

Summary table 167 — age or ageing and myopia

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2139	Edwards 1999	Prospective cohort	7-year-old children in Hong Kong, 5-year follow-up	Ageing	NA	123	II	Myopia in the group increased over the 5-year period. The incidence of myopia at the start of the study was 9% and was 18–20% at the end.	
2145	Matsumara and Hirai 1999	Cross-sectional (annual) + prospective cohort	Mass survey of Japanese students from age 3 to 17 years annually from 1984–96 + cohort of 12-year-olds with 6-year follow-up	Ageing	NA	17,320 + 346 (cohort)	II/IV	Cross-sectional study: over the 13 years of the study, the incidence of myopia in children older than 7 increased, and this increase was statistically significant for children over 10 years old. The prevalence of myopia in 17-year-old students increased from 49.3% to 65.5%. Authors suggest that this increased prevalence was due to changes in physique over this period and trends to more intensive schooling. Cohort study: the prevalence of myopia increased from 43.5% at 12 years to 66% at 17 years. The annual mean progression towards myopia was statistically significantly more rapidly for boys than girls.	
2137	Bullimore et al 2002	Retrospective cohort	Wearers of soft contact lenses aged between 20 and 40 in Georgia, USA, 5-year follow-up	Ageing	NA	291	III-2	21.3% of the group had a progressive increase in their myopia over the 5-year period. Myopia progression was greater in the subjects in their 20s (41.75%) compared with those in their 30s (26.15%). There was no difference in the reading, computer use and television viewing habits of the progressors and the nonprogressors.	
2135	Bengtsson and Grodum 1999	Cross-sectional	Swedish pensioners age 65 to 74 years in 3 separate population studies	Ageing	NA	35,618	IV (LPS)	An increase in myopia was observed over 10 years. Changes in myopia from one generation to the next were smaller, indicating that the change was specifically age related.	
982	Buch et al 2004	Cross-sectional	Adults age 20 to 84 from the general population of Copenhagen,	Ageing	NA	9980	IV (LPS)	Myopia was the biggest cause of visual problems in the under 65-year-olds.	

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
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2142	Lee et al 1999	Prospective cohort	Beaver Dam Eye Study (people aged 43 to 84, 5-year follow-up)	Ageing	NA	3684	II (LPS)	Before the age of 70, people became more hyperopic and after 70, more myopic. 39% of the under 70 group became more hyperopic over the 5-year period. Only 24% of the over 70 group became hyperopic.	
2133	Lee et al 2002	Prospective cohort	All people age 43 to 84 in Beaver Dam, Wisconsin studied in 1988-1990 and then 5 and 10 years later	Ageing	NA	2937	II (LPS)	Before the age of 70 people became more hyperopic and after 70, more myopic. 39% of the under-70 group became more hyperopic over the 10-year period. Only 24% of the over-70 group became hyperopic.	

Summary	Group
Myopia increases with age up to the age of 30 and again for people over the age of 70.	<p>Group 1 — Clear association/causality</p> <p>Group 2 — Possible association/causality (more research needed)</p> <p>Group 3 — Lack of association/causality</p> <p>Group 4 — Possible lack of association/causality (more research needed)</p> <p>Group 5 — Conflicting results</p> <p>Group 6 — Possible protection</p> <p>Group 7 — No studies</p>

Summary table 168 — age or ageing and hyperopia

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2130	Haegerstrom-Portnoy et al 2002	Cross-sectional	Population aged between 58 and 102 from Marin County, California, USA	Ageing	NA	569	IV	Hyperopia increased to age 70, stabilised for 10 years and then increased further in the oldest group (85 years plus).	
2133	Lee et al 2002	Prospective cohort	All people age 43 to 84 in Beaver Dam, Wisconsin studied in 1988-1990 and then 5 and 10 years later	Ageing	NA	2937	IV (LPS)	Before the age of 70, people became more hyperopic and after 70 years, more myopic. 39% of the under-70 group became more hyperopic over the 10-year period. Only 24% of the over-70 group became hyperopic. 50% of the population under 60 years had a shift to hyperopia greater than 0.5D. This trend reversed in the over 70s.	
1860	Wang et al 1998	Cross-sectional	Residents over 49 years in Blue Mountains, west of Sydney.	Ageing	NA	3654	IV (LPS)	There was a significant link between hyperopia and age-related maculopathy (OR 2.0; 95%CI 1.2 to 3.4).	

Summary	Group
Hyperopia appears to increase with age up to the age of 70. Some studies report a stabilising and then a further increase with extreme old age, whereas others report a shift to myopia between 70 and 85 years.	<p><i>Group 1</i> — Clear association/causality</p> <p><i>Group 2</i> — Possible association/causality (more research needed)</p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

Summary table 169 — age or ageing and astigmatism

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2126	Atchison et al 2005	Cross-sectional	Younger and older people (Queensland, Australia)	Older people (59+ years)	Students (21–27 years)	41 (older) 55 (young)	III-3	Complicated study design — not very useful. Age did not affect peripheral refraction. Authors note that this finding was contrary to two previous findings in the late 1980s but claim that these previous studies were flawed.	Paper not very relevant as looks are peripheral refraction only
2131	Topuz et al 2004	Prospective cohort	Patients, employees and students, all with normal corneas, at a hospital in Turkey	Ageing	NA	120	II	Mean astigmatism values were similar in all age groups, but the type of astigmatism varied between age groups.	
2130	Haegerstrom-Portnoy et al 2002	Cross-sectional	Population aged between 58 and 102 from Marin County, California, USA	Ageing	NA	569	IV	Astigmatism increased with age by a factor of 3.5. Age-related corneal changes contributed to the increase in astigmatism in people older than 70 years.	
2127	Gudmundsdottir et al 2000	Cross-sectional	Random selection of people 50 years and over in Reykjavik, Iceland	Ageing	NA	1045	IV (LPS)	Astigmatism increased with age. 38% females and 36% males in the group 50–54 years compared with 89% females and 87% males older than 80 years. On average, the increase in prevalence was 7.7% in 5 years.	
2128	Guzowski et al 2003	Cross-sectional	Residents over 49 years in Blue Mountains, west of Sydney	Ageing	NA	3654	IV	Prevalence and severity of anisometropia increased with age (10% at < 60 years to 31% at 80+ years; $P < 0.01$), increasing astigmatism or ametropia. Associated with age, ametropia and cataract.	Not directly about ageing and astigmatism

Summary	Group
<p>It is not clear whether ageing affects the incidence of astigmatism or just the type of astigmatism present.</p>	<p> <i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies </p>

Summary table 175 — diabetes and myopia

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2158	Logstrup et al 1997	Retrospective cohort	45 twin pairs (16 MZ, 14 DZ same sex, 15 DZ opposite sex) with one or both partners affected by insulin-dependent diabetes melitis (IDDM), born 1953–82, from the Danish Twin Register	Duration of IDDM	Interpair differences of IDDM duration correlated with interpair diffs in refraction and each of its components	45 twin pairs (=90 people) 16 MZ, 14 DZ same sex [DZss], 15 DZ opposite sex [DZos]) From total of 20888 twin pairs	III-2	<p>Median and mean refractive values were more myopic in diabetic than in nondiabetic subjects ($P < 0.05$, Mann-Whitney test).</p> <p>Refraction was negatively correlated with the duration of IDDM in DZss and axial length was correspondingly positively correlated (ie axial lengths longer in twins with longer duration IDDM, corresponding to the more myopic refractive power).</p> <p>No statistically significant correlations with other groups of twins (eg MZ twins had decreased axial length and were therefore more longsighted with increased duration IDDM; however, could be due to chance as sample size small [not significant]).</p> <p>Were not able to test the correlation of the severity of IDDM and refractive error.</p> <p>Refraction in MZ ($n = 16$): $R = +0.39$ ($P = 0.135$) $L = +0.46$ ($P = 0.075$)</p> <p>Refraction in DZss ($n = 14$): $R = -0.76$ ($P = 0.02$) $L = -0.65$ ($P = 0.012$)</p> <p>Refraction in DZos ($n = 15$): $R = -0.14$ ($P = 0.612$) $L = -0.11$ ($P = 0.703$)</p>	Did not adjust for all the confounding effects because of the small size of the study. Paper slightly off topic (ie investigating duration of diabetes, rather than presence or absence as a risk factor).

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
2142	Lee et al 1999	Prospective cohort	196 people with diabetes were included within a total study sample of 3684 people aged 43–84 years from Beaver Dam (total sample included anyone in the appropriate age range). First sample 1988–1990; second sample 1993–95.	Diabetes	No diabetes (note: this was only one component; other factors were studied)	2994	II (LPS)	Those with diabetes (adjusted for confounding factors) were more likely to have hyperopic shifts (ie become more farsighted rather than shortsighted). After adjusting for age and sex, diabetic people had a -0.22 -D change in spherical equivalent ($P = 0.02$). Those without diabetes had a $+0.10$ -D change in spherical equivalent.	Diabetes as a risk factor for refraction changes was only a small component of the study. Study primarily looked at time as a risk factor for refractive change.

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
2133	Lee et al 2002	Prospective cohort	133 people with diabetes from a total sample of 2937 people aged over 40 years from the Beaver Dam study (total sample from the general population — anyone over 40 years). Measures taken 1988– 90, 1993–95 (5-year interval) and 1998–2000 (10-year interval)	Diabetes	No diabetes (note: this was only one component; other factors were studied)	133	II	Same as Lee et al 1999: people with diabetes had a greater shift towards hyperopia than those without diabetes. The 10-year change in spherical equivalent (measured in diopters) for people with diabetes (<i>n</i> = 133) was +0.42. Adjusting for age, the estimated change in refractive power was +0.49 (<i>P</i> = 0.008) (without diabetes = 0.26).	Study primarily looked at time as a risk factor for refractive change.

Summary	Group
Diabetes does not appear to be a risk factor for myopia.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

Summary table 176 — diabetes and hyperopia

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2151	Giusti 2003	Case series	Teenagers (< 20 years) with hyperopia and type 1 diabetes (poor metabolic control was an inclusion factor). Four-month study with fortnightly follow-up.	Juvenile (type 1) diabetes	None	20 (40 eyes)	–	Transient hyperopic changes were highly dependent on magnitude of plasma glucose concentration, as well as HbA1c percentages ($P < 0.001$). Rapid glycaemic control in early stages of juvenile diabetes minimised refractive changes. Contrasts with earlier studies that showed that myopia was more often associated with hyperglycaemia, and hyperopia with hypoglycaemia.	Note: study assessed transient hyperopia caused by juvenile diabetes. Also measured refractive components

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2153	Fumiki et al 2000	Case series	Patients with persistent diabetes presenting to hospital (consecutive; selected according to high plasma glucose level and high HbA1c)	Diabetes	None	14 patients (28 eyes)	–	<p>Transient hyperopic changes occurred in all patients receiving improved control after hyperglycaemia (transient change of 0.5D or more in all eyes) (occurred at a mean of 3–4 days after treatment onset; peaked at a mean of 10.3 days)</p> <p>Maximum hyperopic change in an eye = 1.47 (+ 0.87)D</p> <p>Significant positive correlation between maximum hyperopic change of an eye and plasma glucose concentration ($r = 0.49, P < 0.01$)</p> <p>Significant positive correlation between maximum hyperopic change of an eye and HbA1c ($r = 0.57, P < 0.005$).</p> <p>During transient hyperopia, no significant changes were observed in refractive components (corneal curvature, axial length, lens thickness, depth of anterior chamber).</p> <p>Degree of transient hyperopia associated with rapid correction of hyperglycaemia is highly dependent on rate of reduction of plasma glucose level.</p>	Study assesses transient hyperopia, not permanent damage.

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
2158	Logstrup et al 1997	Retrospective cohort	45 twin pairs (16 MZ, 14 DZ same sex [DZss], 15 DZ opposite sex [DZos]) with one or both partners affected by insulin- dependent diabetes melitis (IDDM), born 1953– 82, from the Danish Twin Register	Duration of IDDM	Interpair differences of IDDM duration correlated with interpair diffs in refraction and each of its components	45 twin pairs (= 90 people) 16 MZ, 14 DZss, 15 DZos) From total of 20,888 twin pairs	III-2	<p>Median and mean refractive values were more myopic in diabetic than in nondiabetic subjects ($P < 0.05$, Mann-Whitney test).</p> <p>Refraction was negatively correlated with the duration of IDDM in DZss and axial length was correspondingly positively correlated (ie axial lengths longer in twins with longer duration IDDM, corresponding to the more myopic refractive power).</p> <p>No statistically significant correlations with other groups of twins (eg MZ twins had decreased axial length and were therefore more longsighted with increased duration IDDM; however, could be due to chance as sample size small (not significant).</p> <p>Were not able to test the correlation of the severity of IDDM and refractive error.</p> <p>Refraction in MZ ($n = 16$): $R = +0.39$ ($P = 0.135$) $L = +0.46$ ($P = 0.075$)</p> <p>Refraction in DZss ($n = 14$) $R = -0.76$ ($P = 0.02$) $L = -0.65$ ($P = 0.012$)</p> <p>Refraction in DZos ($n = 15$): $R = -0.14$ ($P = 0.612$) $L = -0.11$ ($P = 0.703$)</p>	<p>Did not adjust for all the confounding effects because of the small size of the study.</p> <p>Paper slightly off topic (ie investigating duration of diabetes, rather than presence or absence as a risk factor).</p>

Summary	Group
Diabetes can cause transient hyperopia. This effect is corrected when hyperglycaemia is corrected.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

Summary table 179 — heredity and myopia

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1788	Schwarz et al 2002	Case series	School-aged children in Bradford, English, with visual impairments			72	–	The study concluded that high myopia is possibly genetically linked. It confirmed the results of previous studies which suggested that there is a high incidence of hereditary visual disease in a population with a high proportion of consanguineous marriages.	

Summary	Group
High myopia may have a genetic link, but more research is needed.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

Summary table 181 — heredity and astigmatism

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2159	Mandalos et al 2002	Cross-sectional	Students from Northern Greece	Heredity		1738	IV	Females ran a significantly higher risk of astigmatism than males, and heredity seemed to be an important predisposing factor for astigmatism.	Extracted from abstract

Summary	Group
Heredity may be a predisposing factor for astigmatism.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies

Summary table 186 — hyperopia and presbyopia

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2361	Spierer and Shalev 2003	Case series	Male pilots who suffered from presbyopia	Hyperopia		100	—	A number of ocular variables were compared between those who needed reading glasses at 45 or earlier, and those who needed reading glasses after 45. The authors concluded that hyperopia and low amplitude of accommodation at the age of 20 might predispose to early development of presbyopia in normal individuals	

Summary	Group
Hyperopia may predispose to early development of presbyopia in normal individuals.	<p><i>Group 1</i> — Clear association/causality</p> <p><i>Group 2</i> — Possible association/causality (more research needed)</p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

Summary table 187 — occupation that requires near vision and myopia

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
1873	Kinge et al 2000	Prospective cohort study	Norwegian students mean age 20.6 years. 70 males, 79 females (right eye) 3-year follow-up	Near work (assessed by questionnaire examining: lecture time, calculation tasks, reading, video viewing, television watching)	NA	149 (70 male, 79 female)	II	<p>The prevalence of myopic right eye in these 192 students increased significantly over the 3 years, from 48% to 65%. The mean refractive change of -0.51 +/- 0.49 D was significant ($P = 0.0001$).</p> <p>A statistically significant relationship (Pearson's r) was found between mean refractive change and average time spent at lecture ($r = -0.24$), reading scientific literature ($r = -0.25$) and practical near-work during holidays ($r = -0.17$).</p> <p>No relationship was found between mean refractive change and time spent at computer work or watching television.</p> <p>This study supports earlier work showing that the prevalence of myopia increases in groups exposed to high educational demands.</p>	
2141	Kinge et al 1999	Prospective cohort study	Norwegian students mean age 20.6 years. (right eye) 3-year follow-up)	Students (reading, writing, etc)	NA	149 (70 male, 79 female)	II	<p>Over the 3-year period, the prevalence of myopic right eyes increased from 49% to 66% in this group. The increase was observed in all 3 subgroups (initially myopic, emmetropic and hyperopic eyes).</p> <p>The biometric changes</p>	The study examines related biometric changes, not the influence of any risk factor. However, subjects were

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	<i>N</i>	Level (quality)	Results	Other notes
								examined were corneal radius, anterior chamber depth, lens thickness and vitreous chamber depth. There was a highly significant correlation between an increase in vitreous chamber elongation and an increase in mean refractive change towards myopia ($P = 0.0001$) No such relationship was found with other biometric characteristics.	students (ie high study demands).
1870	Gwiazda et al 2004	Prospective cohort	469 children (aged 6–11 years) 3-year follow-up	Near work (assessed by questionnaire)	NA	469	II	The study examined a number of risk factors for progression of myopia over 3 years, and their interaction with treatment using progressive addition lenses (PALs) ($n = 235$) or single vision lenses (SVLs) ($n = 234$). The most significant risk factor for progression of myopia in these children was accommodation lag, which was slowed using PALs. For children with larger accommodation lags, more hours of near work tended to increase the usefulness of PALs but the effect was not significant with the small numbers examined.	The study is not an effective or rigorous examination of near work on progression of myopia in children.
1874	Mutti et al 2002	Cross-sectional	366 eighth grade children who participated in a longitudinal	1. Heredity 2. Intellectual ability 3. Near work — assessed by survey of parents	NA	366	IV	The study examined the relative importance of heredity, near work, and intellectual ability on the incidence of myopia in	The authors suggest prospective longitudinal studies are

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
			study of myopia 1991–96	examining (i) reading and studying (ii) reading for pleasure (iii) television watching (iv) computer/videogames (v) sport				<p>children.</p> <p>In the study sample, 67 were myopes, 28 were hyperopes and 271 emmetropes. Children with myopia spent more time in near activities (OR = 1.018) and less time in sport (OR = 0.936), and scored higher in reading (OR = 1.013) and language scores (OR = 1.014). Watching television and computer work did not differ between myopes and emmetropes. Parents with myopia tended to have children with myopia.</p> <p>These risk factors interconnect and therefore confound one another; however, near work had little influence on the association between heredity and myopia, suggesting heredity is the dominant risk factor.</p>	needed to examine these risk factors.
1872	Khader et al 2006	Cross-sectional	1777 secondary students in Amman, Jordan, aged 12–17 years	Near work (assessed by questionnaire and included reading, writing, television watching, and computer work)	NA	1777 (1081M, 696F)	IV	In the study, there were 313 students with myopia (20.3%F, 15.9%M). The activities outside school associated with myopia were age, family history, computer work (OD = 1.16), and reading/writing (OD = 1.24).	

Summary	Group
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<p>The studies are not sufficient to examine in detail the relationship between the effect of near work and incidence and progression of myopia. Two studies suggest that near work has less effect than heredity; one study suggests that intensive near work could initiate myopia or lead to its progression in young adults. Further longitudinal studies are needed to examine the effect of near work.</p>	<p><i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies</p>
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Summary table 191 — ocular disease and myopia

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2392	Smith and Tasman 2005	Case series	Patients (age 45+) diagnosed with untreated retinopathy of prematurity (ROP)	Retinopathy of prematurity (low birthweight and gestational age)	NA	47 (33 female, 14 male)	–	86 eyes were examined: refractive index could be determined for 43 eyes. 39 eyes (90.7%) showed some degree of myopia. 14 eyes (32.67%) were highly myopic. 19 eyes (44.2%) were moderately myopic. 6 eyes (14.0%) were mildly myopic.	This study is very specific to ROP patients and not relevant to the general population.
2399	Wu et al 2005	Prospective cohort	Barbados-born citizens 49+ years (original study 40–84 yrs) 9-year follow-up	Nuclear lens opacities; glaucoma; ocular hypertension	NA	2792	II (LPS)	The presence of nuclear lens opacities at baseline increased the risk of myopia (RR 1.7; 95%CI 1.01 to 2.89) and moderate-high myopia (RR 3.6; 2.0 to 6.7). Myopia risk also increased with increasing severity of nuclear opacities ($P < 0.05$). The baseline incidence of glaucoma (RR 6.0; 95%CI 3.9 to 9.3) and ocular hypertension (RR 2.0 95%CI 1.3 to 3.0) also increased the risk of myopia.	

Summary	Group
Nuclear opacities (cataract) and glaucoma (and ocular hypertension) may increase the risk of myopia. Further studies are needed to examine the effect of ocular diseases on myopia. Untreated retinopathy of prematurity (ROP) leads to a high incidence of myopia in adults.	<p><i>Group 1</i> — Clear association/causality</p> <p><i>Group 2</i> — Possible association/causality (more research needed)</p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

Summary table 192 — ocular disease and hyperopia

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2399	Wu et al 2005	Prospective cohort (9-year follow-up)	Barbados-born citizens 49+ years (original study 40–84 yrs)	Glaucoma and ocular hypertension	NA	2793 (original study 4631 participants)	II	<p>Glaucoma was negatively associated with the incidence of hyperopia (RR 95%CI 0.4; 0.2 to 0.8) in males and females. Ocular hypertension showed a similar negative trend but the association was not statistically significant. The incidence of hyperopia was slightly less in males than in females.</p> <p>Increasing age also decreased the risk of hyperopia.</p> <p>There was no statistically significant association between baseline lens opacities of any type and the incidence of hyperopia.</p>	

Summary	Group
Hyperopia incidence decreased with incidence of glaucoma and ocular hypertension.	<p><i>Group 1</i> — Clear association/causality</p> <p><i>Group 2</i> — Possible association/causality (more research needed)</p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

Summary table 193 — ocular disease and astigmatism

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
2401	Mombaerts et al 2006	Case-control study	Patients under 55 years with inactive Grave's ophthalmopathy in Belgium	Ocular disease, specifically Grave's ophthalmopathy	109 controls without Grave's ophthalmopathy	109 cases, 109 controls	III-3	Grave's ophthalmopathy is a disease that affects the extraocular muscles that rotate the eyeball. It is related to Grave's disease (hyperthyroidism). Prevalence is 0.25% in US. This study is the first to demonstrate that patients with Grave's ophthalmopathy have a significantly greater steepening of the central cornea (astigmatism) in the with-the-rule meridian (horizontal) compared with control eyes.	

Summary	Group
Grave's ophthalmopathy may be associated with greater with-the-rule (horizontal) astigmatism. However, given the low prevalence of Grave's ophthalmopathy, it is unlikely to be a significant risk factor for astigmatism in the general population.	<p><i>Group 1</i> — Clear association/causality</p> <p><i>Group 2</i> — Possible association/causality (more research needed)</p> <p><i>Group 3</i> — Lack of association/causality</p> <p><i>Group 4</i> — Possible lack of association/causality (more research needed)</p> <p><i>Group 5</i> — Conflicting results</p> <p><i>Group 6</i> — Possible protection</p> <p><i>Group 7</i> — No studies</p>

Summary table 197 — trauma and astigmatism

Paper no.	Reference	Type of study	Population/ study information	Risk factor	Comparator	N	Level (quality)	Results	Other notes
835	Ludwig et al 2002	Case report	Child	Trauma	NA	1	–	A 6-year-old boy suffered a scleral perforation with vitreous prolapse, which was repaired during surgery. Within 6 weeks he developed lenticular astigmatism, presumably caused by anterior vitreous fibres and anterior hyaloid, which were removed. Full visual acuity was restored. Lenticular astigmatism following penetrating eye injury has been described on only one other occasion.	

Summary	Group
Although rare, a wound can lead to secondary problems such as lenticular astigmatism.	<i>Group 1</i> — Clear association/causality <i>Group 2</i> — Possible association/causality (more research needed) <i>Group 3</i> — Lack of association/causality <i>Group 4</i> — Possible lack of association/causality (more research needed) <i>Group 5</i> — Conflicting results <i>Group 6</i> — Possible protection <i>Group 7</i> — No studies