# Structural macular evaluation by optical coherence tomography after vitrectomy for diabetic fibrovascular proliferation

***Thesis***

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**رسالة**
**مقدمة توطئة للحصول على درجة الدكتوراه فى طب وجراحة العيون**

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| | |
|---|---|
| **AGEs** | Advanced glycation endproducts |
| **AHFP** | Anterior hyaloidal fibrovascular proliferation |
| **ANOVA** | Analysis of Variance |
| **BCVA** | Best Corrected Visual Acuity |
| **CAMs** | Cell adhesion molecules |
| **CFT** | Central Foveal Thickness |
| **DME** | Diabetic macular edema |
| **DR** | Diabetic retinopathy |
| **DRCRn** | Diabetic Retinopathy Clinical Research Network |
| **DRVS** | Diabetic Retinopathy Vitrectomy Study |
| **ECM** | Extracellular matrix |
| **ELM** | External limiting membrane |
| **ERG** | Electro RetinoGram |
| **ERM** | Epiretinal membrane |
| **ETDRS** | Early Treatment Diabetic Retinopathy Study |
| **FAZ** | Foveal avascular zone |
| **FVP** | Fibrovascularproliferation |
| **G1** | Group 1 |
| **G2** | Group 2 |
| **ICAM** | Intracellular adhesion molecule |
| **ICAM-1** | Intercellular adhesion molecule 1 |
| **INL** | Inner nuclear layer |
| **IOP** | Intra Ocular Pressure |
| **IPL** | Inner plexiform layer |
| **IRMA** | Intraretinal microvascular abnormalities |
| **LAM** | Leucocyte adhesion molecule |
| **NFL** | Nerve fibers layer |
| **NPDR** | Nonproliferative diabetic retinopathy |
| **NV** | Neovascular |
| **NVD** | Neovascularization of the optic disc |
| **OCT** | Optical coherence tomography |

| | |
|---|---|
| **ONL** | Outer nuclear layer |
| **OPL** | Outer plexiform layer |
| **P Value** | Probability |
| **PAF** | Platelet-activating factor |
| **PDR** | Proliferative diabetic retinopathy |
| **PKC** | Protein kinase C |
| **PKC-beta** | Protein kinase C-beta |
| **PVD** | Posterior Vitreous Detachment |
| **r** | Pearson's correlation coefficient |
| **RPE** | Retinal pigmented epithelium |
| **SD** | Standard deviation |
| **SFP** | Stereo fundus photographs |
| **TDME** | Tractional diabetic macular edema |
| **tPA** | Tissue plasminogen activator |
| **VCAM** | Vascular cell adhesion molecule |
| **VCAM-1** | Vascular cell adhesion molecule-1 |
| **VE-cadherin** | Vascular endothelial cadherin |
| **VEGF** | Vascular endothelial growth factor |
| **VVOs** | Vesiculo vacuolar organelles |
| **ZO-1** | Zonula occludin-1 |

# INTRODUCTION

Diabetic retinopathy is one of the leading causes of blindness in the world. It classically has been regarded as a disease of the microvasculature of the retina, and the natural history of the disease has been divided into an early non-proliferative stage and a later proliferative stage. (1)

Proliferative retinopathy is defined as any new vessels, fibrous proliferations, preretinal hemorrhage, vitreous hemorrhage or fibrous proliferations (1). Diabetic maculopathy in fibro vascular proliferation (FVP) is unique for its strong vitreoretinal adhesion (2), the frequent presence of epiretinal membrane (ERM) and the strong pro-inflammatory and pro-angiogenic environment.(3)

Vitrectomy is one of the major treatment methods for FVP(4). As surgical techniques and instruments improve, high anatomical success may be achieved; however, functional results are less favorable (5). Despite attached retina, postoperative visual function may be affected by various macular and disc abnormalities. Among the major changes are the structural alternations of the macula. (6)

Recently, optical coherence tomography (OCT) can be used to detect, qualify, quantify and document these alterations. Furthermore, OCT is non-invasive, can qualify the changes and can detect subtle abnormalities not evident with other imaging studies. (7)

Although OCT has been used to examine postoperative macular changes in various retinal diseases, its application to study postoperative macular abnormality in diabetic FVP has not been performed prospectively in the past.

# AIM OF THE WORK

The goal of the study is to determine the type and frequency of various macular structural abnormalities after Vitrectomy for diabetic FVP such as nature and types of macular thickness change, macular contour changes and epiretinal membrane by using OCT.

# ANATOMY OF THE MACULA

## *The Macula*

The macula or the area centralis is the portion of the posterior retina that contains xanthophyll pigment and lies between the upper and lower temporal arcades. It measures approximately 5.5mm in diameter and is centered approximately 4mm temporal to and 0.8mm inferior to the center of the optic disc. It corresponds to approximately 15 degrees of the visual field**.**[8]

The clinical macula is the central area, measures approximately 1.5mm in diameter within the area centralis. Within the center of the macula lies a depression approximately 0.35mm in diameter surrounded by a ring of slightly thickened tissue. This region is called the foveola by anatomists and the fovea by clinicians. The center of the fovea is called the umbo (figure 1)**.**[9]

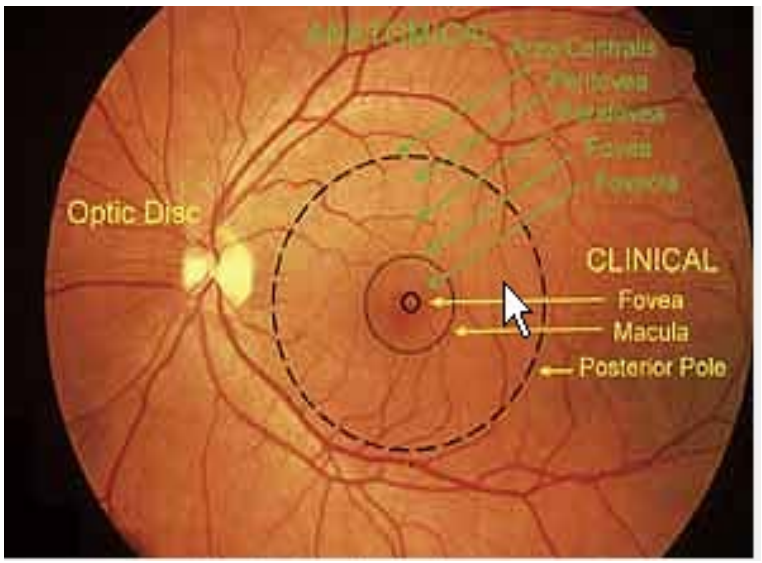


***Figure 1:*** Clinical posterior pole.[9]

## *The foveal avascular zone (FAZ)*

The FAZ is located within the fovea but extends beyond the foveola. The exact diameter is variable and its location can be determined with accuracy only by fluorescein angiography (figure 2)[(2)].

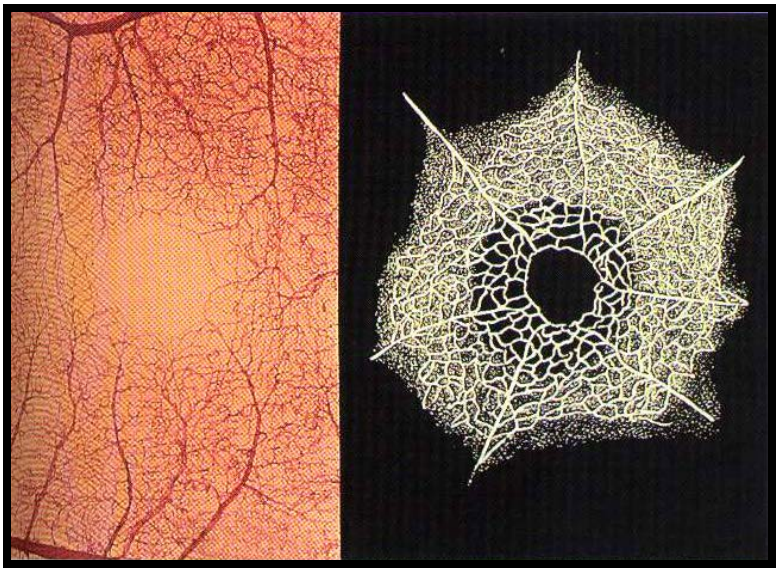

***Figure 2:*** Foveal avascular zone *(Courtesy of Wilmer Eye Institute)*[(2)]

## *Microscopic anatomy*

***Gass et al, 1997*** [(8)] described the retina microscopically in cross section as 10 layers as following:

1- Retinal pigmented epithelium (RPE).
2- Photoreceptors layer of rods and cones.
3- External limiting membrane (ELM).
4- Outer nuclear layer (ONL).
5- Outer plexiform layer (OPL).
6- Inner nuclear layer (INL).
7- Inner plexiform layer (IPL).
8- Ganglion cell layer GCL.
9- Nerve fibers layer (NFL), internal limiting membrane.