Racial Differences in Optical Coherence Tomography Angiography (OCTA) Parameters Among Subjects without Glaucoma

Casey Strauss[1], Aaron Hurd[1], Andrew Davis[1], Betty Tong[1], Jane Gu[1], Jeffrey Wooliscroft[1], Saheba Bhatnagar[1], Karanjit Kooner[1,2]

[1]University of Texas Southwestern Medical Center Dallas, [2]Veterans Affairs North Texas Health Care System Dallas

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Abstract

Purpose:

- To analyze differences in normative OCTA values between white, black, Hispanic, and Asian patients without glaucoma.

Methods:

- In this IRB approved retrospective study, a total of 1080 eyes from 536 patients (mean age 63.24±12.87) with no evidence of glaucoma underwent OCTA imaging in a university eye clinic. Eyes with myopia of 6 diopters or more were excluded. One eye from each individual was selected randomly for analysis. OCTA parameters were analyzed using one-way ANOVA and Tukey HSD post-hoc tests to determine significant differences in mean OCTA values between white, black, Hispanic, and Asian eyes.

Results:

- The mean foveal vessel density (VD) for white eyes (28.03±12.74) was significantly higher than the mean foveal VD for black eyes (22.61±14.44, p=.010). The mean foveal avascular zone (FAZ) area for white eyes (0.255±0.107) was significantly less than the mean FAZ area of black (0.365±0.146, p<.001), Hispanic (0.336±0.121, p<.001), and Asian eyes (0.323±0.124, p=.001). The mean central retina inner thickness for white eyes (50.46±9.66) was significantly higher than the mean for black eyes (40.47±9.3, p<.001). Disc area was smaller in white eyes (2.10±0.416) than in black (2.42±0.484, p<.001), Hispanic (2.35±0.512, p=.006), and Asian eyes (2.29±0.483, p=.038).

Conclusion:

- Our data suggests that there are significant differences in normative OCTA values between different races. These racial differences may be attributed to varying levels of susceptibility to pathologic processes, but exact mechanisms are not yet known. Our data may be valuable in interpreting both normative and glaucomatous OCTA values.

Background

- Optical Coherence Tomography Angiography (OCTA) is an imaging modality that provides fast, reliable, objective, and reproducible three-dimensional scans of the retina, optic nerve, and choroid.
- OCTA allows for high resolution visualization of the vasculature surrounding these areas and aids in the diagnosis and treatment of various eye pathologies.

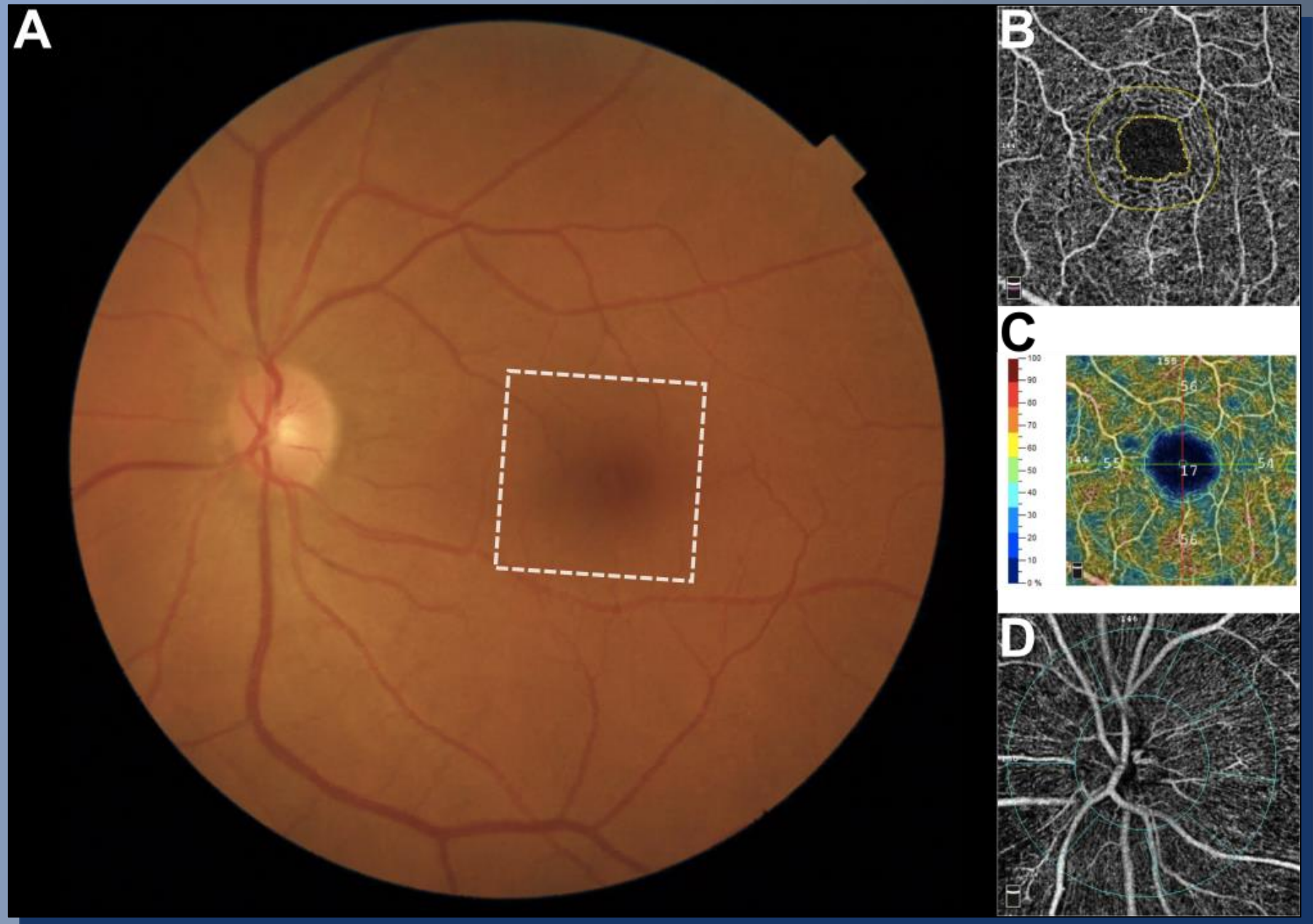
Example images of the left eye of a healthy subject using ocular fundus photography (A) and OCTA (B-D).

A: Color fundus photograph. Dotted white box shows approximate area where the OCTA machine scans for the retinal images in B and C.

B: En face 3.0 x 3.0 mm OCTA image of the retina. The inner yellow ring outlines the foveal avascular zone (FAZ). The area between the outer and inner yellow rings is measured for vessel density.

C: Retinal Vessel Density image. Color legend illustrates vessel density in percent.

D: 4.5 x 4.5 mm image of the vasculature of the optic nerve head.



Purpose

- One major challenge facing OCTA analysis is lack of an established normative database. Another challenge is the lack of knowledge about how normative values may differ between races. Further study of normative OCTA values for different races could help clinicians better interpret patients' OCTA values.
- The purpose of this study was to establish a normative database of patients without glaucoma using OCTA and to analyze differences in normative OCTA values between races in North Texas.

Methods

- In this IRB approved retrospective study, a total of 1080 eyes from 536 patients (mean age 63.24±12.87) with no evidence of glaucoma underwent OCTA imaging (using Optovue RTVue XR Avanti, Fremont, CA) in the university eye clinic in Dallas, Texas. Patients included had no retinal or vascular pathology and had vision better than 20/200. Eyes with myopia of 6 diopters or more were excluded. Eyes were randomized to account for correlation between right and left eyes of individuals.

Statistical Analysis

- OCTA parameters were analyzed using one-way ANOVA and Tukey HSD post-hoc tests to determine significant differences in mean OCTA values between white, black, Hispanic, and Asian eyes.
- Analysis was done using IBM SPSS Statistics version 27. Tables showing mean values and standard deviations for each parameter were made for each race. Examples of these tables are Table 1 and Table 2 in subsequent slides.

Results

One-way ANOVA and Tukey HSD post hoc tests showed significant differences in various OCTA parameters between racial groups.

Table 1: *indicates a significant difference ($p<.05$) between the means of the racial groups according to One-way ANOVA. Parafoveal values are averages of superior, inferior, temporal, and nasal measurements. VD values are reported in %. FD-300 Area Density is the vessel density of the 300µ width ring surrounding the FAZ, in %.

VD=Vessel Density, FAZ=Foveal Avascular Zone

Table 1: Average Values for Different Races from 3.0 x 3.0 mm Retinal Scan				
Parameter	White (166)	Black (105)	Hispanic (51)	Asian (66)
Retina VD Foveal*	28.03±12.74	22.61±14.44	24.06±14.89	23.17±14.78
Retina VD Parafoveal	46.90±4.46	47.55±4.67	46.54±3.85	48.31±4.37
Retina VD Temporal*	45.60±4.01	46.27±4.52	44.82±3.98	47.26±3.54
FAZ Area (mm^2)*	0.255±0.107	0.365±0.146	0.336±0.121	0.323±0.124
FAZ Perimeter (mm)*	2.01±0.455	2.41±0.510	2.36±0.472	2.28±0.454
FD-300 Area Density*	48.34±4.21	49.75±4.69	48.51±4.14	49.75±4.27

Tukey Post-Hoc Results

Table 2: Post hoc test for significant differences between specific racial groups.

White eyes showed significantly greater foveal vessel density than black eyes. White eyes also showed a significantly smaller FAZ area and FAZ perimeter than the three other races.

Table 2: Post Hoc Test for Statistically Significant Differences Between Races				
Parameter	Race (I)	Race (J)	Mean Difference (I-J)	Sig.
Retina VD Foveal	White	Black	5.41804	.010
Retina VD Temporal	White	Asian	-1.65746	.028
	Hispanic	Asian	-2.43918	.008
FAZ Area	White	Black	-.109862	<.001
	White	Hispanic	-.080695	<.001
	White	Asian	-.067391	.001
FAZ Perimeter	White	Black	-.402272	<.001
	White	Hispanic	-.354554	<.001
	White	Asian	-.276106	<.001
FD-300 Area Density	White	Black	-1.63358	.015

Results continued

Other significant differences between races:

Retina inner thickness and full thickness values were overall higher in white eyes and lower in black eyes. The mean central retina inner thickness (ILM-IPL) for white eyes (50.46±9.66) was significantly different than the mean for black eyes (40.47±9.3, $p<.001$).

Disc area was smaller in white eyes (2.10±0.416) than in black (2.42±0.484, $p<.001$), Hispanic (2.35±0.512, $p=.006$), and Asian eyes (2.29±0.483, $p=.038$).

Conclusions

- In this sample population, our data suggests that there are significant differences in normative OCTA values between different races. These findings may be valuable in interpreting normative OCTA values.
- Greater foveal vessel density in white eyes compared to black eyes and smaller FAZ, FAZ perimeter in white eyes compared to other races may suggest less susceptibility to various ocular pathologies in white eyes.
- Further studies are needed to elucidate the mechanisms that lead to racial differences in OCTA parameters.

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