Normal Fundus

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Introduction

Normal fundus of an adult comprises of visible part of the retina. Human retina is a transparent structure extending from the optic disc posteriorly to the ora serrata anteriorly.

The color of normal fundus may be described as ranging from orange to vermilion, depending on the diffusion spectrum of blood (oxyhemoglobin), the amount of pigment in the choroid, and hexagonal epithelium of the retina. Fundus shows a generalized water-silk reflex corresponding to the light reflecting off the surface of the retina during examination. A fine-stippled reflex (tapetoretinal reflex) due to reflection of light off the pigment epithelial layer may be seen near the macula. The choroid may be deeply pigmented, appearing as dark polyhedral areas between the lighter choroidal vessels, called tessellated fundus (Fig. 1).

The various structures identified on fundus examination include optic nerve, macula, peripheral retina, ora serrata, and retinal vessels.

Optic Nerve

Optic nerve head is the well-defined pale circular area about 1.5 mm in diameter corresponding to the area of exit of the nerve fibers of the optic nerve. It is located nasal and superiorly with respect to the macula. At the center of the optic disc is a depression called the physiological cup. It varies in shape, size, position, and depth. The usual ratio of area of the cup and the disc being from 0.2 to 0.5. It is also the point of entry of the retinal vessels (Fig. 2).

Area Centralis (Macula)

It is the central area of the retina bound by the optic disc medially and the vascular arcades superiorly, inferiorly, and laterally. It corresponds to central 15° field of vision. It measures about 5–5.5 mm across and 3.5–4 mm vertically. It is further subdivided as:

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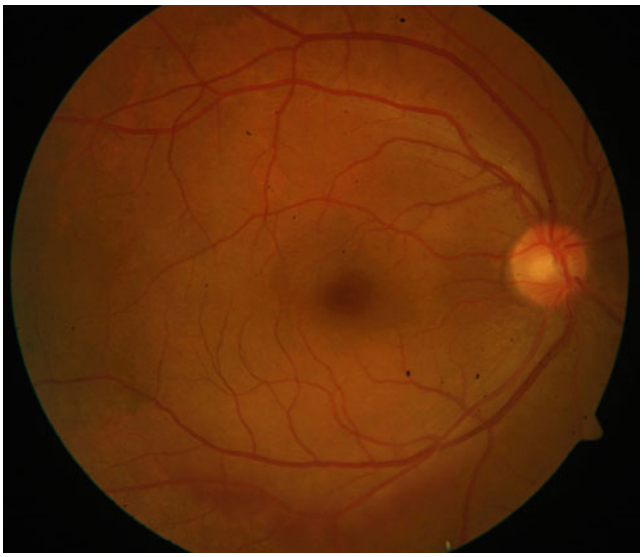

Fig. 1 Normal fundus photograph obtained using a conventional fundus camera showing the posterior pole and the mid-periphery (approximately 55° view)

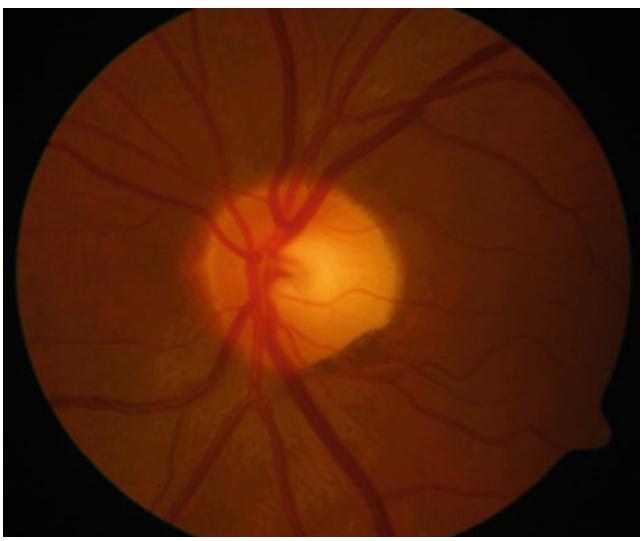

Fig. 2 Disc photograph of the left eye of a patient with no known ocular disease showing the physiological cup and healthy neuroretinal rim

1. Fovea centralis.

It is the central depressed area which is the most sensitive part of the retina. It measures about 1.85 mm in diameter and corresponds to central 5° of the visual field. It comprises of:

(a) Margin – It is situated at about 1.5 mm from foveal center.
(b) Foveola – It is the depressed base of the fovea where the highest concentration of cones is present. It measures 0.35 mm in diameter.
(c) Umbo – It is the central 150–200 μm, corresponding to the foveal light reflex.
(d) Foveal avascular zone – It is an area with diameter ranging from 250 to 600 μm from the foveal center where no blood vessels are present.

2. Parafovea – It is the area of the macula up to 0.5 mm beyond the fovea.

3. Perifovea – It is the area from the edge of the parafovea up to 1.5 mm from it.

Peripheral Retina

1. Near periphery – It is a 1.5 mm wide belt beyond the macula.
2. Mid-periphery – It is the area of the fundus, 3 mm wide, from near periphery up to the equator.
3. Far periphery – It extends beyond mid-periphery up to the ora serrata.

Structures observed in the peripheral retina include:

Equator – It is the area that divides the eyeball into two equal halves. It is present at the posterior margin of ampullae of vortex veins. The circumferential diameter at the equator of the adult eye averages 69 mm.

Ampullae of vortex veins – They are four to eight in number, located at the equator in all four quadrants. There is pigment migration, toward and around the vortex ampullae, which might sometimes be the only indicators of their location.

Long ciliary nerves – yellow-to-orange linear structure with variably pigmented borders is observed at approximately 3 and 9 o'clock positions starting at the equator and passing up to the ora serrata. They divide the fundus into superior and inferior halves (Fig. 5).

Short ciliary nerves – They are fine, lightly colored branching structures located in the choroid on either side of both vertical meridian (around 1, 5, 7, 11 o'clock positions) present at the equator, for a total of four per eye.

Ora serrata – Serrated anterior margin of the retina. Here retina is firmly attached to the vitreous base and the retinal pigment epithelium.

Vascular Arcades

The blood supply to the inner retina comes from the central retinal artery that emerges from the optic disc. It has four main branches into supero-nasal, supero-temporal, infero-nasal, and infero-temporal. The arteries appear bright red in

Fig. 3 Montage (seven-field) view of a normal fundus obtained using a conventional fundus camera

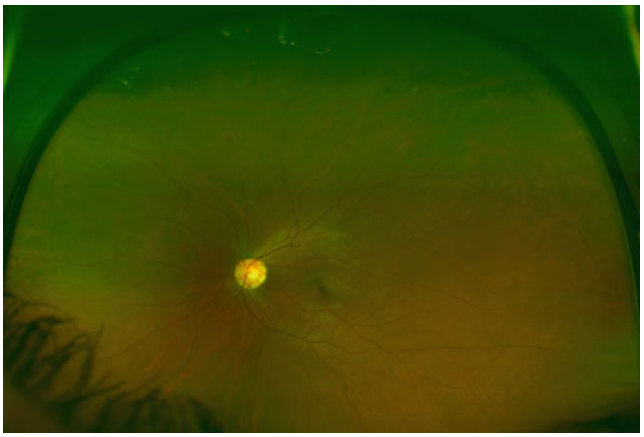

Fig. 4 Ultrawide field fundus imaging of a normal fundus with a camera showing approximately 200° view

color. The temporal branches along with the temporal tributaries of the ophthalmic veins form the boundary of the area centralis. The veins of the retina follow the arteries and finally drain out through the central retinal vein which leaves the retina at the optic disc. Veins appear thicker with dark reddish hue. The normal ratio of caliber of arteries to veins is 2:3.

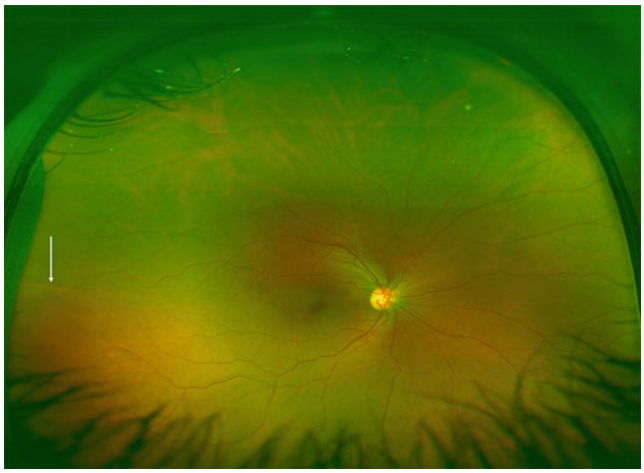

Fig. 5 Ultrawide field fundus imaging of a normal fundus showing the long ciliary nerve (*white arrow*)

Key Points

- Normal fundus is the visible part of the retina. It is described according to the landmarks of optic disc, vascular arcades, macula, and ora serrata.
- Optic disc is 1.5 mm diameter area marking the location of exit of retinal nerve fibers.
- Area centralis is the central part of the retina which includes fovea centralis, parafovea, and perifovea.
- Peripheral retina is the area beyond the macula, divided as near, mid, and far periphery. Structures seen include the equator, short and long ciliary nerves, ampullae of vortex veins, and the ora serrata.

Suggested Reading

Bowling B, FRCSEd(Ophth), FRCOphth, FRANZCO. Kanski's clinical ophthalmology. 8th ed. Elsevier: Canada; 2016.

Khurana AK, Khurana I. Anatomy and physiology of eye. 3rd ed. CBS publishers and Distributors: New Delhi; 2016).

Ryan SJ, MD, Schachat AP, MD, Wilkinson CP, MD, Hinton DR, MD, Sadda SR, MD Wiedemann P, MD. Retina. 5th ed. Elsevier: Canada; 2013.

Yanoff M, Duker JS, . Ophthalmology. 4th ed. Elsevier: Canada; 2014.