REVIEW ARTICLE

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Application of Telemedicine in the Care and Follow-up of Ophthalmic Patients: A Narrative Study

Matin Mohammadi[1], Sasan Gharehkhanaloustani[2]

[1]*Medical Student, Faculty of Medicine, Far Eastern Federal University, Vladivostok, Russia*
[2]*6th Year Medical Student, Faculty of Medicine, Far Eastern Federal University, Vladivostok, Russia*

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Abstract

Background: With advances in communication technologies and the expansion of digital tools, telemedicine has become a modern approach in healthcare delivery, gaining particular importance in medical specialties such as ophthalmology. Many ocular diseases — including glaucoma, macular degeneration, diabetic retinopathy, and ophthalmic emergencies — require continuous follow-up and monitoring. However, geographical barriers and a shortage of specialists have limited patient access to timely and specialized care. Telemedicine, through remote consultation, digital imaging, and online monitoring, provides a practical solution to bridge this gap.

Objective: This study aimed to review and analyze existing evidence on the application of telemedicine in the care and follow-up of ophthalmic patients, focusing on its advantages, limitations, and implementation challenges.

Methods: This narrative review was conducted by searching major scientific databases including *PubMed*, *Google Scholar*, and *ScienceDirect* using keywords such as *Telemedicine*, *Teleophthalmology*, *Eye care*, *Follow-up*, and *Patient monitoring*. Articles published between 2010 and 2025 were reviewed, and 17 eligible studies were selected for detailed analysis.

Findings: esults indicated that telemedicine improves access to specialized eye care, reduces in-person visits, saves time and costs, and increases satisfaction among patients and healthcare providers. In several hybrid models, the quality of care was found to be nearly equivalent to face-to-face examinations. Telemedicine has shown notable success in diabetic retinopathy screening, glaucoma monitoring, and emergency ophthalmic management. Nevertheless, challenges such as low image quality, high equipment costs, limited infrastructure, and user resistance to adopting technology were frequently reported.

Conclusion: Teleophthalmology can serve as an effective complement to conventional eye care. Strengthening digital infrastructure, training healthcare professionals, improving image quality, and developing clear legal and ethical guidelines are essential for its successful integration into healthcare systems.

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Introduction

With advancements in information and communication technologies, telemedicine has emerged as an innovative tool in healthcare, particularly in specialized fields such as ophthalmology (1). In ophthalmology, various diseases such as glaucoma, macular

Correspondence:
Matin Mohammadi, Medical Student, Faculty of Medicine, Far Eastern Federal University, Vladivostok, Russia
E-mail: matin.mohammadi1992@gmail.com

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degeneration, diabetic retinopathy, and ocular emergencies require continuous monitoring and care. However, geographical limitations, shortage of human resources, and the need for long-term care pose major challenges in providing services to patients (2). Telemedicine, through innovative solutions such as remote consultations, remote imaging, and patient monitoring via digital tools, facilitates access to specialized services for patients in remote areas (3).

Various studies have shown that the use of telemedicine in monitoring diseases such as glaucoma, macular degeneration, and ocular emergencies can effectively improve treatment outcomes and reduce costs. For example, in one study, the use of telemedicine in follow-up care for glaucoma patients led to increased return rates for in-person examinations and early detection of new diseases (4).

In diseases like diabetic retinopathy (DR), it has been demonstrated that telemedicine programs can be accurate and reliable, enabling wider screening, increased patient access, and cost savings (5). The use of tools such as telephone calls and remote monitoring systems not only increases patient satisfaction but also provides access to services in remote areas for individuals who are disabled or lack primary caregivers (6–8). A 2024 article reported that telemedicine programs in ophthalmic care achieved diagnostic accuracy of approximately 93% for non-specific symptoms (such as blurred vision, eye pain, redness, or diplopia) (9).

Teleophthalmology (remote ophthalmic care) is feasible and applicable in various areas including consultation, screening, triage (patient prioritization), and remote monitoring (10). However, challenges such as poor image quality, lack of access to proper equipment, and technical issues in certain regions may affect the effectiveness of telemedicine (11). Therefore, there is a need for comprehensive evaluations and narrative studies to examine the experiences of patients and physicians in using this technology for follow-up care in ophthalmic diseases.

Methodology

This study was a narrative review on the application of telemedicine in the care and follow-up of ophthalmic patients. To collect data, searches were conducted in reputable databases including PubMed, Google Scholar, and ScienceDirect. The search used a combination of keywords and related terms, such as “Telemedicine,” “Teleophthalmology,” “Eye care,” “Follow-up,” “Patient monitoring,” “Remote consultation,” and Boolean combinations like “Teleophthalmology AND Glaucoma,” “Telemedicine AND Diabetic Retinopathy,” and “Telemedicine AND Macular Degeneration.”

Inclusion criteria were articles published between 2010 and 2025, in English, and relevant to the application of telemedicine in the care, monitoring, and follow-up of ophthalmic patients. Duplicates, articles with limited access to full text, and studies primarily focused on other medical fields were excluded.

The article selection process consisted of three stages: initially, 60 articles were identified from the preliminary search. In the second stage, after reviewing titles and abstracts, 34 relevant articles were selected for further review. Finally, after a full-text review, 17 articles were included as the main sources for this narrative study.

The selected articles were analyzed narratively based on the type of ophthalmic disease (glaucoma, diabetic retinopathy, macular degeneration, and ocular emergencies), telemedicine applications (consultation, monitoring, screening, and triage), advantages and limitations, and effectiveness outcomes.

Results

In this narrative study, findings related to the application of telemedicine in the care and follow-up of ophthalmic patients were collected. The results indicate that telemedicine enables faster access to specialized services, continuous patient monitoring, and a reduction in in-person visits. Additionally, this approach saves time and costs and is associated with high satisfaction among both patients and healthcare providers. However, challenges such as poor image quality, limited access to equipment, and technical issues have also been reported.

1. Increased access to specialized eye care

Studies have shown that the use of teleophthalmology and telemedicine in ophthalmology, particularly in resource-limited areas, improves patient access to specialized services. For example, recent reviews have indicated that this approach has been successful in underserved populations (11).

2. Care quality nearly equivalent to in-person examinations in some cases

Research reports that hybrid models, combining digital imaging with remote consultation, can effectively manage up to 98% of cases, while reducing patient wait times and the number of in-person visits (12).

3. Cost reduction and time savings

The use of telemedicine in diabetic retinopathy screening, along with digital imaging, has led to reduced costs compared to traditional methods and significant time savings (11).

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4. High patient and provider satisfaction

Reports indicate that over 90% of patients and the majority of healthcare providers are satisfied with telemedicine models and are willing to continue using this approach (13).

5 Suitable application in emergency situations and remote populations

Some models have been implemented for remote care and even ocular emergencies, such as video-conferencing services, allowing faster evaluation and reducing unnecessary patient transfers (14).

6. Technical and operational limitations and challenges

The implementation of teleophthalmology has certain limitations, including the high initial cost of equipment, issues with stable electricity and internet supply, and resistance among some populations in specific regions to adopt this technology (15). A review titled *"Telemedicine for healthcare: Capabilities, features, barriers ..."* concluded that despite significant advantages, multiple barriers exist, such as weak communication infrastructure, lack of necessary equipment, limited user access, and legal and technological concerns (16).

Discussion

Technology has significantly transformed medical practices, including diagnosis, treatment, and access to healthcare services. The use of telemedicine in ophthalmology appears to be a promising area. In underserved populations, limited coverage of ophthalmic care centers has led to an increased burden of eye diseases and visual impairments (15).

The findings of this study indicate that telemedicine plays an effective role in improving the quality of care and increasing patient access to specialized services in ophthalmology. This technology can be particularly efficient in under-resourced areas where the number of specialists is limited (17). Increased service delivery speed, reduced in-person visits, and time savings are among its main benefits. Moreover, various studies have shown that the quality of care in some teleophthalmology models is nearly equivalent to in-person examinations, which strengthens the scientific validity of this approach (16, 18).

One notable advantage of telemedicine is the high satisfaction of both patients and physicians, resulting from easy access, reduced travel costs, and facilitation of treatment follow-up (19). In the screening of diseases such as diabetic retinopathy, this technology has also significantly reduced costs (20). Additionally, the use of video consultations in ocular emergencies has accelerated therapeutic decision-making and reduced unnecessary patient transfers (11).

However, challenges exist in the widespread implementation of telemedicine. Poor image quality in some cases, dependence on stable internet infrastructure, and high equipment costs are among the main barriers (8, 9). Cultural resistance and lack of familiarity with modern technologies among some patients and even healthcare staff can also slow adoption (9). Legal concerns and patient data security are additional important issues requiring attention from healthcare policymakers (3, 9).

Overall, the results suggest that teleophthalmology can serve as an effective complement to in-person care, and when combined with hybrid models, it achieves the highest effectiveness (2, 4, 10). Successful implementation requires careful planning for training personnel, developing communication infrastructure, and ensuring image quality (10). Additionally, establishing standardized guidelines and clear legal frameworks can enhance the trust of patients and healthcare providers (8). Ultimately, it appears that the future of eye care will move toward broader use of telemedicine technologies alongside in-person services (1, 10).

Conclusion

The results of this study indicate that telemedicine, particularly teleophthalmology, can effectively increase patient access to specialized ophthalmic services. This technology reduces the need for in-person visits, saves time and costs, and enhances satisfaction for both patients and providers. Its application in screening diseases such as diabetic retinopathy and in ocular emergencies has yielded successful outcomes. However, challenges such as inadequate infrastructure, high equipment costs, and legal and technical concerns limit its full expansion. To effectively leverage this technology, strengthening communication infrastructure and training users is essential. Overall, telemedicine can serve as a complement to in-person care and as an effective step toward health equity.

Study Limitations

This study, as a narrative review, has limitations that should be considered when interpreting the results. First, variations in study design and quality among the reviewed articles may have caused heterogeneity in outcomes. Second, most existing evidence is reported from developed countries, limiting the generalizability to underserved or developing regions. Third, some studies relied on self-reported data from patients and providers, which may introduce response bias. Fourth, rapid changes in digital technologies and telemedicine

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software may render some findings quickly outdated. Finally, due to limited access to certain Persian and English resources, it was not possible to review all relevant studies.

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Conflict of Interest

There is no conflict of interest in this article.

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