Development of a myopia model in chicken to test relationships between ocular aberrations and myopia

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Footnotes

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Abstract

Abstract: : __Purpose:__ Experiments in animal models and evidence in humans show that visual experience is critical for proper emmetropization. Retinal image degradation results in excessive ocular growth, and therefore myopia. The purpose of this study is to develop a chicken (Gallus domesticus) myopia model to test relationships between ocular aberrations and myopia. __Methods:__ Nine one-day-old White Legorn chickens were used. Measurements of refractive error (RE) with streak retinoscopy and Axial Length (AL) with an adapted biometer were made before and after monocular application of white diffusers (one day after hatching). The non-occluded eye was used as control. Chicks were raised in 12/12 hr light/dark cycle conditions. Measurements were made every 1-2 days, for 1-2 weeks. A Hartmann-Shack aberrometer was developed to measure total aberrations in this model. __Results:__Initial mean RE was: +3.17 D in the treated eye and +4.17 D in the control eye. After 1 week mean RE was: -5.39 D in the treated eye and +4.28 D in the control eye. After 2 weeks mean RE was: -

17.33 Dp in treated eye and +1.67 D in the control eye. The average intersubject variability of RE was 4.73 D in the treated eye and 0.90 D in the control eye. The mean difference in AL between the treated eye and the control eye was: 0.10 mm before treatment, 0.28 mm after 1 week and 1.24 after 2 weeks, with an average variability of 0.59 mm. RE increased at a rate of –0.25 D/day in the treated eye and –0.05 D/day in the control eye. The treated eye increased at a rate of 0.011 mm/day more than the control eye. **Conclusions:** Retinal image degradation with white diffusers induces myopia in newborn chicks. Retinoscopic measurements of refraction showed average differences of 9.67 D after 1 week and 19 D after 2 weeks between the treated and untreated eyes. The increase in refraction is correlated (r=0.67, p<0.01), particularly after day 5 (r=0.9, p=0.002). This model will allow us to measure aberrations with a custom–built Hartmann–Shack aberrometer and to assess whether refraction changes are accompanied by an increase in aberrations.