

Lens-induced Myopia: Heightened STAT3 Activation in Ocular Posterior Compartments and Altered Scleral MMP-2/TIMP-2 Secretory Balance

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Abstract

Purpose: To investigate changes in signal transducer and activator of transcription 3 (STAT3) activation in posterior segment ocular tissues, scleral matrix metalloproteinase-2/tissue inhibitor of metalloproteinases-2 (MMP-2/TIMP-2) balance, and their potential mechanisms during lens-induced myopia (LIM) development. **Methods:** Sixty 2-week-old pigmented guinea pigs were divided into four groups: normal control (NC, no intervention), lens-induced myopia (LIM, right eye fitted with a -6.00D lens), LIM+AG490 (following LIM induction, intravitreal injection of 5μL AG490 solution every 2days), and LIM+injection control (LIM+InjCon, following LIM induction, intravitreal injection of 5μL physiological saline every 2days). At 2 and 4weeks, refraction, axial length, retinal/choroidal thickness, posterior segment microstructure, and levels of STAT3/phosphorylated (p)-STAT3 (retina, choroid, sclera) and scleral MMP-2/TIMP-2 were measured. **Results:** Compared with the NC group, the LIM group showed a significant myopic refractive shift, axial elongation, enhanced STAT3 activation in the retina, choroid, and sclera, upregulated scleral MMP-2, downregulated scleral TIMP-2, along with thinning and loosening of posterior pole tissues (including the sclera) at 2 and 4weeks. In contrast to the LIM group, the LIM+AG490 group exhibited attenuated myopia progression, reduced STAT3 activation, downregulated scleral MMP-2, upregulated scleral TIMP-2, and alleviated thinning of posterior pole tissues. The results of the LIM+InjCon group were similar to those of the LIM group. **Conclusions:** During LIM development, STAT3 activation is enhanced in the retina, choroid, and sclera, with disrupted scleral MMP-2/TIMP-2 balance. These changes may correlate with myopia-related phenotypes (e.g. axial elongation, scleral remodeling), though their specific mechanism(s) remain to be elucidated.

Keywords

Guinea Pigs, Lens-induced Myopia, STAT3, MMP-2, TIMP-2