

Title: Use of Imaging Technology to Assess the Effect of COVID-19 on Retinal Tissues: A Systematic Review

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Study	Funding	Study Type	Time post covid	Cohort size (Cases, Controls)	Covid Severity	Study group OCT findings	Study group OCTA findings	Study Group Fundus Photography/ Fundus Autofluorescence findings
Abrishami et al.	Financial support of the Vice-Chancellor of Research of Mashhad University of Medical Sciences	Case-Control	At least 14 days from symptoms	31, 23	Mild (71%), Severe (29%)		Reduced mean SCP VD and DCP VD; decreased blood flow in the SCP and DCP.	
Beni et al.	Nil	Case-Control	40-95 days post symptom onset	51,37	Moderate		Moderate-intensity SARS-CoV-2 pneumonia had altered peripapillary and macular vessel density	x
Burgos-Blasco et al.	Nil	Case-Control	38.8 days ± 13.3	29,61	Mild	Increase in peripapillary RNFL thickness (global and sectoral)	x	Nil of note
Cennamo et al.	Nil	Case-Control	6 months post hospital discharge	40,40	Moderate		Significant reduction in SCP and DCP VD and Radial	

Banderas García et al.	Nil	Case- Control	8.5 months	56,19	Mild (18) moderate (21) severe (17)		Peripapillary Capillary plexus (RPC) in all sectors; more significant impairment of the DCP than the SCP Persistent reduction in the central vascular area over time in patients with moderate and severe disease
Gonzalez Zamora et al.	Research grants from the "Instituto de Salud Carlos III/European Regional Development Fund (ERDF)" and RD16/0008/0011, OFTARED: Enfermedades oculares: "Prevención, detección precoz, tratamiento y rehabilitación de las	Case- Control	14 days post hospital discharge	25,25	Mod to severe	VCIPL thinning	Thinner ganglion cell layer and thicker retinal nerve fibre layer

	patologías oculares”.							
Guemes Villahoz et al.	Nil	Case-Control	88 days post diagnosis	66,29	Intrathrombotic, no thrombotic event		Lower VD and perfusion density compared to healthy controls	
Hazar et al.	Financial Support: National Medical Research Council Singapore Open Fund Large Collaborative Grant: NMRC/LCG/004/2018	Case-Control	1 month post-hospital discharge	50,55	Mild to moderate		VD is low in some sectors in both superficial and deep layers, but no change in FAZ	
Invernizzi et al.	Nil	Case-Control	30 days from symptom onset	54,133	Mild (74%), severe (26%)			Dilated fundus veins (27.7%), CWS (7.4%), retinal haemorrhages (9.25%), Higher MAD and MVD
Oren et al.	Nil	Case-Control	14 to 30 days post symptoms	35,25	Mild	Increased CMT, reduced GCL and INL thickness	x	
Savastano et al.	Nil	Case-Control	36.1 days post discharge	70,22	Moderate to severe		Reduced perfusion density and a reduced	

Szkodny et al.	Nil	Case-Control	1-4 months post diagnosis	156,98	Mild to severe	Nil significant found	perfusion flow index of the RPC Nil significant found	
Turker et al.	Nil	Case-Control	Within 1 week post hospital discharge	27,27	Moderate		VD was considerably lower and significantly higher choriocapillary is flow area values The decreased central retina	
Zapata et al.	Nil	Case-Control	36 days post hospital discharge, 60d post diagnosis	96,27	Mild (24) moderate (24) severe (21)		VD was related to COVID-19 infection severity	
Brantl et al.	Nil	Case Series	3 months	21	Mild to Moderate	Nil of note after 3 months of follow up	Nil of note after 3 months of follow up	
Bypareddy et al.	Nil	Case Series	6 days	138	Mild to moderate(hospitalised)			Nil of note found on examination (1 patient had a retinal streak)

Costa et al.	Scholarship from the "Conselho Nacional de Desenvolvimento Científico e Tecnológico" (CNPq) for working with COVID-19 research projects	Case Series	82±36.4 days post symptom onset	64	Mild to moderate (n = 7), severe (n = 33), critical (n = 24)(hospitalised)	haemorrhage, likely incidental) N=2 showed discrete white-yellowish dots in the posterior pole, leading to hypo-reflective changes at the RPE level, outer segment, and ellipsoid layers.
Landecho et al.	Nil	Case Series	14 days post-hospital discharge	27	Moderate Severe, post-hospital discharge	cotton wool spots in six of 27 eyes (22%)
Lani Louzada et al.	Nil	Case Series	2 to 14 days post symptom onset	25	Moderate Severe, (hospitalised)	microhemorrhages, flame-shaped haemorrhage and nerve fibre layer infarcts Hyper-autofluorescence findings were present in 6 patients, Hypo-autofluorescence in 14 patients and six patients had mixed pattern lesions.
Marinho et al.	Nil	Case Series	Mean 44 days post covid diagnosis	18	Mild to severe	

Pereira et al.	Nil	Case Series	11.5 days	18	Severe (hospitalised)			Flame hemorrhages (n = 4) CWS (n = 4) Flame hemorrhages and CWS (n = 1) Peripheral hemorrhages (n = 2) Acute retinal ischaemia (n=1)
Pirraglia et al.	Nil	Case Series	21.5 days post hospitalisation	46	Mild to severe (hospitalised)	x	x	No sign of retinal involvement seen
Sim et al.	Nil	Case Series	16 days post-diagnosis	108	Mild (not hospitalised)			

Study	Study Type	Age	Covid Severity	Ocular Symptoms	Monocular?	OCT	OCTA	Fundus Photography/Fundus autofluorescence	Fundus Exam
Conrady et al.	Case Report	40		Visual loss	Monocular	White-dot-like outer retinopathy	White-dot-like outer retinopathy	white-dot-like outer retinopathy	
Dumitrascu et al.	Case Report	48	Severe	Acute visual loss	Monocular				Incomplete OAO
Gascon et al.	Case Report	53	Mild	acute loss of vision	Monocular	Acute macular neuroretinopathy and paracentral acute middle maculopathy			

Gonzalez-Lopez et al.	Case Report	50	Mild	Arcuate VF defect	Monocular			SCP ischemia which corresponds to the arcuate scotoma observed on VF testing	
Ortiz-Egea et al.	Case Report	42	Mild	Scotoma		Hyperreflective, placoid band at the GCL and IPL			
Olguín-Manríquez et al.	Case Report	35	Mild	Visual loss		acute posterior multifocal placoid pigment epitheliopathy Inner retinal thinning		Multiple yellow-white placoid lesions involving the fovea	
Ortiz-Seller et al.	Case Report	51	Mild	Retro-orbital pain	Binocular	temporal to the fovea in both eyes, and focal disruptions of the outer retinal layers	Bilateral areas of nonperfusion at the level of the choriocapillaris	Weak hyper autofluorescence of lesions	
Virgo and Mohamed et al.	Case Report	37	Mild	Paracentral scotoma		PAMM			
Virgo and Mohamed et al.	Case Report	32	Mild	Paracentral scotoma		AMN			
Acharya et al.	Case Report	60	Severe	Visual loss	Monoocular	x	x	x	CRAO

Sheth et al.	Case Report	52	Reduced vision	Monocular	Serous macular detachment and significant CMO	x	BRVO, HRVO	BRVO, HRVO
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x not done

RNFL Retinal Nerve Fiber Layer

RPC radial peripapillary capillary

MAD Mean Artery Diameter

MVD Mean Vein Diameter

SCP Superficial Capillary Plexus

CMO cystoid macular oedema

FAZ Foveal Avascular Zone

VD Vessel Density

CWS Cotton Wool Spots

OAO Ophthalmic Artery Occlusion

CRAO Central Retinal Artery Occlusion

BRVO Branch Retinal Vein Occlusion

HRVO Hemiretinal Vein Occlusion

PAMM Paracentral Acute Middle Maculopathy

AMN Acute Macular Neuroretinopathy