

# Diabetic Retinopathy: Diagnostic Challenges and Impact of Physical Activity

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## Abstract

**Introduction:** Diabetes represents a major public health challenge, affecting over 463 million people according to the World Health Organization (WHO). Among its complications, diabetic retinopathy stands out as the leading cause of blindness in industrialized countries. Physical activity is now recognized as a cornerstone of diabetes management, and its impact on diabetic retinopathy is of growing interest. **Observation:** Mr. A.E, a 54-year-old man, presents with progressive deterioration of his vision. Family history of diabetes and hypertension is noted. He engages in one hour of physical activity daily, including treadmill running and indoor cycling. Despite recent optical correction, his visual acuity remains at 3/10 unimproved. Ocular imaging, notably fluorescein retinal angiography and optical coherence tomography, reveals proliferative diabetic retinopathy with bilateral macular edema. Blood tests, performed after physical activity, show normal values of blood glucose and HbA1c, delaying the initiation of treatment and promoting the progression of retinopathy. Despite appropriate management, no significant improvement in visual function is observed during follow-up. **Conclusion:** The management of diabetic retinopathy requires an approach integrating physical activity. A better understanding of the interaction between physical activity and diabetic retinopathy is needed to optimize prevention and treatment strategies.

## Keywords

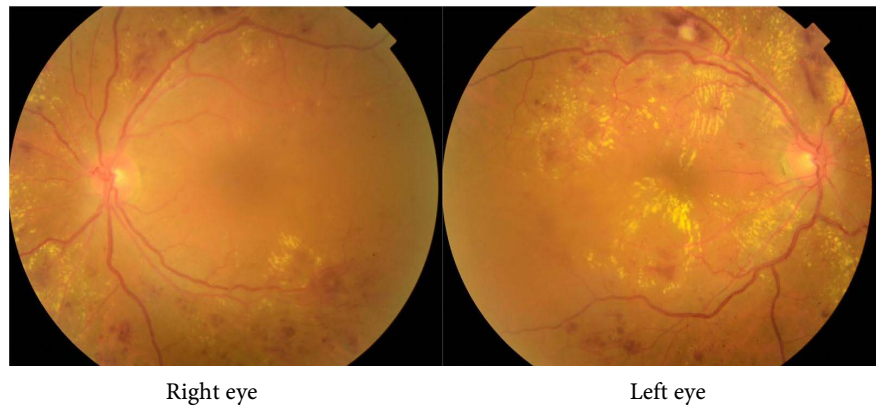
Diabetes, Retina, Blood Glucose, HbA1c, Physical Activity

## 1. Introduction

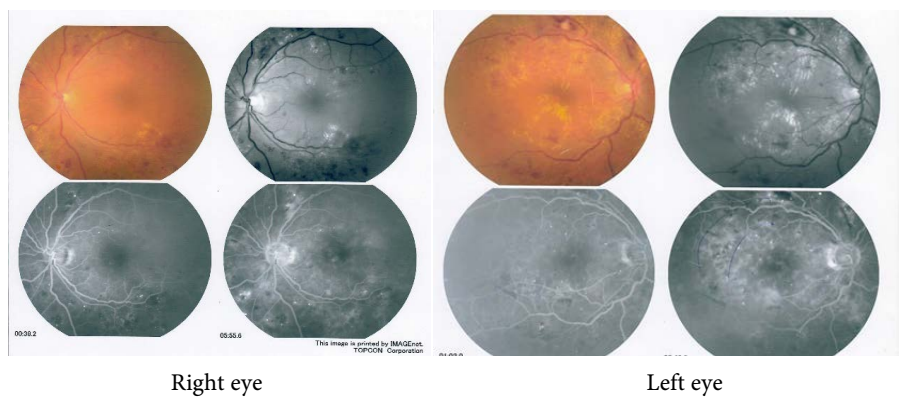
Diabetes represents a growing challenge for global health, affecting an ever-increasing population, now surpassing 463 million people according to the World Health Organization (WHO) [1] [2]. Among the complications associated with diabetes, diabetic retinopathy emerges as a major concern, being the leading cause of blindness in industrialized countries [3]-[10]. In a world where the importance of physical activity is increasingly recognized, managing this complication requires a multidisciplinary approach, taking into account the impact of physical activity on its development and progression. Epidemiological and interventional studies have confirmed the benefits of physical activity in the prevention and management of diabetes mellitus [11] [12]. Furthermore, recent research has confirmed the benefits of regular physical activity in the incidence and progression of diabetic retinopathy [13] [14] [15]. It is imperative to continue deepening our understanding of the relationship between physical activity and the development of diabetic retinopathy, and to assess its impact on the management of diabetic patients [16] [17]. To ensure research ethics and respect patient rights, a rigorous methodology obtained informed consent from the patient before presenting the clinical case, thereby reinforcing the ethical aspect of this study.

## 2. Observation

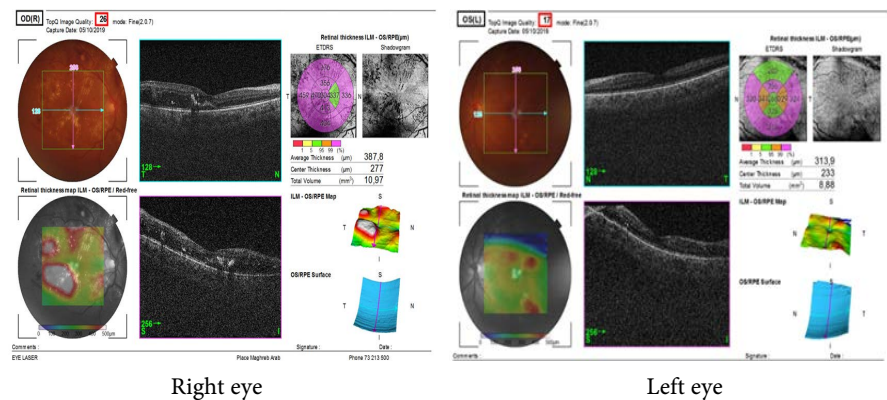
Mr. A.E, a 54-year-old man, consulted for a progressive deterioration of his vision evolving over several months. Family history of diabetes mellitus was revealed during the interrogation. In his habits and lifestyle, the patient reports a daily routine of physical activities, including one hour of treadmill running and indoor cycling. The medical history reveals a persistence of visual degradation over a period of about 3 months despite recent optical correction. Upon ophthalmologic examination, a visual acuity of 3/10 unimproved in both eyes was observed with normal results on biomicroscopy and stable intraocular pressure. Thorough analysis of the fundus (**Figure 1**) confirmed the presence of proliferative diabetic retinopathy with bilateral macular edema, corroborated by ocular imaging exams such as retinal fluorescein angiography (**Figure 2**) and optical coherence tomography (**Figure 3**). Biological tests performed 2 to 3 hours after physical activities revealed normal values of glycemia and glycosylated hemoglobin (HbA1c), leading to diagnostic uncertainty, which delayed the start of treatment and potentially favored the progression of diabetic retinopathy to more advanced stages with an increased risk of blindness. Faced with the persistence of poor vision, a therapeutic approach combining oral antidiabetic drugs and intravitreal injection of anti-VEGF drugs was initiated. The evolution is marked by stabilization of lesions in the fundus and no improvement in visual function. Rigorous patient follow-up included regular checks of glycemia and HbA1c twice a month for 3 months, fundus surveillance once a month for 3 months to search for changes in retinal lesions, and measurement of visual acuity once a



**Figure 1.** Fundus photograph of proliferative diabetic retinopathy with macular edema.



**Figure 2.** Fluorescein angiography of proliferative diabetic retinopathy with macular edema.



**Figure 3.** Macular edema on optical coherence tomography.

month for 3 months then every 3 months in search of vision improvement. The overall prognosis is reserved due to the lack of improvement in visual acuity despite the therapeutic interventions undertaken.

### 3. Discussion

Physical activity plays a crucial role in the management of diabetes and its com-

plications, particularly diabetic retinopathy. Epidemiological studies have demonstrated the numerous benefits of regular physical activity in diabetic patients [11] [12] [13] [14] [15]. By helping to maintain blood glucose within recommended limits, improving insulin sensitivity, and promoting glucose absorption by muscles, physical activity reduces postprandial blood glucose spikes, thus helping diabetic patients effectively stabilize their blood sugar levels. Early detection of diabetic retinopathy represents a major challenge in physically active patients, requiring regular screening, particularly through methods such as fundus photography, considered the gold standard [10] [11] [12]. Regarding diabetic retinopathy, physical exercise is essential for preventing its development and progression. Studies have shown that regular exercise can improve blood circulation in retinal vessels, thus reducing the risk of lesions and macular edema [13] [14] [15]. Although the overall health benefits of exercise are well established, its specific effect on diabetic retinopathy remains subject to debate and requires further exploration. Managing diabetic retinopathy in physically active patients presents complex diagnostic and therapeutic challenges.

Regular physical activity can influence the results of biological tests used to diagnose and monitor diabetes, making the management of diabetic patients particularly delicate. Caution is recommended in interpreting blood test results in these patients, as illustrated in this clinical observation where blood glucose and glycated hemoglobin (HbA1c) levels are influenced by physical exercise, leading to misleading conclusions despite the presence of significant retinal lesions. Faced with normal results of diabetes biological tests, it is important to consider risk factors such as family history of diabetes and lifestyle factors including diet, physical activity, and smoking to establish the diagnosis of diabetic retinopathy. This underscores the importance of using advanced imaging techniques such as retinal fluorescein angiography and optical coherence tomography to contribute to accurate diagnosis and effective management of diabetic retinopathy.

Understanding the impact of physical activity on diabetic retinopathy represents a complex yet crucial challenge in diabetes management. While many studies support the pivotal role of physical activity in diabetes management as a cornerstone of diabetes management alongside diet and medication, it is essential to continue exploring this area [13] [14]. Previous research has suggested the potential benefits of exercise on ocular health by improving blood circulation and insulin sensitivity. However, it is important to consider the risks associated with intense physical activity, including hypoglycemia and worsening retinal lesions in patients with advanced diabetic retinopathy. Although studies indicate that regular exercise can help reduce the risk or progression of diabetic retinopathy [15]-[23], additional research warns against the potential negative effects of certain intensive exercises [24]. Integrating regular physical activity into the overall therapeutic plan requires thorough clinical evaluation, taking into account the patient's abilities and clinical and social context to establish personalized recommendations [17]. Large-scale longitudinal studies are needed to guide clinical recom-

mendations and minimize the risk of ocular complications. Prescribing physical activity should be tailored to each patient, taking into account various factors such as the type, intensity, duration of exercise, as well as the severity of diabetic retinopathy [14]. In-depth exploration of the relationship between physical activity and diabetic retinopathy progression requires large-scale longitudinal studies to identify the best types and intensities of exercise for the ocular health of diabetic patients and formulate specific clinical recommendations.

Managing diabetic retinopathy in physically active individuals presents complex therapeutic challenges, requiring a delicate balance between diabetes control and prevention of ocular complications. Adjusting antidiabetic medications to avoid hypoglycemia during exercise while maintaining adequate glycemic control is essential. A personalized approach, taking into account each patient's lifestyle, is crucial to optimize therapeutic outcomes while minimizing the risks associated with physical activity.

In addition to oral antidiabetic medications, several therapeutic options may be considered, such as laser therapy, anti-VEGF injections, and vitreoretinal surgery, depending on the stage and severity of the disease. A multidisciplinary approach involving ophthalmologists, endocrinologists, and other healthcare professionals is necessary for comprehensive management of diabetic retinopathy. Furthermore, informing and educating patients about the importance of regular screening and preventive measures is essential to promote their involvement in their health.

Future perspectives and clinical recommendations arising from this clinical observation are crucial for improving the management of diabetic retinopathy in physically active patients. First and foremost, it is imperative to review and update recommendations regarding physical activity in diabetic patients. Healthcare professionals need to be aware of the potential effects of exercise on the results of biological tests used to diagnose and monitor diabetic retinopathy, and be trained to interpret these results cautiously, taking into account each patient's level of physical activity. Specific guidelines need to be developed to assist practitioners in adjusting physical activity recommendations based on individual risk of diabetic retinopathy and the needs of each patient.

Secondly, regular ophthalmological monitoring is essential for early detection and effective management of diabetic retinopathy in physically active patients. Physicians should encourage these patients to undergo regular eye examinations, even in the absence of apparent symptoms, to detect any disease progression and initiate early treatment if necessary. This preventive approach would help reduce the risk of serious complications, including vision loss, and improve long-term outcomes for active diabetic patients.

Finally, further research efforts are needed to better understand the interaction between physical activity and diabetic retinopathy, as well as to develop interventions and diagnostic tools tailored to this specific population. Future studies could focus on identifying specific biomarkers of diabetic retinopathy in physically active patients, as well as evaluating the effectiveness of personalized management strategies to prevent and treat this complication in these patients.

By integrating these recommendations into clinical practice and continuing research in this area, we can hope to significantly improve the management of diabetic retinopathy in physically active patients and thereby reduce the burden of this devastating complication.

#### 4. Conclusion

Diabetic retinopathy poses a major diagnostic challenge, especially in individuals who engage in regular physical activity. This clinical case underscores the importance of regular monitoring and early screening in diabetic patients, even in the absence of obvious symptoms. Furthermore, exploring the impact of physical activity on diabetic retinopathy raises important questions that require further research for optimal management of this ocular complication of diabetes. By integrating a multidisciplinary approach and considering the individual characteristics of each patient, we can better understand and effectively treat diabetic retinopathy, thereby improving the quality of life for individuals with this condition.

#### Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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