A Retrospective Study of Myopia Progression in Adult Contact Lens Wearsers

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PURPOSE. To study retrospectively the frequency of myopia progression and risk factors for progression in a sample of adult contact lens wearers.

METHODS. From a database of 815 soft contact lens wearers, patients were identified whose age was between 20 and 40 years, who had at least −0.50 D spherical equivalent of myopia in both eyes, three or more refractions, and ≥5 years of follow-up. Only data from the right eye were used. Progression was defined as an increase of at least −1.00 D over 5 years. Subjects were also asked to complete a questionnaire regarding their ocular history, demographics, family history, and the amount of time spent performing different tasks at home and at work.

RESULTS. Two hundred ninety-one subjects met the eligibility criteria with a mean baseline refractive error of −3.29 ± 1.92 D and a mean age of 28.5 ± 5.0 years. Of these, 21.3% progressed by at least −1.00 D over the 5-year period. The 5-year rate of progression decreased with increasing age ($\chi^2 = 12.44$, $P = 0.006$). One hundred ninety-seven subjects (67.6%) completed and returned questionnaires. “Progressors” ($N = 41$) did not differ from “nonprogressors” ($N = 156$) in terms of hours per day spent reading and writing, computer use, education level, family history of myopia, age of onset of myopia, and contact lens wear.

CONCLUSIONS. In this database of soft contact lens wearers, myopia progression was common for subjects in their twenties and less common for those in their thirties. (Invest Ophthalmol Vis Sci. 2002;43:2110-2113)

The majority of myopia develops during the school years and stabilizes in the teenage years.1 Nonetheless, a number of individuals show myopic changes after entering college. This may manifest as an increase in myopia in a previously myopic subject (adult myopia progression) or as the onset of myopia in a previously emmetropic or hyperopic individual (adult onset myopia). The National Research Council Committee on Vision Working Group on Myopia Prevalence and Progression reviewed more than 500 articles on myopia, the majority of which were published since 1950.2 They concluded that “myopia can start or progress after [age] 16, although it is less severe and limited to a smaller proportion of individuals.”

They also noted that myopic shifts are apparently small enough to go undetected in cross-sectional, population-based studies. On the basis of the studies reviewed, the report concluded that up to 40% of low hyperopes and emmetropes entering college and military academies are likely to become myopic by the age of 25. Conversely, in populations where college graduates are excluded, <10% of hyperopic or emmetropic individuals become myopic before the onset of presbyopia. Eye care practitioners are now describing adult myopia progression in 30- to 40-year-old patients, anecdotally associated with professional or graduate school and/or increasing computer use.

We retrospectively studied a group of adults between 20 and 40 years of age using a contact lens research clinic database to determine the proportion of subjects that underwent significant myopia progression and the risk factors associated with myopia progression.

METHODS

A retrospective study was conducted using a database of 815 soft contact lens wearers from a contact lens industry research clinic (CIBA Vision, Duluth, GA). Patients attended this research clinic for routine contact lens care and involvement in new clinical studies, primarily studies evaluating different soft contact lenses and contact lens care systems. To remain in the clinic database, patients had to receive a full eye examination at least once every 2 years from an optometrist or ophthalmologist and had to provide the clinic with a copy of their spectacle prescription. Most likely, this examination did not include a cycloplegic refraction. Presumably, the patients’ motivation for remaining in the database was to receive free contact lenses and solutions rather than because their myopia was increasing and their visual acuity was decreasing. The database included patient information from between 1977 and 1996. Patient age ranged from 10 to 70 years, with up to 17 years of follow-up. Information on strabismus and visual acuity was not available. The tenets of the Declaration of Helsinki were followed, and informed consent was obtained from subjects.

Frequency of Myopia Progression

Patients were identified whose ages were between 20 and 40 years and who had at least −0.50 D spherical equivalent of myopia in both eyes at baseline, three or more refraction visits, and ≥5 years of follow-up. Patients were not excluded on the basis of high myopia, anisometropia, or astigmatism. Myopia progression was defined as an increase in myopia of at least −1.00 D spherical equivalent over a 5-year period, although we also present progression data for a criterion of −0.75 D spherical equivalent. Progression was defined by the first visit when a given criterion was reached. The proportion of subjects that progressed over a 5-year period was then calculated. Only data from the right eye were included.

Risk Factors for Myopia Progression

Subjects who met the above entry criteria were mailed a questionnaire asking about their ocular history, demographics, family history of myopia, and the amount of time spent performing different near vision tasks at work and at home. Because the subjects’ refractive data were retrospective, subjects were asked the following question: “Over the past 10 years, how much of your time (in hours per day) during work...
has been spent doing each of the following activities: driving, reading and writing, in meetings, using a computer/VDT? Subjects were asked a similarly worded question regarding their home activities. Subjects were not required to provide any refractive data. Completed questionnaires were returned in an enclosed business reply envelope. They received $10 reimbursement for returning a completed questionnaire.

RESULTS

Frequency of Myopia Progression

Two hundred ninety-one subjects met the eligibility criteria. The mean refractive error at baseline was $-3.29 \pm 1.92$ D, and the mean age was $28.5 \pm 5.0$ years. At baseline, 5 subjects had anisometropia of $\geq 2.00$ D, 10 had astigmatism of $\geq 2.00$ D, and 6 had myopia of $\geq 8.00$ D or greater. Subjects had been followed for up to 17.2 years (median, 7.7 years), but only data through 5 years of follow-up were used to define progression.

The mean progression of myopia was $-0.44 \pm 0.60$ D (median, $-0.37$ D; range, $1.88$ to $-2.75$ D), based on the difference between the first and last visits in the 5-year window. Myopia progression of at least $-1.00$ D over the 5-year period occurred in 21.3% of eligible subjects but showed a marked age dependence. Table 1 shows that the frequency of myopia progression decreases with age from 34.9% in 20 to 25 year olds to 10.0% in 35 to 40 year olds ($\chi^2 = 12.44$, $P = 0.006$). Progression in subjects with baseline myopia of at least $-3.00$ D was similar to those with less than $-3.00$ D of myopia (16.9% vs. 23.7%, relative risk $= 0.65$, 95% CI = 0.32–1.34). One subject showed regression of myopia of at least 1.00 D. Table 1 also shows the relation between age at entry and frequency of myopia progression for a criterion of $-0.75$ D over 5 years.

Risk Factors For Myopia Progression

One hundred ninety-seven subjects (67.6%) completed and returned the questionnaires. Of the remaining 94 subjects, 29 questionnaires were returned as undeliverable. If these subjects are excluded, the response rate increases to 75.1%. The mean refractive error ($-3.30 \pm 1.85$ D), mean age ($28.7 \pm 4.9$ years), and frequency of progression (20.8%) for the respondents were not significantly different from those for the nonresponders ($-3.26 \pm 2.05$ D, $28.1 \pm 5.0$ years, and 22.3%). Of the 197 subjects who completed questionnaires, 41 were categorized as progressors (at least $-1.00$ D over the 5-year period) and 156 as nonprogressors.

Questionnaire results are summarized in Tables 2 and 3. The sample is predominantly female, white, and well educated. Subjects began wearing spectacles at a mean age of $14.3 \pm 5.9$ years and contact lenses at a mean age of $21.8 \pm 6.4$ years. More than 80% had at least one parent or sibling who was myopic. Ninety percent were currently wearing soft contact lenses.

The only statistically significant difference between the two groups was that progressors began wearing spectacles at an older age than nonprogressors ($16.5 \pm 6.3$ years vs. $13.7 \pm 5.6$ years).
years, odds ratio by univariate logistic regression = 1.08, 95% CI = 1.02 to 1.14, $P = 0.009$). The groups did not differ in terms of the age that they began wearing contact lenses (progressors mean, 22.1 ± 5.9 years and non progressors mean, 21.7 ± 6.5 years) or their current lens wear schedule (Table 2).

The odds ratios presented in Table 3 are controlled for age at baseline and age at which subjects began wearing spectacles. Progressors did not differ from nonprogressors in terms of hours per day spent reading and writing, computer use, education level, or current mode of refractive correction. Given that multiple comparisons are presented, it is appropriate to use more conservative alpha values by applying the Bonferroni correction (Table 3). Adopting different criteria for myopia progression, e.g., −0.75 D, did not substantially alter the study findings presented in Tables 2 and 3, nor did restricting the age range to <35 years. Controlling for other potential confounding variables, i.e., gender, age, education, race, and age when contact lens wear began, also did not alter the findings.

**DISCUSSION**

Our data demonstrate that significant myopia progression (at least −1.00 D over 5 years) occurred in roughly 20% of this population of young myopic adults wearing soft contact lenses, although caution should be exercised in generalizing the results from our database to populations with different occupations or modes of refractive correction. Progression was more common in subjects in their twenties but still occurred in >10% of adults in their thirties. Using different criteria for progression revealed that ~36% of subjects progressed by at least −0.75 D. These estimates may be unstable because refractions were performed by a large number of clinicians, and it is not known what proportion of refractions was performed under cycloplegia. In spite of these potential sources of variability, only one subject regressed by at least +1.00 D compared with 62 who progressed by at least −1.00 D.

There have been a number of recent reports of myopia progression in adulthood, and a selection are summarized in Table 4.3-10 It is difficult to make direct comparisons between
our results and the studies listed in Table 4 because of the different periods of follow-up, methodology, populations studied, and the various criteria for progression. Nonetheless, some comment is appropriate. McBrien and Adams\(^9\) reported that 108 of 225 myopic eyes (48.4\%) in their sample of microscopists (mean age, 29.7 years) progressed by at least \(-0.37\) D over 2 years. Studies of students and military recruits in their twenties suggest that between 26\% and 47\% of myopes progress by at least \(-0.50\) D over a period of up to 3 years.\(^3,4,6\)

Data on older subjects are scarce, but Ellingsen et al.\(^8\) found a mean shift of \(-0.39\) D per decade in myopes in their thirties and Waring et al.\(^7\) reported a mean myopic shift of \(-0.065\) D across 10 years in the fellow eye of 47 Prospective Evaluation of Radial Keratotomy (PERK) Study patients who had elected not to undergo radial keratotomy on their second eye. Our results provide further evidence that myopia progression is common in adults.

We found that the frequency of myopia progression was similar in subjects with at least \(-3.00\) D of myopia at baseline (16.9\%) and those with less than \(-3.00\) D (23.7\%). Previous studies are contradictory on this issue. In a retrospective study of military recruits, O’Neal and Connan\(^4\) found that myopes over \(-3.00\) D progressed at a faster rate than lower myopes, but they do not give the upper range of myopia in their sample. More recently, Ellingsen et al.\(^8\) reported that subjects with less than \(-1.00\) D of myopia progress at a faster rate during adulthood than those with between \(-1.00\) and \(-6.00\) D of myopia, in a retrospective practice-based study.

Our sample is different from those used in previous studies. Although we studied a clinic-based sample, the patients’ likely motivation for remaining in this clinic database was most probably to receive free contact lenses and solutions. Presumably, their frequency of attendance was not motivated by changes in their refractive error, their visual acuity, or both. In contrast, Zadnik and Mutti\(^3\) and Ellingsen et al.\(^8\) retrospectively studied practice records, raising the possibility of higher rates of progression because patients whose myopia is progressing may be more likely to return more often for eye care.

Unlike some previous reports of adult myopia progression, our study was conducted on subjects from a broad range of occupations rather than a single professional group, e.g., optometry students,\(^6\) military recruits,\(^4\) or microscopists.\(^3,9\) Nonetheless, our sample was somewhat homogenous in a number of other ways. As a group, subjects were well educated and Waring et al.\(^7\) reported a mean myopic shift of \(-0.65\) D across 10 years in the fellow eye of 47 Prospective Evaluation of Radial Keratotomy (PERK) Study patients who had elected not to undergo radial keratotomy on their second eye. Our results provide further evidence that myopia progression is common in adults.

In summary, myopia progression is common in this adult sample, but we failed to find any association of myopia progression with near work, education, family history, or mode of refractive correction. Progressors began wearing spectacles at an older age than nonprogressors. Prospective investigations are warranted to overcome the limitations of this retrospective study.

**References**


