Published in final edited form as:

Int Ophthalmol. 2018 April ; 38(2): 869–874. doi:10.1007/s10792-017-0510-x.

Advanced Myopia, Prevalence and Incidence Analysis

Peter R. Greene, Ph.D.⁺ and Judith M. Greene, M.P.H.^{*}

⁺P. R. Greene, BGKT Consulting Ltd., Bioengineering, Huntington, NY, 11743,
prgreenBGKT@gmail.com +1 631 838 0395

^{*}J.M. Greene, BGKT Computer Sciences, jmgreene333@gmail.com +1 631 721 8108

Abstract

Purpose—Various high-percentage high-incidence medical conditions, acute or chronic, start at a particular *age of onset* t_1 [yrs.], accumulate or progress rapidly, with a *system time constant* t_0 [yrs.], typically from one week to five years, and then level off at a *plateau level* $\langle S \rangle$, ultimately affecting ten to ninety-five percent of the population. This report investigates the prevalence and incidence functions for myopia and high myopia as a function of age.

Methods—Fundamental *prevalence vs. time* and *incidence vs. time* results allow continuous prediction of *myopia* and *high myopia* population fractions as a function of age. This is a retrospective study. Nine reports are calculated with $N = 444,600$ subjects, from S.E. Asia. No interventions other than usual regular eye exams, and subsequent indicated refraction change.

Results—The main result is continuous prediction of myopia prevalence-time data along with incidence rate data [% / year], age of onset [years], system plateau level, and system time constant [yrs.]. These parameters apply to *progressive myopia and high myopia* ($R < -6 D$), useful over several decades.

Conclusions—The primary finding of this research is that the *prevalence ratio* of *high-myopes* ($R < -6.0 D$) to *common-myopes* is expected to increase from 15% entering college, to 45% or more after college and graduate school. These statistics are particularly relevant to the many years of study required by M.D., Ph.D., and M.D. / Ph.D. programs.

Keywords

prevalence; incidence; myopia; high myopia; exponential equations; reading glasses; time constant; onset age; plateau level

Nomenclature

$Pr(t)$ = myopia prevalence fraction as a function of time [%]

$In(t)$ = myopia incidence rate as a function of time [% / year]

t_0 = myopia time constant [years]

t_1 = myopia onset age [years]

t_2 = onset age [years] for advanced myopia

$\langle S \rangle$ = plateau level [%], 30% – 95% for myopia

95% CI = 95% conf. interval, r = correl. coefficient

$\langle \text{std.err.} \rangle$ = r.m.s. error @ regression line, typically $\pm 2\%$

Compliance with ethical standards, conflict of interest

The authors have no proprietary or financial conflicts of interest.

Introduction

Background

By definition, “high myopia” or “advanced myopia” is classified as a refractive error (SER) greater than 6.0 diopters. Usually myopia onset age t_1 is 1 to 18 yrs., typically initial refraction R_0 is -1.0 to -3.0 diopters, thereafter often progressing at an average yearly rate $\langle R' \rangle$ of -0.25 to -1.00 diopters/year.

High myopia ($R < -6$ D) often results in serious problems that can lead to detrimental ramifications, involving the retina, choroid, sclera, vitreous and/or lens, (including glaucoma, macular degeneration, detachment of retina, choroid and/or vitreous, staphyloma, and cataract). It is important to quantify the fractional occurrence of these advanced myopia cases, and if possible, attempt to attenuate the rapid rate of myopia progression, so as to lessen these problems. Plus add reading glasses are one possibility for decreasing the focusing demand on the visual system, including bifocals, progressive add lenses (PALs), and ordinary reading glasses.

The myopia prevalence fraction $\mathbf{Pr(t)}$ [%] versus time and the myopia incidence rate $\mathbf{In(t)}$ [%/yr] versus time are fundamental *mathematically coupled functions*, basic to the understanding of progressive myopia (Fan et al. [1]; Lam & Goh [11]; Lin et al. [12]; Greene et al. [4]; Pan et al. [15]).

In general, medical conditions may be communicable or non-contagious, endemic or epidemic, inherited or acquired. For myopia, a typical incidence rate $\mathbf{In(t)}$ [%/yr.] of 16% percent per year, means one can expect sixteen new myopes each year, from each class of one-hundred students, at that age bracket. Practical ophthalmic examples of *prevalence and incidence equations* include retinopathy of prematurity (R.O.P.), juvenile onset myopia, with onset age ranging from $t_1 = 0$ to 12 yrs. (Fig. 1a below), adult onset glaucoma [17] with onset age $t_1 \sim 30$ years, macular degeneration, cataract development, and presbyopia, with onset around age 40.

Population demographic and epidemiologic surveys often include prevalence measurements, but not incidence data, incidence but not prevalence data, or prevalence without age-specific data. A system time constant t_0 [yrs.] is rarely cited. In this report, we relate these fundamental parameters with basic equations, as applied to the progression of myopia, of epidemic proportions in some populations, (Pan, Ramamurthy, Saw [11]). Some reports simultaneously include prevalence and incidence rates, at *age-specific* time intervals, allowing for an improved understanding of the problem of myopia, [1] [2] [3] [4] [5] [6] [7] [8] [9] [11] [12] [13] [14] [16].

Usually, incidence data $\mathbf{In(t)}$ [%/yr] and prevalence $\mathbf{Pr(t)}$ [%] are not available simultaneously. Similar equations for prevalence as a function of time or age $\mathbf{Pr(t)}$ are derived by Brinks & Landwehr (2013, 2015). Basic exponential equations for prevalence $\mathbf{Pr(t)}$ and incidence $\mathbf{In(t)}$ yield *four key system parameters*: *onset age t_1* [yr], *time constant t_0* [yr], *plateau level $\langle S \rangle$* [%], and *initial incidence rate $\mathbf{In(t_1)}$* [%/yr]. These then, in turn, allow direct comparisons between one data set and another, both cross-sectional and longitudinal.

Materials and methods

Basic equations

Myopia prevalence as a function of time is modeled with the following exponential [equation 4]:

$$\text{Pr}(t) = 0.90[1 - \exp(-(t - t_1)/t_0)] \quad (1)$$

The derivative $d[\text{Pr}(t)]/dt$ is given by

$$\ln(t) = 0.90[(1/t_0)\exp(-(t - t_1)/t_0)] \quad (2)$$

where t_0 [yrs.] is the system time constant, t_1 [yrs.] is the onset age, and $\langle S \rangle = 0.90$ is the plateau level. For myopia, the plateau level $\langle S \rangle = 0.90$ indicates that by age 25 to 30 years old, 90% percent of these populations will develop myopia. The general format for the exponential prevalence equation, with plateau $\langle S \rangle$ is:

$$\text{Pr}(t) = \langle S \rangle [1 - \exp(-(t - t_1)/t_0)] \quad (2a)$$

As derived in Theoretical Results below, Eqs. 4 & 5. Data are from the studies of Goh & Lam [5], Lin et al. [8] [9], Saw et al. [12], Fan et al. [1] [2], Greene [3], Tay et al. [14], Lam & Goh [7], Greene et al. [4].

Data selection criteria

As a practical matter, the nine (9) studies listed above, each with a different number of subjects, are “weighted” equally, for regression purposes. These studies were the only ones readily available prior to 2014, providing detailed prevalence $\text{Pr}(t)$ and incidence $\text{In}(t)$ data on an age-bracket basis (i.e. “age specific” data). As it happens, most of these are from the S.E. Asia area, presumably because the myopia problem, now of epidemic proportions, is being researched in this region. As shown in Fig. 1b, years of education is given by age minus five: t [yrs] = $A - 5$. Appendix I derives practical mathematical techniques using semi-log co-ordinates to determine the system time constant t_0 , onset age t_1 , and plateau level $\langle S \rangle$, extricating these parameters from large data sets.

Results

Statistics

Least squares regression calculates an average incidence rate $\text{In}(t) = 4.7\%$ per year. Confidence limits on the incidence rate are $\text{In} = [95\% \text{ CI: } 2.1 \text{ to } 7.3\%/\text{yr}]$. This means one can expect 2.1 to 7.3 new cases of myopia per year, on average, from each class of 100 at the same education level, Fig 2, 3. The exponential equations predict much higher initial incidence rates $\text{In}(t_1)$, i.e. 15% to 20% per year, consistent with the incidence rate data, as shown in Fig 2, 3. The myopia prevalence vs. time function $\text{Pr}(t)$ [yrs] and myopia

incidence vs. time function **In(t) [%/yr]** are continuously generated and compared with student data, Figures 1b and 2.

Theoretical results

Myopia incidence rates [%/yr] are 5 to 10 times more rapid, during the juvenile and teen years, compared to the college and university years. Figure 1b presents prevalence as a function of years of education **Pr(t)**, using the data from [4], and theory from (Eq. 1). (Figure 2) shows incidence as a function of time **In(t)**, using data from [4], and theory from (Eq. 2).

For comparison with the exponential model, Figure 3 displays least squares regression statistics, yielding the following:

$$\text{prev}(t) = 0.047(t) + 0.178(x100\%) \quad (3)$$

where t = years of education, correlation $r = 0.88$, $N=9$, $\langle \text{std.err.} \rangle = \pm 10.6\%$ about regression line, constant incidence rate $\langle \mathbf{In} \rangle = 4.7\%$ per year, [95% CI: 2.1 to 7.3 %/yr].

Eq. (1) and (2) are derived setting the number of new incident subjects proportional to the residual fraction of normal subjects, yielding :

$$\mathbf{In}(t) = k \times [1 - \mathbf{Pr}(t)] \quad (4)$$

From this, the inverse relation between incidence and time constant also can be derived:

$$\mathbf{In}(t_1) = \langle S \rangle / t_0 \quad (5)$$

An important sub-set, accounting ultimately for 1/2 the myopia total, the advanced myopes are presented in Figure 1b, showing the myopia prevalence function **Pr(t) [%]** vs. years of education, **Pr(t) = 0.90 * [1 - exp(-(t - t₁)/t₀)]**, $t_0 = 4.5$ yrs., $t_1 = 1.5$ yrs. For the advanced myopes, **Pr(t) = $\langle S \rangle$ [1 - exp(-(t - t₂)/t₀)]**, where $t_0 = 4.5$ y, $t_2 = 9$ y, $\langle S \rangle = 0.45$.

Discussion

Applications

Basic exponential equations presented here can continuously predict the prevalence **Pr(t) [%]** and incidence rate **In(t) [%/yr]** functions for myopia development. Symmetrically, the incidence function is derived from the prevalence function, the prevalence is the integral of the incidence. Thus, these are coupled equations. The initial incidence rate is inversely related to the system time constant, Eq. 5. For instance, an initial incidence $\mathbf{In}(t_1) = 33$ new cases per year, per 100, implies a time constant $t_0 = 3$ yrs. for a plateau level of $\langle S \rangle = 1$. For the analysis of myopia development, the time constant is $t_0 = 4.5$ years, which is comparable to the individual myopia time constant $2 < t_0 < 5$ years, as reported by Medina & Fariza [6].

Least squares regression, while useful for prevalence data, Eq. 3 and Fig. 3, considerably underestimates the incidence rate. Nevertheless, this approximation is reasonable, at a constant incidence level $\langle \text{In} \rangle = 4.7\%/\text{yr}$. [95%CI: 2.1 to 7.3 %/yr.]. By comparison, the exponential equations are quite accurate, able to predict the incidence rate data within $\pm 2.6\%/\text{yr}$, over the entire age range, (Figure 2).

Pan, Ramamurthy, & Saw [11] present a summary of N=12 worldwide age-specific prevalence studies, examining juvenile myopia from China, India, Malaysia, Nepal, United States, South Africa, and Chile. More recent prevalence studies include Kim et al. [6], and Sun et al. [13], who report *myopia prevalence* $Pr = 95.5\%$, $N=5083$, for college students, and Yip et al. [16], and Lee et al. [15] who report *83.3% myopia prevalence*, $N=2805$, among university students. Holden et al. [24] and Pan et al. [25] expand upon the increasing modern international trends of myopia prevalence.

Conclusions

In this report we investigate the two simplest mathematical models available for prevalence and incidence, linear regression and exponential regression. Each may be applied to various ophthalmic prevalence and incidence studies, allowing modeling of progressive myopia, glaucoma, presbyopia, and cataract, each with a specific *onset age range and system time constant*. These equations are accurate over the course of 2 to 3 decades.

For myopia, *onset age, time constant, and plateau level* are fundamental system parameters derived from *age specific* prevalence data. In turn, these characteristic system parameters may be compared with the results of future myopia intervention studies, including bifocals, progressive add lenses (PALs), and reading glasses [4] [5].

High Myopia

Ordinary uncomplicated myopia ($R > -6\text{ D}$) is quite common, not considered a disease, *per se*. The prevalence fraction $\text{Pr}(\text{t})$ [%] and incidence rates $\text{In}(\text{t})$ [%/year] of high myopia are important to examine separately. Mathematically, the high myopia prevalence fraction is a matter of a delayed onset t_2 of 9 to 12 years after t_1 , and a reduced plateau level 50%, Greene & Medina [4b], (Eq. 6) graphed in Fig. 1b.

$$\text{pr}(\text{t}) = \langle \text{S} \rangle * [1 - \exp(-(t - \text{t}_2)/\text{t}_0)] \quad (6)$$

The literature has many mathematical models of prevalence for various types of contagious or acquired diseases [14 – 23], some requiring multiply linked differential equations (i.e. SEIR = susceptible, exposed, infected, and resistant population fractions), including linear and exponential models, compared here, power law, binomial, quadratic, Markov, random, and oscillating (Podgor & Leske [22], Keiding [23]). For progressive myopia, the variables of interest, in addition to time, include age, discussed here, ethnicity, location, discussed here, inherited factors, and the near-point environment.

Summary

The prevalence-incidence equations presented here are “minimum complexity” mathematical models, in terms of number of parameters, requiring only slope and intercept for the regression model, Fig. 3, and system time constant, onset age, and plateau level for the exponential, Fig. 1. The exponential model is important, because it can be derived from fundamental principles, Eqs. 1–5, and also used for a variety of other naturally occurring medical problems that accumulate over time, cardiovascular, pulmonary, and so forth.

The primary finding of the research presented here is that the *prevalence ratio* of *high-myopes* ($R < -6.0 D$) to *common-myopes* is expected to increase from 15% entering college to 45% or more after college and graduate school, Fig. 1b. These statistics are particularly relevant to the many years of study required by M.D., Ph.D., and M.D./Ph.D. programs.

Figures 4 and 5 below schematically show the -3.0 to -4.0 diopter near-work demand on the eye's focusing system caused by studying, typical of some college students, and the proposed optical solution to this problem, by counter-acting the $-3.0 D$ near-point environment with a compensating $+3.0 D (+)$ lens.

Acknowledgements

The authors thank F. Young, B. Curtin, O. Brown, A. Medina, D. Guyton, W. Baldwin and S. Colgate for many helpful discussions.

Appendix I—: Prevalence Calculation Details

As a practical matter, the basic exponential equation [2a] for prevalence as a function of time $Pr(t)$ is somewhat difficult to work with, in terms of exactly determining the system time constant τ (t_0) and the onset age t_1 :

$$pr(t) = \langle S \rangle [1 - \exp(-(t - t_1)/\tau)] \quad (2a)$$

Setting $\langle S \rangle = 1$, rearranging, taking natural log $\ln []$ yields :

$$\ln [1 - pr(t)] = (t - t_1)/\tau \quad (2c)$$

For the more general situation with plateau at $\langle S \rangle = 0.90$, this is modified to

$$\ln [(\langle S \rangle - pr(t)) / \langle S \rangle] = (t - t_1)/\tau \quad (2d)$$

Thus, using semi-log paper, plotting $\ln[1 - Pr(t)]$ versus time t , the slope and intercept will yield the system's time constant τ (t_0) and the onset age t_1 . For a general value of plateau $\langle S \rangle$, several such plots must be generated, iterating over a range of values, to determine the optimal regression.

References [[Linked](#)]

1. Fan DS, Lam DS, Lam RF, Lau JT, Chong KS, Cheung EY, Lai RY, Chew SJ, "Prevalence, incidence, and progression of myopia of school children in Hong Kong." *Invest Ophthalmol Vis Sci.* 45(4), 1071–5 (2004). [PubMed: 15037570]
2. Fan DS, Cheung EY, Lai RY, Kwok AK, Lam DS, "Myopia progression among preschool Chinese children in Hong Kong." *Ann Acad Med Singapore* 33(1), 39–43 (2004). [PubMed: 15008560]
3. Greene PR, "Gaussian and Poisson blink statistics: a preliminary study." *IEEE Trans Biomed Engr.* 33(3), 359–61 (1986).
4. Greene PR, Vigneau ES, Greene J, "Exponential prevalence and incidence equations for myopia." *Clin Exp Opt.* 98(3), 210–13 (2015). 4a. Greene PR, Grill ZW, Medina A, "Mathematical Models of College Myopia." *Optik (Stuttg).* 127(2), 896–899 (2016). https://www.academia.edu/18233864/Greene_2016_Mathematical_Models_of_College_Myopia [PubMed: 26709316]
- 4b. Greene PR, Medina A, "Refraction data survey: 2nd generation correlation of myopia." *Int Ophthalmol.* 36(5), 609–615 (2016). file:///C:/Users/rasdpatron/Downloads/Greene_Medina_2016_Refraction_Data_Surve.pdf [PubMed: 26757932]
5. Greene PR, Medina A, "Analogue Computer Model of Progressive Myopia – Refraction Stability Response to Reading Glasses." *J Comput Sci Syst Biol* 9, 104 (2016). <http://www.omicsonline.org/open-access/analogue-computer-model-of-progressive-myopiarefraction-stability-response-to-reading-glasses-jcsb-1000226.pdf> [PubMed: 30626992]
6. Medina A, Fariza E, "Emmetropization as a first-order feedback system." *Vision Research* 33(1), 21–26 (1993). [PubMed: 8451841]
7. Medina A, "The progression of corrected myopia." *Graefes Arch Clin Exp Ophthalmol.* 253(8), 1273–77 (2015). [PubMed: 25863670]
8. Medina A, "Detecting the effect of under-correcting myopia." *Graefes Arch Clin Exp Ophthalmol.* 254(2), 409–11 (2016). [PubMed: 26254110]
9. Goh WS, Lam CS, "Changes in refractive trends and optical components of Hong Kong Chinese aged 19–39 years." *Ophthalmic Physiol Opt.* 14(4), 378–82 (1994). [PubMed: 7845695]
10. Kim MH, Zhao D, Kim W, Lim DH, Song YM, Guallar E, Cho J, Sung J, Chung ES, Chung TY, "Heritability of myopia and ocular biometrics in Koreans: the healthy twin study." *Invest Ophthalmol Vis Sci.* 54(5), 3644–49 (2013). [PubMed: 23620424]
11. Lam CS & Goh WS, "The Incidence of Refractive Errors Among School Children in Hong Kong in Relationship with the Optical Components." *Clin. Exp. Opt.* 74(3), 97–103 (1991). <http://onlinelibrary.wiley.com/doi/10.1111/j.1444-0938.1991.tb04618.x/abstract>
12. Lin LL, Shih YF, Hsiao CK, Chen CJ, "Prevalence of myopia in Taiwanese schoolchildren: 1983 to 2000." *Ann Acad Med Singapore* 33(1), 27–33 (2004).
13. Lin LL, Shih YF, Lee YC, Hung PT, Hou PK, "Changes in ocular refraction and its components among medical students--a 5-year longitudinal study." *Optom Vis Sci.* 73(7), 495–98 (1996). [PubMed: 8843130]
14. Brinks R, Landwehr S, Icks A, Koch M, Giani G, "Deriving age- specific incidence from prevalence with an ordinary differential equation." *Statistical Medicine* 32(12), 2070–78 (2013). 14a. Brinks R, Landwehr S, "A new relation between prevalence and incidence of a chronic disease." *Math Med Biol.* 32(4), 425–35 (2015). [PubMed: 25576933]
15. Pan CW, Ramamurthy D, Saw SM, "Worldwide prevalence and risk factors for myopia." *Ophthalmic Physiol Opt.* 32(1), 3–16 (2012). [PubMed: 22150586]
16. Saw SM, Tong L, Chua WH, Chia KS, Koh D, Tan DT, Katz J. "Incidence and progression of myopia in Singaporean school children." *Invest Ophthalmol Vis Sci.* 2005 1;46(1):51–7. [PubMed: 15623754]
17. Sun J, Zhou J, Zhao P, Lian J, Zhu H, Zhou Y, Sun Y, Wang Y, Zhao L, Wei Y, Wang L, Cun B, Ge S, Fan X, "High prevalence of myopia and high myopia in 5060 Chinese university students in Shanghai." *Invest Ophthalmol Vis Sci.* 53(12), 7504–09 (2012). [PubMed: 23060137]
18. Tay MT, Au Eong KG, Ng CY, Lim MK, "Myopia and educational attainment in 421,116 young Singaporean males." *Ann Acad Med Singapore* 21(6), 785–91 (1992). [PubMed: 1295418]

19. Lee JH, Jee D, Kwon JW, Lee WK, “Prevalence and risk factors for myopia in a rural Korean population.” *Invest Ophthalmol Vis Sci.* 54(8), 5466–71 (2013). [PubMed: 23838769]
20. Yip VC, Pan CW, Lin XY, Lee YS, Gazzard G, Wong TY, Saw SM, “The relationship between growth spurts and myopia in Singapore children.” *Invest Ophthalmol Vis Sci.* 53(13), 7961–66 (2012). [PubMed: 23150611]
21. Quigley HA, Vitale S, “Models of open-angle glaucoma prevalence and incidence in the United States.” *Invest Ophthalmol Vis Sci.* 38(1), 83–91 (1997). [PubMed: 9008633]
22. Podgor MJ, Leske MC, “Estimating incidence from age-specific prevalence for irreversible diseases with differential mortality.” *Stat Med.* 5(6), 573–8 (1986). [PubMed: 3823665]
23. Keiding N, “Age-Specific Incidence and Prevalence: a Statistical Perspective.” *J. Roy. Statist. Soc. A* 154(3), 371–412 (1991). http://www.jstor.org/stable/2983150?seq=1#page_scan_tab_contents
24. Holden BA, Fricke TR, Wilson DA, Jong M, Naidoo KS, Sankaridurg P, Wong TY, Naduvilath TJ, Resnikoff S. Global Prevalence of Myopia and High Myopia and Temporal Trends from 2000 through 2050. *Ophthalmology.* 2016 5;123(5):1036–42. doi: 10.1016/j.ophtha.2016.01.006. Free Article [PubMed: 26875007]
25. Pan CW, Dirani M, Cheng CY, Wong TY, Saw SM The age-specific prevalence of myopia in Asia: a meta-analysis. *Optom Vis Sci.* 2015 3;92(3):258–66 [PubMed: 25611765]

Fig. 1a.

Schematic of basic exponential function parameters for prevalence $Pr(t)$ [%] vs. time t [yrs], showing onset age t_1 , system time constant t_0 , plateau level $\langle S \rangle$ (typically 0.90 to 0.95 for highly myopic populations).

Fig. 1b.

The myopia prevalence function $\text{Pr}(t)$ [%] vs. years of education, $N=9$ studies, [4]. $\text{Pr}(t) = 0.90 * [1 - \exp(- (t - t_1) / t_0)]$, $t_0 = 4.5$ yrs., $t_1 = 1.5$ yrs. For the advanced myopes, $\text{Pr}(t) = \langle S \rangle [1 - \exp(- (t - t_2) / t_0)]$, where $t_0 = 4.5$ y, $t_2 = 9$ y, $\langle S \rangle = 0.45$.

Fig. 2.

Myopia incidence function $\text{In}(t)$ [%/yr.] i.e. # of new cases per year, per class of 100, $N = 7$ studies, where $\text{In}(t) = 0.90 \left[\frac{1}{t_0} \exp(-\frac{t-t_1}{t_0}) \right] \pm 0.6\%/yr.$, $t_0 = 4.5$ yrs., $t_1 = 1.5$ yrs., [4]. For the advanced myopia incidence: $\text{In}(t) = \langle S \rangle * \left[\frac{1}{t_0} * \exp(-\frac{t-t_2}{t_0}) \right]$.

Fig. 3.

Linear regression of myopia prevalence as a function of years of education, N=9 demographic studies. Pre-medical N=345 students, H.K., engineers N=39 students, U.S. On average, myopia incidence = 4.7 %/yr., conf. limits [95% CI: 2.1 to 7.3 %/yr.], [4].

Fig. 4. Norman Rockwell's "*The Law Student*", from the Feb. 19, 1927, Saturday Evening Post, is seen reading at an effective distance of -3.0 to -4.0 diopters.

Fig. 5.

Reading glasses for a -5.00 D. college myope. (+) Add technology is used by both bifocals and progressive addition lenses, "PAL's". PAL's are "no-line" bifocals. Basically, these (+) Add reading glasses are distance compensators, with a $+3.00$ D Add for reading [4] [5].