

Study shows sleep deprivation impairs stem cells in the cornea

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The microenvironment of the tear film is just like the macroenvironment of the

sea. It protects the corneal basal epithelial stem cells from overexposing to environmental ROS. There are many antioxidants present in the tear film, like the diversity of marine creatures. Even a short period of sleep deprivation will disrupt the balance of the redox homeostasis in the tear film, thus affect the behavior of underneath corneal epithelial stem cells. Credit: Yuehang Li

Sleep deprivation, which means getting too little high-quality sleep, is a serious health problem. More than one-third of people in the U.S. report getting less than the recommended minimum of seven hours sleep per night. Sleep deprivation has negative impacts on mental and physical health. Eye problems such as dryness and itching are commonly experienced after episodes of sleep deprivation, while long-term sleep deprivation comes with an increased risk for eye disease.

The cornea, which is the transparent tissue layer covering the eye, is essential for assuring health and function of the eye. The cornea is maintained by stem cells, which divide to replace dying cells and to repair small injuries. Corneal stem cell activity needs to be precisely tuned to assure an adequate output of new corneal cells, and dysregulation of [corneal stem cells](#) can lead to eye disease and impaired vision.

In a study recently published in *Stem Cell Reports*, researchers Wei Li, Zugou Liu and colleagues from Xiamen University, China and Harvard Medical School, U.S., evaluated how [sleep deprivation](#) impacts corneal stem cells. Their experiments in mice showed that short-term sleep deprivation increased the rate at which stem cells in the cornea multiplied. At the same time, sleep deprivation altered the composition of the protective tear film, reducing the tear film antioxidants in sleep-deprived mice. The researchers found that the tear film composition had a direct impact on corneal stem cell activity and, encouragingly,

application of tear drops containing antioxidants reversed the excessive stem cell activity.

The study revealed that serious effects on corneal health, such as thinning and ruffling of the cornea and loss of transparency, were seen after long-term sleep deprivation. Furthermore, corneas of long-term sleep-deprived mice contained less stem cells, suggesting that persistent stimulation of stem cell activity over longer periods led to exhaustion and loss of corneal stem cells. These data suggest that sleep deprivation negatively affects the stem cells in the cornea, possibly leading to vision impairment in the long run. Further studies are required to confirm that similar processes are happening in human corneal [stem cells](#) and in patients, and to test if local antioxidant therapy may overcome some of the negative effects of sleep deprivation on corneal health.

More information: Wei Li, Sleep Deprivation Induces Corneal Epithelial Progenitor Cell Over-Expansion through Disruption of Redox Homeostasis in the Tear Film, *Stem Cell Reports* (2022). [DOI: 10.1016/j.stemcr.2022.03.017](#)

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