

Early Detection of Diabetic Retinopathy in Older Adults: Evidence From Preventing Vision Loss Through Modern Screening Methods



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Introduction/Background

Diabetic retinopathy (DR) is one of the leading causes of preventable vision loss worldwide and disproportionately affects older adults with long-standing diabetes. As the prevalence of diabetes continues to rise, the number of individuals at risk of developing diabetic retinopathy and vision loss is also expected to increase. Although vision loss from DR can be severe, it is largely preventable through early detection and timely intervention. For many years, diabetic retinopathy has been diagnosed through clinically visible retinal vascular changes identified during fundus examination. However, new evidence suggests that retinal neurovascular abnormalities may develop before these visible signs appear. As a result, the effectiveness of screening technologies in detecting diabetic retinopathy is increasing, allowing the disease to be detected even before clinically visible retinal damage occurs. This study examines how early detection of DR in older adults helps prevent vision loss and evaluates the evidence supporting the effectiveness of existing screening methods, including structural and functional biomarkers, advanced retinal imaging techniques, and AI-based screening programs.

Diabetic Retinopathy

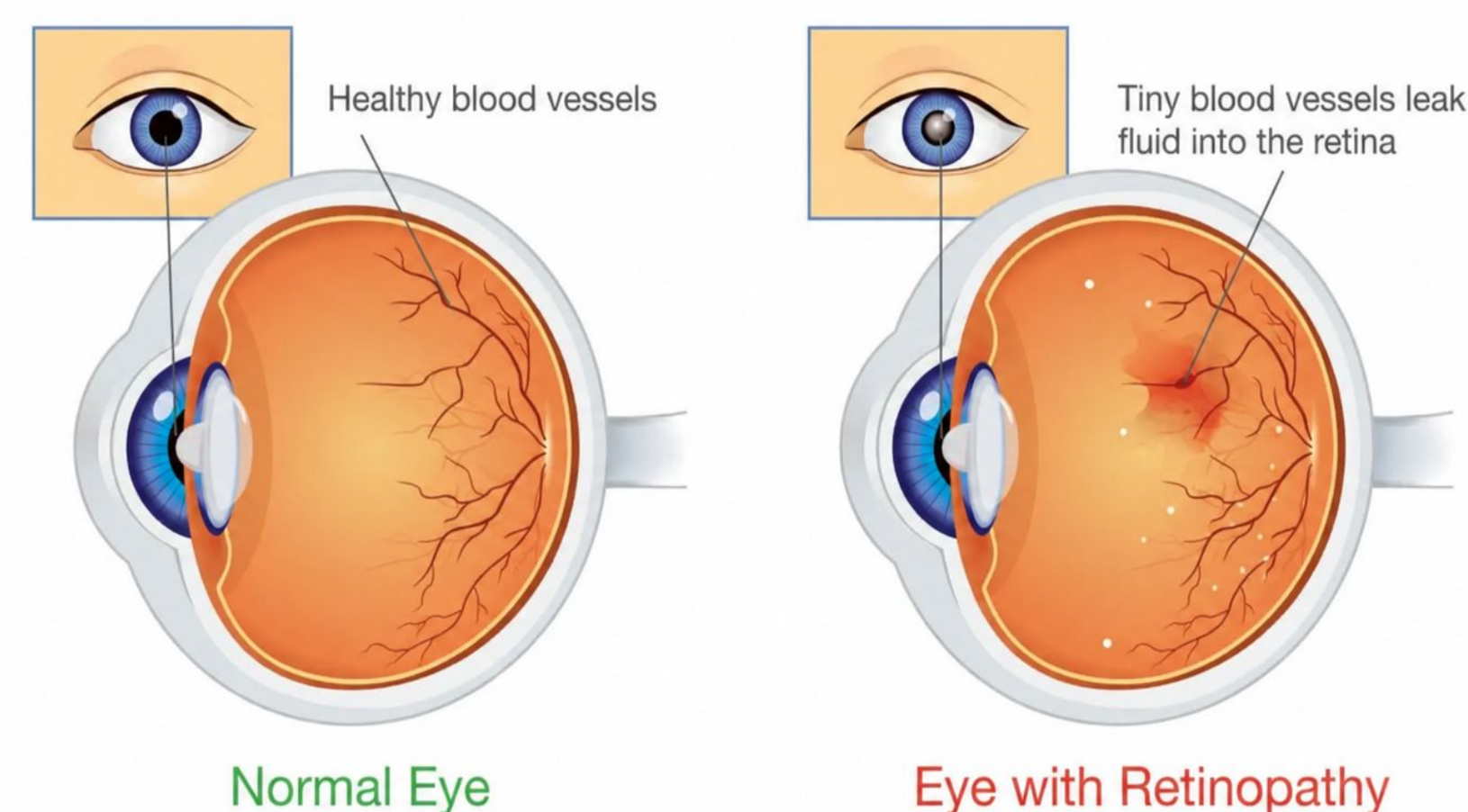


Fig. 1. Comparison of healthy retina (top) and a retina affected by DR (bottom). Diabetic retinopathy is characterized by retinal vascular damage, hemorrhages, and other abnormalities that can lead to vision loss if not detected and treated in the early stages. Created in Biorender.com

Methods

- Literature review of primary and secondary sources
- Studies were selected on relevance to DR screenings, early detection, older adults, and vision loss prevention
- Articles focused on biomarkers, advanced retinal imaging, and AI-assisted screening technologies were included.

Key Findings

- OCT and mfERG detect early retinal dysfunction.
- OCT-A reveals microvascular abnormalities before clinical diagnosis.
- AI and teleophthalmology enhance screening efficiency and accessibility
- Early detection supports timely treatment and prevention of vision loss.

* Abbreviations:

- OCT- optical Coherence Tomography
- OCT-A – Optical Coherence Tomography Angiography
- mfERG- Multifocal Electroretinography
- AI – Artificial Intelligence

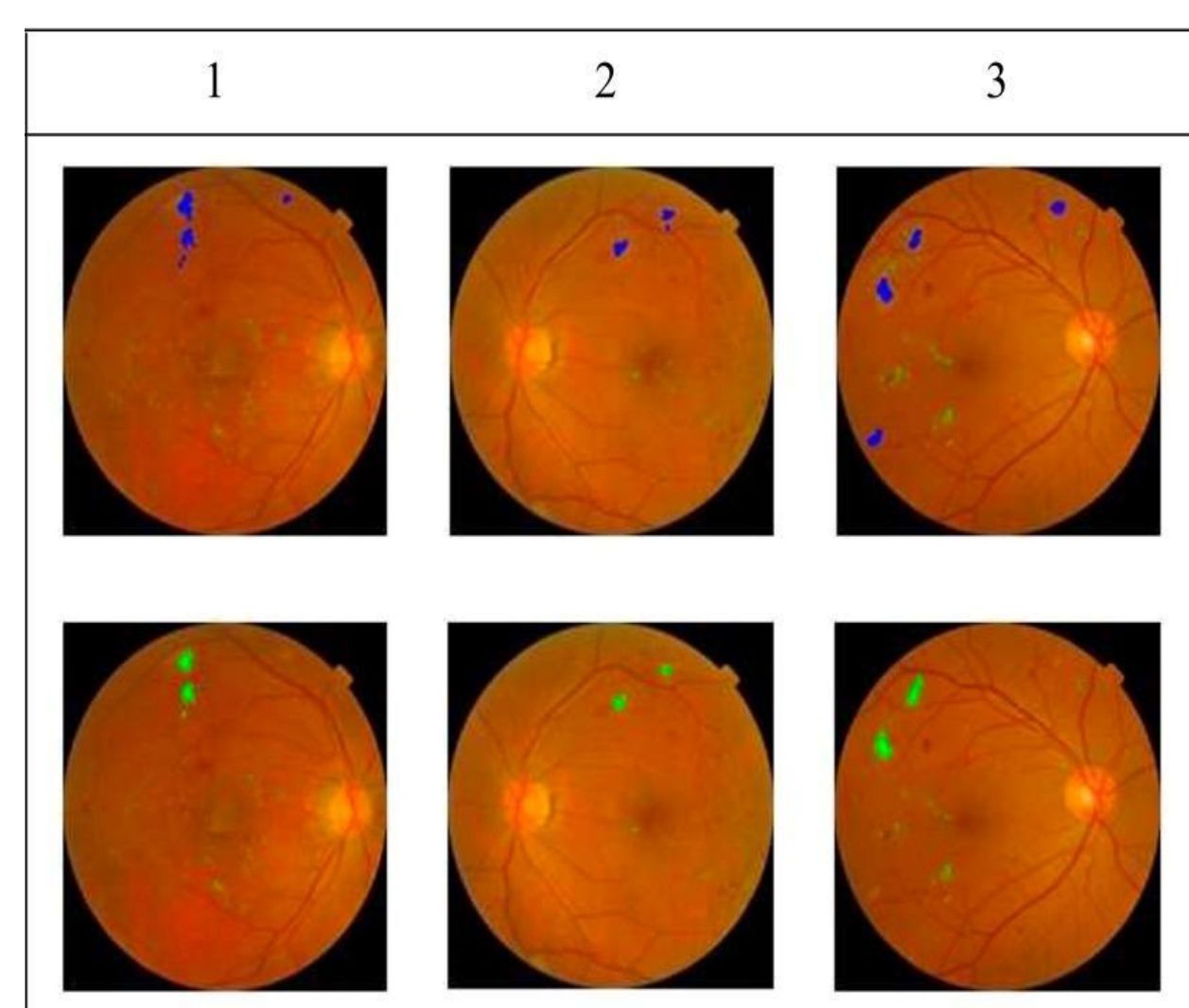


Fig. 2. Common retinal lesions associated with DR, including microaneurysms, hemorrhages, hard exudates, cotton wool spots. Early detection aims to identify disease before progression to these vision-threatening retinal changes. Adapted from Hanusková et al. (2013).

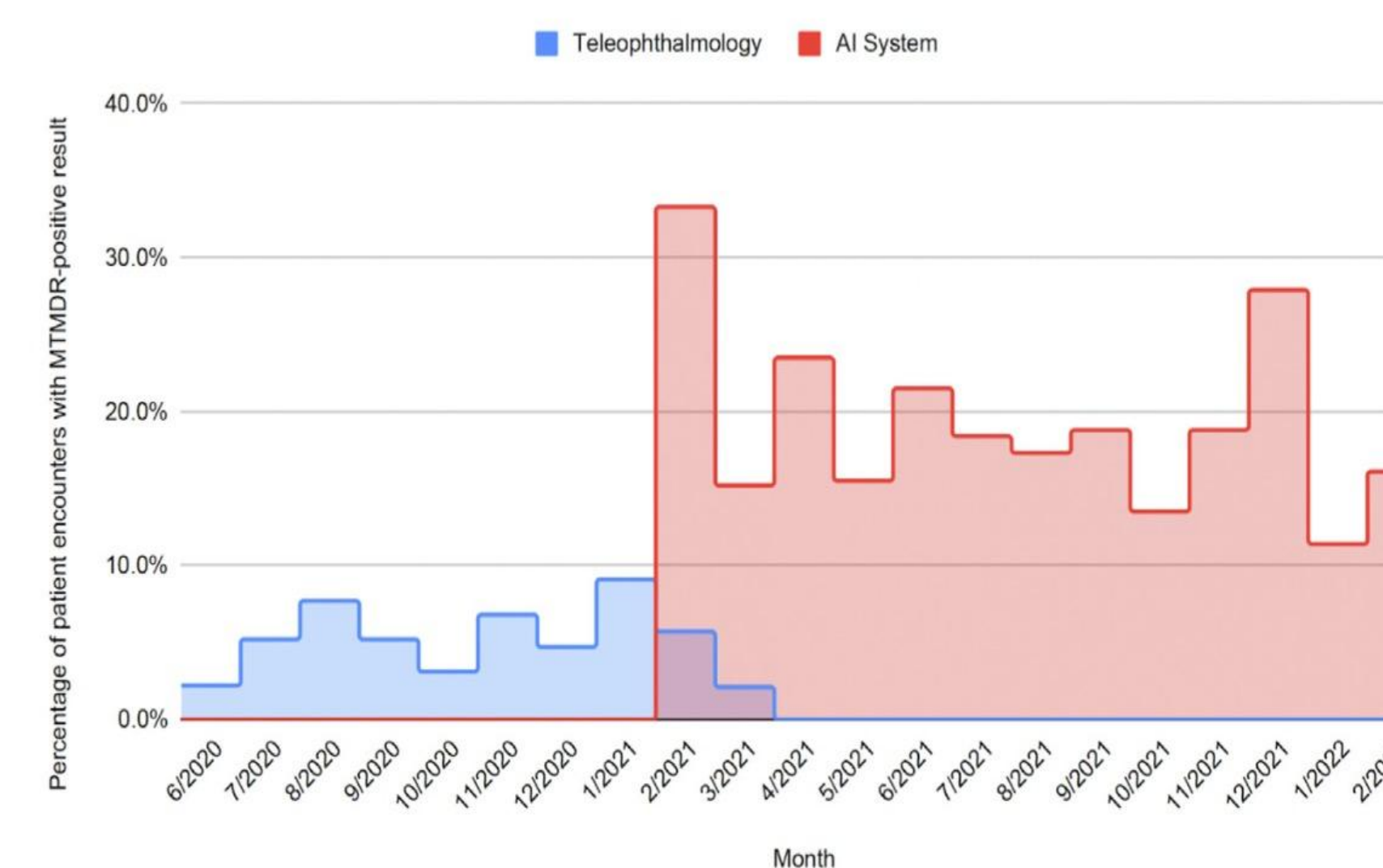


Fig. 3. Percentage of monthly encounters with a more-than-mild diabetic retinopathy (MTMDR)-positive diagnosis identified by human-based teleophthalmology (blue) or artificial intelligence (AI) system (red) among gradable encounters. Adopted from Dow et al. (2023).

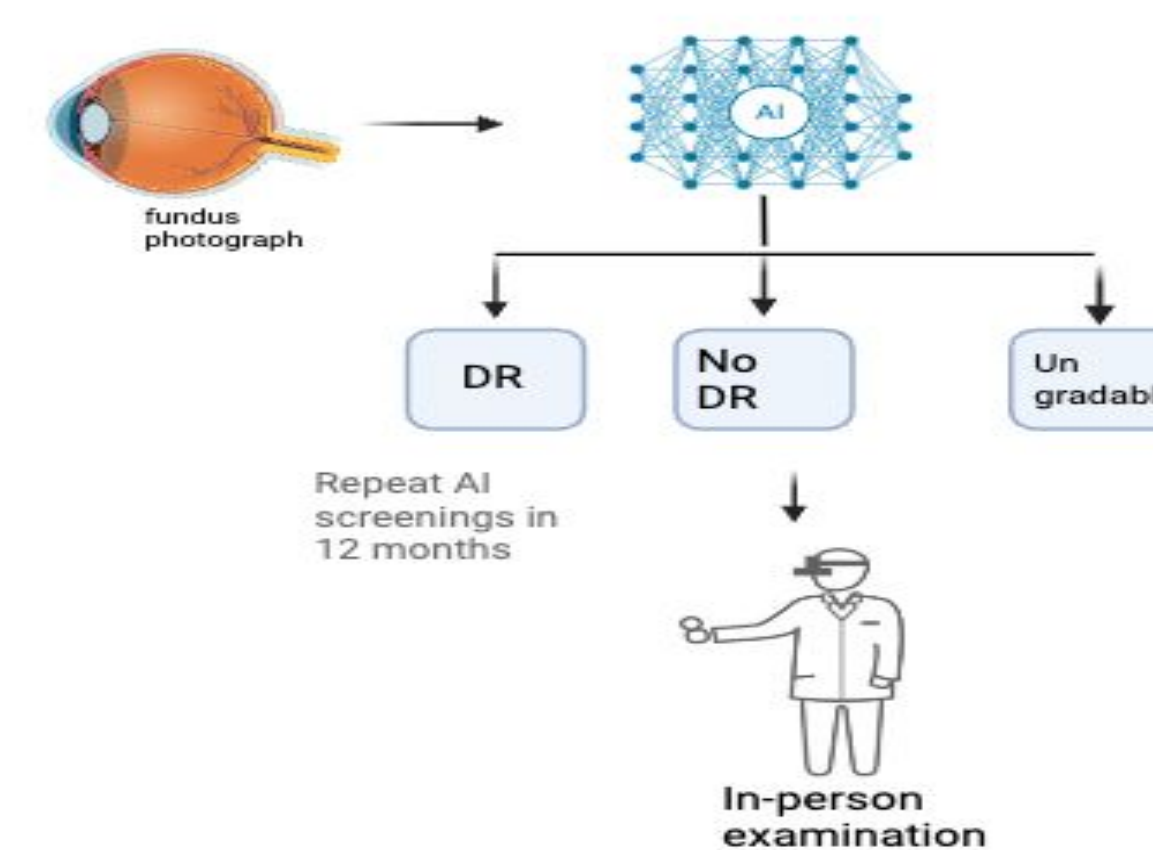


Fig. 4. AI-assisted diabetic retinopathy screening workflow. Fundus photographs are analyzed by an AI system and classified as diabetic retinopathy (DR), no diabetic retinopathy (No DR), or ungradable. Positive and ungradable cases are referred for further clinical evaluation. Created in Biorender.com

Conclusions

- Early detection of diabetic retinopathy (DR) helps prevent vision loss by identifying retinal abnormalities before irreversible damage occurs.
- Biomarkers, including OCT and mfERG, can detect early retinal dysfunction before visible clinical signs develop.
- Advanced imaging techniques such as OCT-A identify microvascular changes associated with disease progression.
- AI-based screening and teleophthalmology improve screening accessibility, detection rates, and efficiency.
- These approaches supports timely prevention and reduces the risk of vision-threatening issues.

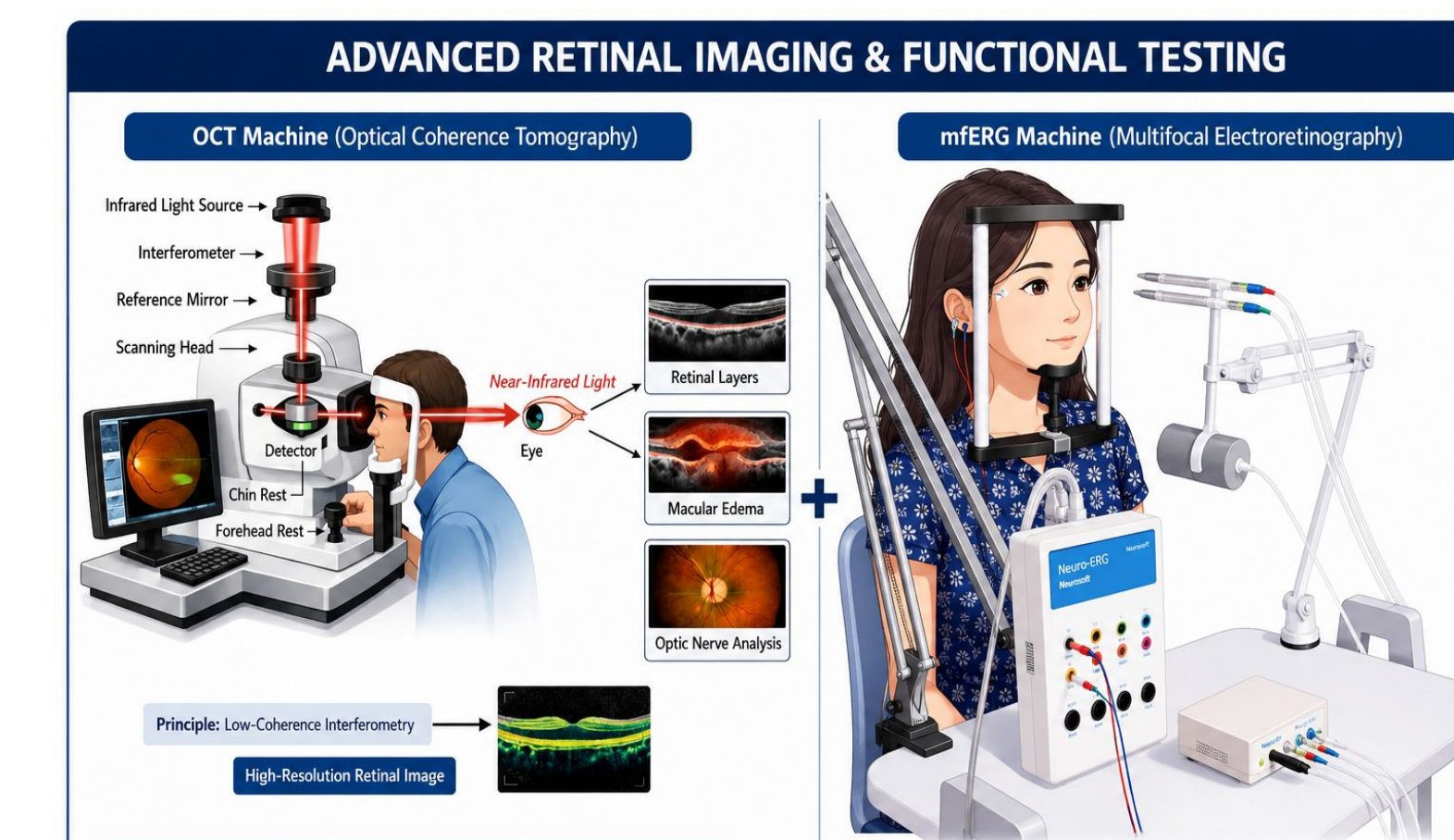


Fig. 5. Advanced retinal imaging and functional testing technologies used for early DR detection. OCT provides high-resolution structural images of the retina, while mfERG measures retinal electrical activity to identify functional abnormalities before visible clinical signs appear. Adopted from Neuro-erg.com.

Future directions

- Future studies should validate OCT-A and mfERG as predictive biomarkers through longitudinal studies.
- Further improvements in AI systems will require larger and more diverse retinal image datasets to increase accuracy and reduce bias.
- Additionally, future studies should evaluate the cost-effectiveness of AI-based and teleophthalmology screening programs across different healthcare settings.

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References

