Myopia Control and Stem Cell Therapies: A New Era in Vision Preservation.

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Introduction

Myopia, commonly known as near sightedness, is a refractive error where distant objects appear blurred, while close objects are seen clearly. It occurs when the eye is too long or when the cornea (the eye's outer layer) is too curved, causing light to focus in front of the retina instead of directly on it. Over the past few decades, myopia has reached epidemic proportions worldwide, especially in urban areas, where more children are developing and progressing toward higher degrees of myopia at an earlier age [1].

While corrective lenses (glasses and contact lenses) and refractive surgery (like LASIK) have traditionally been used to manage myopia, the focus has now shifted toward myopia control — strategies designed to slow the progression of myopia in children and adolescents. Additionally, emerging stem cell therapies offer new possibilities for addressing myopia at a cellular level, potentially altering the course of the condition and offering hope for future treatments. This article will explore current myopia control techniques and delve into the potential of stem cell therapies to transform the treatment landscape for myopia [2, 3].

Myopia typically begins in childhood, often becoming worse as children grow. If left unchecked, myopia can continue to worsen through adolescence, leading to high myopia (severe nearsightedness), which significantly increases the risk of serious eye conditions such as glaucoma, cataracts, retinal detachment, and macular degeneration later in life. Research has shown that myopia progression is influenced by both genetic and environmental factors. The increasing prevalence of myopia in children is largely attributed to near work (such as reading and using digital devices) and reduced time spent outdoors, which is thought to affect the eye's development and growth. As a result, controlling myopia progression has become a priority in ophthalmology, especially for children at risk of developing high myopia [4, 5].

Several strategies are currently available for managing and slowing the progression of myopia, particularly in children. These methods target the underlying mechanisms of eye growth, aiming to reduce the elongation of the eyeball that leads to myopia. Orthokeratology involves wearing special rigid contact lenses overnight that gently reshape the cornea. This temporary reshaping allows individuals to see clearly during the day without needing glasses or contact lenses. While the primary purpose of Ortho-K lenses is to correct refractive errors, research has shown that they can also slow the progression of myopia by altering the way light enters the eye, reducing the stimulus for the eye to elongate [6, 7].

Atropine, a medication traditionally used to dilate pupils, has gained popularity as a myopia control treatment when administered in low doses. Research has demonstrated that low-dose atropine (usually 0.01%) can significantly slow the progression of myopia in children by reducing the eye's tendency to elongate [8].

Multifocal and bifocal lenses are designed to correct both near and distance vision. For children with myopia, these lenses can help slow progression by reducing the focus of light on the central retina, which is thought to contribute to eye elongation. Increasing the amount of time spent outdoors has been shown to be a powerful preventive measure against myopia development and progression. The exact mechanisms remain unclear, but exposure to natural light is believed to influence the release of dopamine in the retina, which helps regulate eye growth and prevent excessive elongation [9].

While myopia control methods primarily focus on slowing the progression of the condition, the field of stem cell therapy offers promising potential for more transformative approaches. Stem cells have the ability to regenerate or repair damaged tissues, and in the case of myopia, they may hold the key to addressing the underlying causes of eye elongation and restoring normal eye development. While the potential of stem cell therapies for myopia is exciting, several challenges remain [10].

Conclusion

Myopia has become a major public health concern, particularly as its prevalence continues to rise worldwide. While current myopia control methods like Ortho-K lenses, atropine, and multifocal glasses offer effective ways to slow its progression, stem cell therapies hold the potential for more radical, regenerative treatments. Stem cell research is still in its infancy in terms of myopia treatment, but the promise of repairing damaged eye structures, regenerating retinal tissue, and altering the growth of the eye itself offers a bright future. As research progresses, stem cell-based therapies could revolutionize the way we approach myopia and its complications, potentially offering hope for those with high myopia and significantly improving long-term eye health.

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