Innovations in corrective lens materials and their impact on visual performance

Siti Husna Hussein, Nur Atiqah Izzati Mustapa

Faculty of Medicine and Health Sciences, Universiti Sains Islam Malaysia, 71800 Bandar Baru Nilai, Negeri Sembilan, Malaysia

ABSTRACT

Introduction: Advancements in ophthalmic corrective lens materials have transformed visual correction by enhancing user clarity, comfort, and adaptability. Newer materials such as high-index, polycarbonate, trivex, photochromic, and blue-light filtering lenses offer multiple benefits, including lighter weight and greater resistance. However, their specific impact on visual performance requires further evaluation. Owing to the lack of clarity regarding the visual performance on these newer lens materials, we conducted a review to identify the visual performance, particularly visual acuity, contrast sensitivity, wavefront, and chromatic aberrations. **Materials and Methods:** A systematic search was conducted on relevant articles published using PubMed, ScienceDirect, Scopus, and Google Scholar. Studies on different lens materials and different outcomes on visual performance were targeted. Only original studies with published data were included. **Results:** A total of 16 studies were included in this review. Among the newer lens materials, high-index lenses offer a thinner profile but may reduce contrast and increase chromatic aberration at higher indices. Polycarbonate lenses are lightweight and impact-resistant, making them suitable for children and sports use, though their low Abbe value contributes to higher chromatic and wavefront aberrations. Trivex lenses provide a balanced profile with excellent visual clarity, reduced chromatic aberrations, and high impact resistance, making them ideal for users requiring both durability and optical performance. Photochromic lenses improve contrast and reduce glare in dynamic lighting but may cause temporary visual distortions during transitions. Blue light-filtering lenses are effective in reducing glare and enhancing contrast in low-light settings, though they show minimal effect on visual acuity and may subtly affect colour perception. A comparative analysis showed Trivex lenses offered the best balance between visual acuity, contrast sensitivity, and minimal aberrations, while high-index and polycarbonate lenses demonstrated trade-offs between clarity and lens thickness or durability. **Conclusion:** This review identified multiple newer lens materials and their impact to visual performance. While no single material is optimal for all users, Trivex lenses stand out for their combination of clarity, safety, and comfort. Eventually, personalized lens selection, guided by visual demands and clinical evidence, remains essential to optimize both vision quality and user satisfaction.

Keywords: Corrective lens material, Visual Performance, Trivex Lens