

Military Institute of Aviation Medicine



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**Application of Optical Coherence Tomography Angiography
and Adaptive Optics in Adults with Systemic Sclerosis**

Doctoral Dissertation submitted for the degree of Doctor of Medical Sciences

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Abstract

Systemic sclerosis (SSc) is a chronic autoimmune disease characterized by an abnormal immune response, excessive fibrosis and vasculopathy. A wide range of ocular manifestations affecting both the anterior and posterior segments of the eye have been described in the literature.

The objective of the dissertation was to evaluate the efficacy of optical coherence tomography angiography (OCTA) and adaptive optics (AO) in assessing retinal microcirculation in patients diagnosed with systemic sclerosis. Furthermore, the study aimed to compare the alterations observed through capillaroscopic examination with the parameters obtained through OCTA and AO.

The review of literature was conducted for the purpose of preparing a review paper entitled "*Ocular Manifestation in Systemic Sclerosis-A Literature Review*", which focused on ophthalmological symptoms in systemic sclerosis. The article was used to systematize the available knowledge and determine the direction of further research.

Microangiopathy, a hallmark of systemic sclerosis, results in progressive endothelial damage, vascular narrowing, and fibrosis. Due to their small diameter and high oxygen demand, retinal vessels may be particularly susceptible to early ischemic changes in the course of this disease.

The first original study "Retinal Microvasculature in Systemic Sclerosis Patients and the Correlation between Nailfold Capillaroscopic Findings and Optical Coherence Angiography Results", assessed the usefulness of OCTA for evaluating retinal microcirculation in patients with scleroderma. In addition, it compared changes in capillaroscopic examination to parameters in OCTA. The study demonstrated that patients diagnosed with systemic sclerosis exhibited increased parafoveal deep vessel density (DVD) in comparison to healthy individuals. Furthermore, an association was identified between the stage of disease progression determined in capillaroscopy and the size of the foveal avascular zone (FAZ).

In the second study "*The correlation between Nailfold Capillaroscopic Findings and Adaptive Optics Imaging of retinal microvasculature in patients with systemic sclerosis.*" the correlation between nailfold capillaroscopic findings and adaptive optics imaging of retinal microvasculature in patients with systemic sclerosis was investigated. The structure of blood vessels was assessed in healthy individuals and patients with systemic sclerosis using the adaptive optics technique, and the results obtained in AO were compared with the parameters of the capillaroscopic examination. The study revealed no significant structural differences in retinal vessels between the study and control groups, nor any correlation with capillaroscopy.

OCT angiography is a useful diagnostic tool for assessing retinal microcirculation abnormalities in patients with systemic sclerosis. A correlation has been demonstrated between the stage of the disease observed in capillaroscopy and the size of the foveal avascular zone in OCTA. The analysis of retinal vessel morphology using Adaptive Optics was found to have limited clinical value. No association was observed between capillaroscopy findings and AO measurements.