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Reports

Efficacy in Myopia Control: The Low-Concentration Atropine for Myopia Progression (LAMP) Study

The 3-year Low-Concentration Atropine for Myopia Progression (LAMP) study has greatly enhanced knowledge of the use of low-concentration atropine for myopia control.[1,2] In year 1, children were randomized to receive 0.05%, 0.025%, or 0.01% atropine, or placebo.[1] Compared with the placebo, axial elongation was slowed 0.21, 0.12, and 0.05 mm by 0.05%, 0.025%, and 0.01% atropine, respectively. Myopia progression showed a corresponding slowing of 0.54, 0.35, and 0.22 diopters (D).

The study also examined acceleration after treatment cessation.[2] At the start of year 3, the 270 children who had been treated throughout the first 2 years were randomized to continued treatment or washout. Thus, half of these children discontinued treatment in year 3, with 127 of these *newly untreated* participants completing year 3. As expected, myopia progression and axial elongation were faster in those discontinuing treatment. During year 3, there was a slightly larger axial elongation of 0.33 mm in those previously treated with 0.05% atropine compared with 0.29 mm among those previously treated with lower concentrations. Differences in myopia progression during year 3 in those previously treated with 0.05%, 0.025%, and 0.01% atropine (−0.68, −0.57, and −0.56 D, respectively) were not statistically significant. In pairwise comparisons, axial elongation and myopia progression were significantly higher in those previously treated with 0.05% atropine, but not 0.025% atropine, compared with those previously treated with 0.01% atropine. This supports a greater rebound with 0.05% atropine, but, overall, the authors regard it as small from a clinical perspective.

Because the year 1 control group in the LAMP study was switched to treatment in years 2 and 3, long-term efficacy of low-concentration atropine could not be directly calculated.[2] Our recent meta-analysis of more than 80 studies of axial elongation among untreated myopic children concludes that it slows by an average of 15.0% per year.[3] Although the annual elongation is 30% greater in East Asian myopes than non-East Asian myopes, the annual slowing is the same in both groups. In the LAMP study, the 93 children initially assigned to placebo elongated by 0.41 mm in year 1. Applying 15% slowing per year predicts elongation of 0.35 and 0.30 mm in years 2 and 3, respectively. As noted, half of the children treated in the first 2 years were washed out in year 3. The mean axial elongation among the 127 children completing the washout was 0.30 mm, identical to the predicted elongation of 0.30 mm based on 0.41 mm in year 1 and 15% slowing per year.

The projected elongation in years 2 and 3 are plotted as a dashed line in Figure 1, giving a cumulative untreated 3-year axial elongation of 1.05 mm. The axial elongation for children treated throughout the 3-year study with 0.05%, 0.025%, and 0.01% atropine, that is, excluding those randomized to washout, was 0.50, 0.74, and 0.89 mm, respectively,[2] and these are also shown in Figure 1. Thus, the 3-year cumulative absolute reduction in axial elongation[4] is 0.55, 0.31, and 0.16 mm.

It is also possible to estimate 3-year slowing of myopia progression. One approach is to apply a ratio of progression to elongation. Axial elongation is highly correlated with change in refractive error in myopes,[4] and the LAMP study is no exception ($r = 0.77$),[1] allowing estimation of the ratio of progression to elongation. The 93 untreated children in year 1 progressed by −0.81 D and elongated by 0.41 mm, a ratio of −1.98 D/mm. Additionally, the 127 untreated children in year 3 progressed by −0.61 D and elongated by 0.30 mm, a ratio of −1.99 D/mm. Applying either of these ratios to the 3-year untreated axial elongation of 1.05 mm gives a 3-year progression of −2.09 D. Comparing this with the mean progression among those treated for 3 years (−0.73, −1.31, and −1.60 D)[2] yields projected 3-year slowing of progression of 1.36, 0.78, and 0.49 D for 0.05%, 0.025%, and 0.01% atropine, respectively. An alternative would be to assume that myopia progression among untreated children, like axial elongation, slows by 15% per year. The year 1 progression of −0.81 D would predict −0.69 and −0.59 D in years 2 and 3, respectively, for a cumulative 3-year progression of −2.08 D, similar to the first approach, thereby yielding similar estimates of efficacy.

Our projection of 3-year treatment efficacy of 0.05% atropine is therefore 0.55 mm or 1.35 D. This compares favorably to other data for both higher atropine concentrations and optical therapies.[4,5] Indeed, in our review of the efficacy of myopia control,[4] we found the largest reported long-term slowing of axial elongation to be 0.44 mm.[6] The slowing of axial elongation in the first year of the LAMP study with 0.05% atropine was 0.21 mm. The projected slowing in years 2 and 3 from our analysis is 0.16 and 0.18 mm, respectively. If our analysis is accurate, low concentration atropine retains its efficacy beyond year 1 better than optical therapies[4] and, possibly, than higher concentrations of atropine.[5]

The values we used are taken from the 1- and 3-year LAMP study reports.[1,2] Over the course of the 3-year study, the cohort size decreased, leading to small variations in mean values. For example, in the 1-year article, 93 children in the placebo group completed that year with a mean axial elongation of 0.41 mm and mean progression of −0.81 D.[1] Of these, 73 completed the third year and their mean year 1 axial elongation was 0.43 mm with a mean progression of −0.90 D.[2] We chose the value from the larger cohort, but accept that alternative values could be used. Our methodology does not permit the direct calculation of confidence intervals for our estimates. A 15% slowing was derived from our meta-analysis with a 95% confidence interval of 11% to 18%.[3] Annual slowing of axial elongation by 11% or 18% would impart a 3-year efficacy of 0.60 mm or 0.52 mm, respectively, for 0.05% atropine.

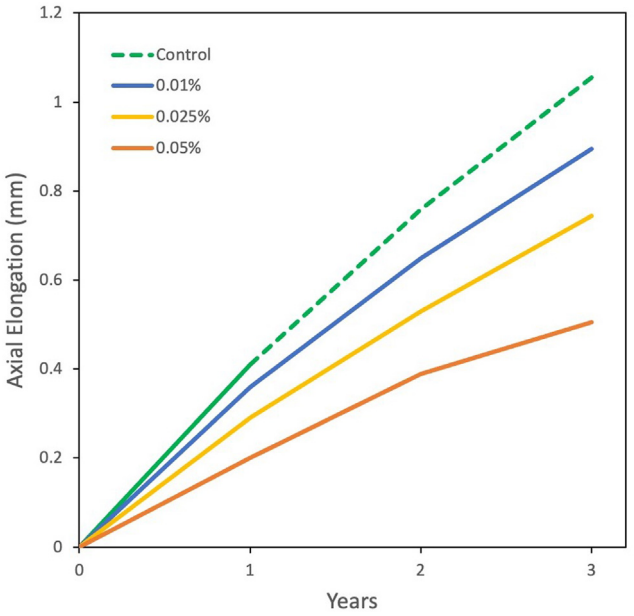

Figure 1. Axial elongation for children treated throughout 3 years with different atropine concentrations, that is, not including those randomized to washout (redrawn from Yam et al[2]). The dashed portion for the control group is a projection for years 2 and 3 based on a 15% slowing per year.[3]

In summary, applying a 15% annual slowing of axial elongation allows prediction of the 3-year efficacy of low-concentration atropine in the LAMP study.

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HUMAN SUBJECTS: Human subjects were not included in this study. This study was exempt from IRB approval. All research adhered to the tenets of the Declaration of Helsinki. This is a retrospective study using de-identified subject details. Informed consent was not obtained.

No animal subjects were used in the study.

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Socioeconomic and Racial Disparities in Vision Care Access and Impairment Among United States Children

Health disparities resulting from the inequitable distribution of resources within health care may lead to worse outcomes for subsets of the population.[1] Disparities often are divided according to socioeconomic and sociodemographic factors including race, ethnicity, and income. These factors, referred to as the social determinants of health, are responsible for more than 75% of a population's health outcomes according to some estimates.[2] Health disparities undermine the fundamental American values of social mobility and the importance of public education. Health disparities have been observed across the health care continuum, with recent evidence suggesting that these gaps are widening. Therefore, it is essential for all domains of health care to identify relevant social determinants of health and to respond to the resulting health inequities accordingly. In this study, we explored the racial disparities in vision access and eye health in children using the National Survey of Children's Health (NSCH) by measuring differences in unmet vision care needs and reported vision impairment. We explored these differences across age groups and socioeconomic categories. The study did not meet the criteria for human subjects research according to the institutional review board at the University of Arkansas for Medical Sciences because this was an analysis of an existing anonymized dataset.

The NSCH is a national, cross-sectional survey that examines children's physical and emotional health from birth to 17 years of age in the United States.[3] Data were analyzed from 2016 through 2020 and included 174 551 completed surveys. Additional details about the survey methodology have been published previously.[4] Our primary outcome variables included (1) unmet vision care access and (2) vision impairment. Unmet vision care is a measure of children who did not receive needed vision care in the previous