is designed to address this lack of information about prosthetic eye wear in New Zealand and to establish a basis for future artificial eye research and international comparison. The study investigated artificial eye wearers' ethnicity, gender, age, causes of eye loss, age of current prosthesis, ocular prosthetic maintenance regimes and the extent and severity of discharge associated with artificial eye wear.

Methods

Background—The New Zealand Artificial Eye Service is the only provider of artificial eyes that offers a local service in Northland, a region which has a mixed rural/urban population, roughly representative of New Zealand's overall population. The estimate of the total size of the anophthalmic population of New Zealand was calculated by extrapolating the number of Northland domiciled patients on the New Zealand Artificial Eye Service database to the estimated residential population of New Zealand.⁶

Recruitment and study design—Ethics approval for a questionnaire designed to document factors associated with artificial eye wear was obtained from the Multi Regional Ethics Committee of the Ministry of Health. The New Zealand Artificial Eye Service, the Royal New Zealand Foundation of the Blind, the Accident Compensation Corporation and five District Health Boards agreed to search their databases for all patients who had lost one or two eyes and to post an anonymous questionnaire to them.

A total of 1373 questionnaires were mailed out. No record could be kept of ‘Gone No Address’ returns or if any patients received more than one letter. The Royal New Zealand Foundation of the Blind delivered the questionnaire to their members by email and no record was kept of the additional number of recipients.

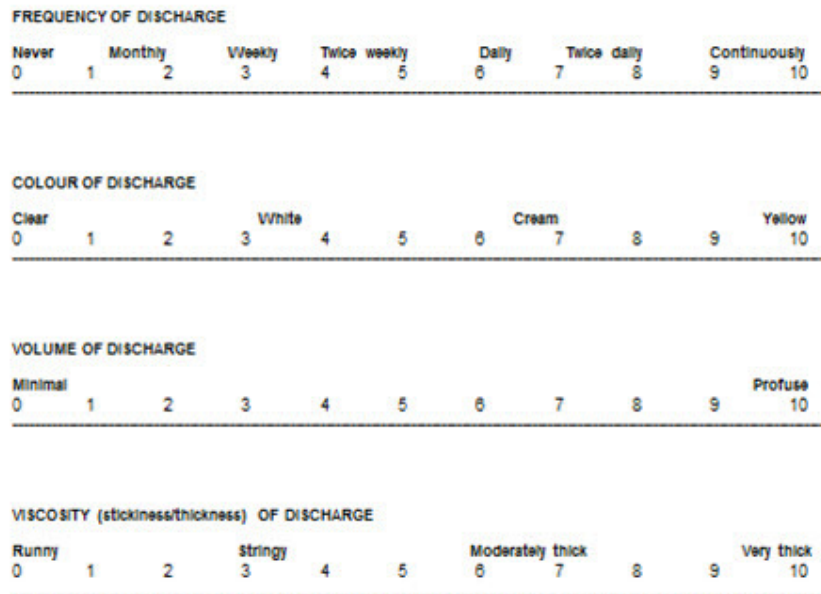
The three sections of the questionnaire addressed different topics: Section 1 requested demographic information and information about how the artificial eye was cared for.

Data were gathered on: age, ethnicity, date of eye loss, why the eye was lost, date of fitting the present prosthesis and date of last professional re-polish, how often the prosthesis was removed for cleaning, the reason for adopting the particular cleaning regime, whether hands were washed before removing the artificial eye, whether the prosthesis was left out over-night, how easy it was to remove the prosthesis, and finally whether help was required to remove it.

Section 2 asked participants to describe the nature and frequency of any discharge they were currently experiencing. Responses to this question were obtained as a value from zero to ten using visual analogue scales (VAS) to measure each of the four discharge characteristics: colour, viscosity, volume and frequency. The visual analogue scales and the descriptors are shown in Figure 1.

The participants were then asked whether they felt that having their artificial eyes professionally re-polished improved discharge and if so, how long the improvement lasted. A further section contained an open invitation and space to comment on prosthetic eye wearing experience.

Figure 1. Visual analogue scales for self-measuring discharge characteristics.



Results

The 109 patients on the Northland database of the New Zealand Artificial Eye Service made up 0.07% of the 157,300 population of the Northland Regional Council.⁶ This percentage, extrapolated to the total population of New Zealand in 2010 (4,367,700)⁷ resulted in an estimated total of 3026 anophthalmic people.

A total of 431 artificial eye wearers (31% of 1373) returned the completed study questionnaire. An analysis of these returns by regional institution is shown in Table 1.

Table 1. Returns of the questionnaire by regional institution

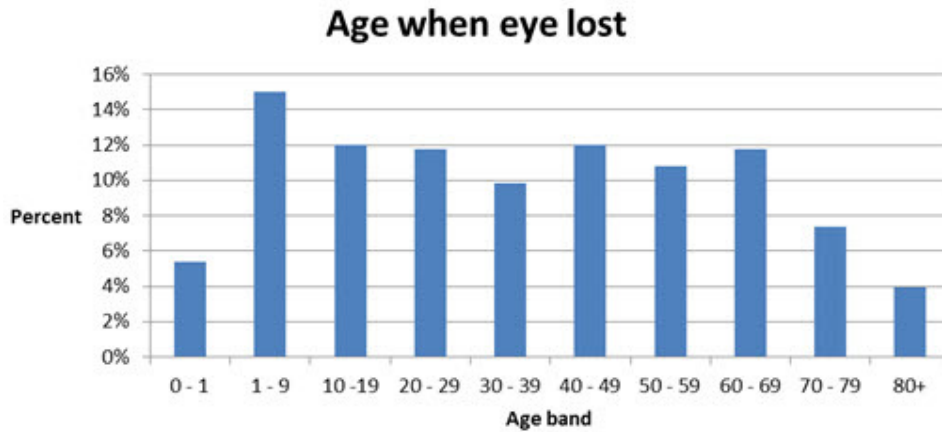
Institution	Questionnaires posted	Returned	Percentage (%) returned
Capital & Coast District Health Board	50	25	50
Lakes District Health Board	53	15	28
Waikato District Health Board	90	20	22
Auckland District Health Board	380	96	25
Royal NZ Foundation of the Blind	Canvassed online	19	unknown
Accident Compensation Corporation	280	83	30
NZ Artificial Eye Service	420	146	35
Canterbury District Health Board	100	27	27
Totals	1373	431	31

Ethnicity—A comparison between ethnicities in the study population and the New Zealand population⁶ was made. Europeans were the only ethnicity to be over represented (79% of the study population compared with 70% of the NZ population). Māori people made up 13% of the study population compared with 14% of the NZ population. Pacific peoples (4% study, 7% NZ), Asian peoples (3% study, 9% NZ) and others (0% study, 1% NZ).

Gender—Of the 334 participants who provided personal details, 41% were women and 59% were men.

Age—Participants were represented across all ten age bands chosen for the study (Figure 2). Eighty-two percent (82%) were 40 years of age or over.

Figure 2. Eye loss as a function of age (using 10 age bands)

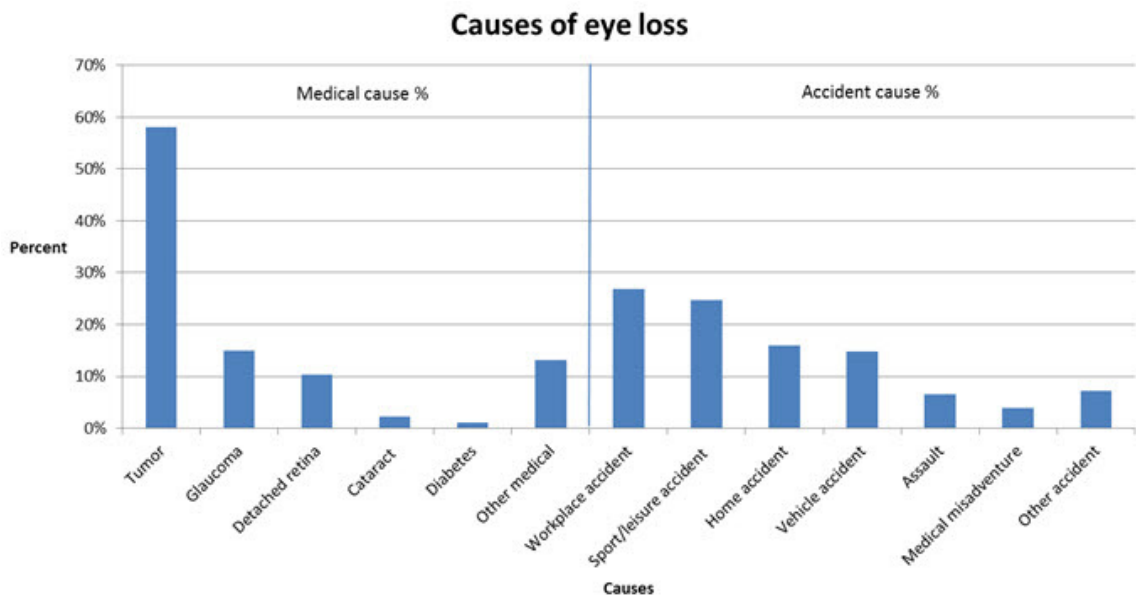


Eye loss—The reported causes of eye loss were: accident (50%), medical (43%) and congenital (7%).

Eye loss due to tumours of various kinds was the most prevalent medical cause followed by glaucoma, detached retina, cataract and then diabetes.

Workplace accidents were the most common type of accident followed by sporting/leisure accidents, home, motor vehicle, assault and lastly medical misadventure (Figure 3).

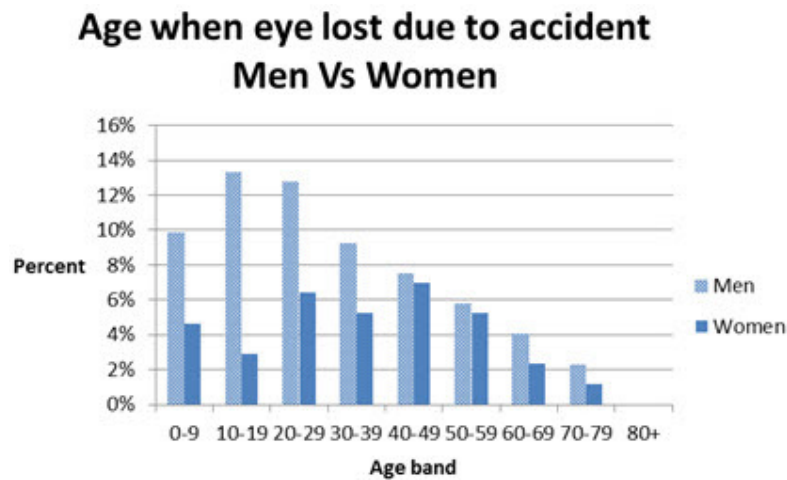
Figure 3. Main causes of eye loss (medical and accidental causes are shown separately)



The highest proportion of eyes lost from any cause occurred between ages one and nine years inclusive (15% of all eyes lost). Between 10 and 69 years eye loss was evenly distributed over the decades (varied between 10% and 12% each decade).

Eye loss due to accident as a function of gender is shown in (Figure 4). For ages less than 40 years eye loss due to accident was significantly greater in men than women (P=0.002) but women and men over 40 lost eyes to accidents in similar numbers.

Figure 4. Gender mix of eye loss due to accident



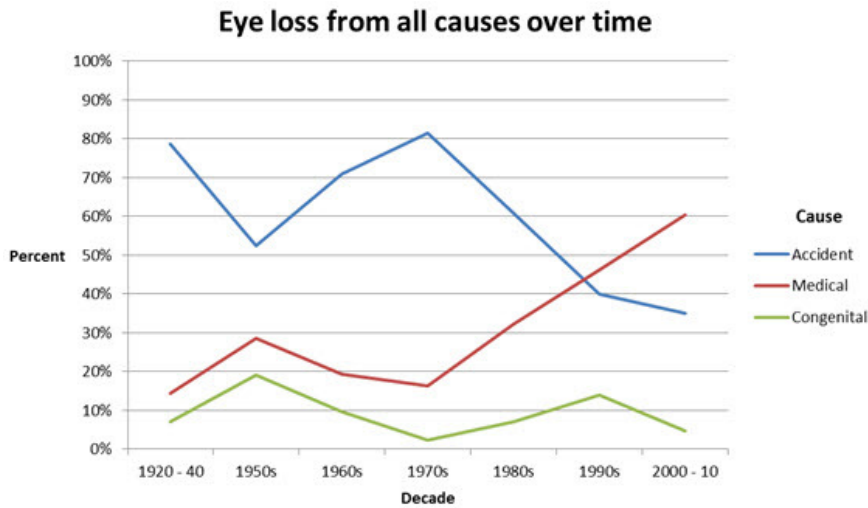
Changing causes of eye loss—Accidents were the main cause of eye loss before the 1990s but since then medical causes of eye loss have predominated (Figure 5).

Table 2 illustrates how the ratio of men to women whose eye loss was due to accident has varied over time.

Table 2. Ratios of men to women whose eye loss was due to accident from 1960 to 2010

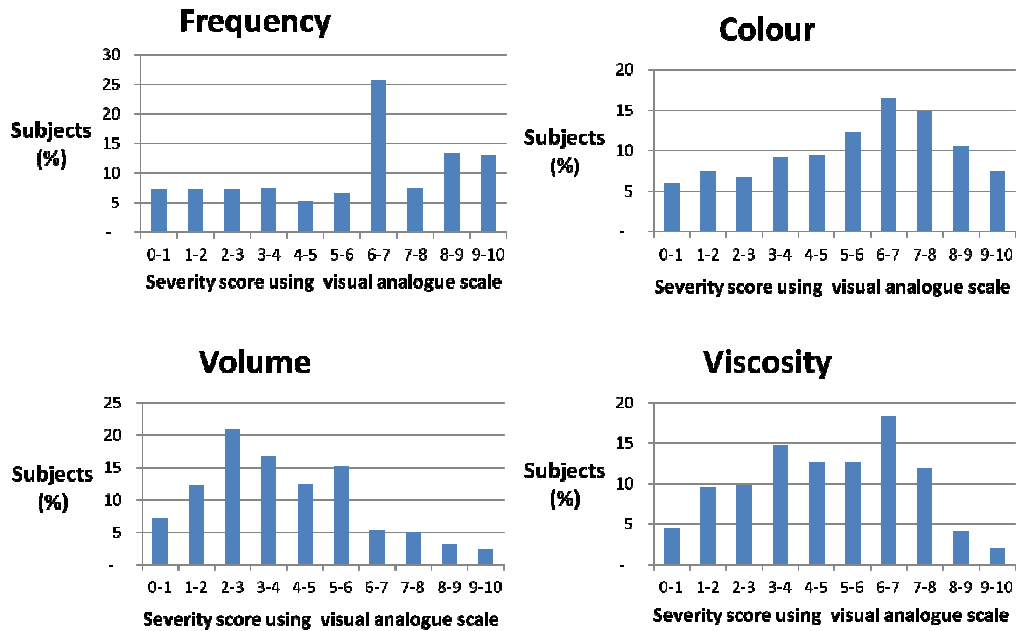
Decade	1960–69	1970–79	1980–89	1990–99	2000–2010
Ratio: men to women	5 : 1	2.3 : 1	1.8 : 1	2.4 : 1	1.4 : 1

Figure 5. Cause of eye loss in New Zealand over time



Discharge associated with artificial eye wear—The average severity score (from 0–10 on the visual analogue scale) for discharge frequency was 5.55 (SD 2.8), discharge colour 5.33 (SD 2.6), discharge volume 3.68 (SD 2.19) and discharge viscosity 4.59 (SD 2.28) (Figure 6).

Figure 6. Self measured visual analogue scale scores for severity of 4 discharge characteristics



Thirty-three percent of the study population marked a VAS score of ≥ 7 for frequency (discharge occurred at least twice daily) and 59.3% of the random comments about discharge were made by participants who scored ≥ 7.0 for discharge frequency. Ten percent of the study population marked a VAS score of ≥ 7 for discharge volume (moderately profuse), 32% for colour (creamy yellow) and 18% for viscosity (thick).

Age of current artificial eye—The majority of participants (64%) had worn their present prosthetic eye for four years or less, 21% for between 5 and 9 years, 8% between 10 and 19 years, and 8% for more than 20 years.

Frequency of professional re-polishing—51% of the participants had their artificial eyes re-polished every year, 9% more often than yearly and 40% less often.

Artificial eye removal and cleaning regimes—48% of people in the study population removed and cleaned their artificial eyes daily but 26% left their artificial eyes in place for more than a month. Twenty-six percent removed their prostheses overnight.

Hand washing behaviour—The majority of wearers (58%) always washed their hands before removing their artificial eye, 25% mostly washed their hands, 12% washed sometimes and 5% never washed their hands.

Removal difficulty—Eight per cent (8%) of wearers had difficulty removing their artificial eye including 6% who needed this to be done by others.

Discussion

While the 431 artificial eye wearers recruited to this study represented 31% of the 1373 letters that were mailed out they probably made up 14% of the total anophthalmic population in New Zealand which is estimated by the authors to be approximately 3000 or 1 anophthalmic person for every 1443 in the general population.

Thirty-six percent (36%) of study participants lost their eye(s) within the past eleven years indicating that individuals were more likely to participate if their experience of eye loss was more recent. This bias may have increased the number of participants whose current artificial eye was under 11 years old relative to those who lost their natural eyes more than 11 years ago. However, it is unlikely to have affected the main conclusions of the study.

Europeans who might be more comfortable than other ethnic groups completing the English language questionnaire may have biased ethnicity representation and accounted for the finding that Europeans were more highly represented in the study population than in the general population.

Another limitation of this study is that different surgical techniques, socket and eyelid problems, or unsuitable prostheses were not investigated. Discharge may be more severe in the presence of these problems, but there is no reason to suspect that such problems were more or less prevalent in our study population than in the general anophthalmic population. Future studies are planned to try to elucidate some of the mechanisms of increased socket discharge.

The literature on the characteristics of anophthalmic populations is sparse but some information can be found on related topics. For example, Chang et al⁸ describe

aetiologies and clinical characteristics of corneal opacities leading patients to seek cosmetic treatments at the Department of Ophthalmology at Seoul National University Hospital. They examined 401 patients with corneal opacities and report characteristics of age and gender that were similar to the anophthalmic population in this study.

A notable exception was the considerably younger age when injury occurred in the Korean study. The Eye Injury Snapshot Data Summary, 2004–2008 from the USA.⁹ also contained characteristics of age, gender and accident type that were reflected in this study although the ratios of accidents resulting in eye injury and eye loss are quite different. In particular, the most common place to injure an eye was in the home (44.1%) but relatively few eyes (16%) were actually lost through home injuries.

The causes and gender mix reported in a study of eye loss carried out in Dallas County, USA from 1990 to 1994⁴ were broadly in line with this study except that the percentage of eye loss due to accident was higher (59.8% compared to 54%).

Comparisons with the literature are summarised in Table 3. While the studies are very diverse they suggest that gender mix (more young males) and causes of eye loss (more accidents) may be common to most present day anophthalmic populations.

Table 3. Comparisons of eye loss in New Zealand with related injuries in Korea and America

Characteristic	Corneal opacities in Korea	Eye injury in the USA	Eye loss in Dallas County 1990–1994	Eye loss in New Zealand
Cause	Trauma: 50.6% Medical: 43.9% Congenital: 5.5%		59.8% 33.3% 6.9%	54% 46% 8%
Gender (all causes)	Men: 60.7% Women: 39.3%		64.2% 35.8%	59% 41%
Gender (accident only)	Men Women	73% 27%		65% 35%
Age when accident occurred	0–15 yrs: 69.5% 15–55 yrs: 28.6%	0–18yrs: 25.4% 18–45yrs: 47.6% 46+ yrs: 26.9%		0–19 yrs: 31% 20–49 yrs: 49% 50+ yrs: 20%
Accident type	Home Sport/recreation Workplace Roads Other	44.1% 14.7% 15.6% 11.4% 14.2%	7.1% 15.8% (gunshot)	16% 25% 27% 15% 18%

Eye loss—Young men who lost their eyes because of accidents strongly altered the gender, age and cause of eye loss characteristics of the study population. This group was the reason that workplace and sporting/leisure accidents were the most prevalent. However, the dynamics of eye loss appear to be changing over time as eye loss due to accident has declined relative to medical causes and the gender mix of accident victims has changed with a decreasing ratio of men to women.

This study was not designed to uncover the reasons for these dynamics but the trend towards less accidents resulting in eye loss is consistent with the decrease of work

related head and neck injuries between 2003 and 2010 reported by the NZ Accident Compensation Corporation⁷ and the decrease of traffic injuries from a peak of 23,385 in 1973 to 14,541 in 2009.¹⁰ Improved medical management of eye injury is likely to also play a part in the reduction of eye loss from accident.

Discharge and artificial eye maintenance—The observation that 59.3% of the random comments referring to discharge were made by participants who scored ≥ 7.0 on the 1-10 range of the visual analogue scale for discharge frequency suggests that these people were more motivated to write a comment about discharge than those with less severe scores. This in turn suggests that severity scores of ≥ 7.0 for frequency (discharge occurred at least twice daily) are likely to impact on the quality of life of prosthetic eye wearers.

It is disturbing therefore that one-third of the study population reported severity scores of ≥ 7.0 for discharge frequency and as many as 9% experienced severity scores of ≥ 7.0 for both volume and frequency. The high incidence and severity of this problem occurred even though access to professional prosthetic eye services was good. Unfortunately, a standardised treatment protocol for discharge associated with artificial eye wear is lacking¹¹ and further research into the cause and treatment of this prevalent and distressing condition is needed.

Conclusions

This study has sought to address the lack of information about prosthetic eye wearers in New Zealand. We estimated that approximately 1 in every 1,440 people wear artificial eyes in this country and that most of the anophthalmic population lost their eyes through accident. Men under 40 years were the most ‘at risk’ group. The gender mix and cause of eye loss appears to be changing over time.

Accidents were the main cause of eye loss in the decades prior to 1990 and medical conditions have been the main cause since. The decline of accidents resulting in eye loss is consistent with decreasing workplace and traffic accidents in the general population and may be due to improved workplace safety standards, safer roads and better medical management. An additional finding of this study was that in spite of good healthcare provision, mucoid discharge is prevalent in the anophthalmic population of New Zealand with 33% experiencing discharge at least twice a day.

Further research is needed to establish an evidence based standardised treatment protocol for discharge associated with artificial eye wear.

Competing interests: Keith Pine owns and operates a private practice in ocular prosthetics, the NZ Artificial Eye Service.

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References:

1. Rasmussen ML. Complications from eye prosthesis. *Ugeskr Laeger*. 2008;170:2456–8.
2. Song JS, Oh J, Baek SH. A survey of satisfaction in anophthalmic patients wearing ocular prosthesis. *Graefes Arch Clin Exp Ophthalmol*. 2006;244:330–5.
3. Nicodemo D, Ferreira LM. Questionnaire of the psychosocial profile of the patient with anophthalmia with indication of ocular prosthesis. *Arq Bras Oftalmol*. 2006 Jul-Aug;69(4):463–70.
4. Trawnik WR, Fitzimmons TD. Eye loss in the 1990s: A comparative study. *Journal of Ophthalmic Prosthetics*. 1996;1:7–13.
5. Pine KR, Sloan B, Stewart J, Jacobs, RJ. Concerns of anophthalmic patients wearing artificial eyes. *Clin Experiment Ophthalmol*. 2011; 39:47–52.
6. New Zealand Government. Population Estimates/Estimated National Ethnic Population by Age and Sex at 30 June 1996, 2001 and 2006. Available from: <http://www.stats.govt.nz/wds>. Accessed March 2012.
7. New Zealand Government. Work-related injury statistics 2002-2010. http://www.stats.govt.nz/tools_and_services/tools/TableBuilder/injury-tables.aspx
8. Chang KC, Kwon JW, Han YK, Wee WR, Lee, JH. The epidemiology of cosmetic treatments for corneal opacities in a Korean population. *Korean J Ophthalmol*. 2010 Jun;24:148–54.
9. American Academy of Ophthalmology. Eye injuries: recent data and trends in the United States. 2008. <http://www.aao.org>
10. New Zealand Government. Motor vehicle crashes in New Zealand. 2011. <http://www.transport.govt.nz/research/Pages/motorvehiclecrashesinnewzealand.aspx>
11. Osborn KL, Hettler DA. Survey of recommendations on the care of ocular prostheses. *Optometry*. 2007;81:142–5.

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