Striking the metronome in morphometric analysis of glaucoma - Shifting from Bruch's Membrane Opening - Horizontal Rim Width (BMO-HRW) to Bruch's Membrane Opening - Minimum Rim Width (BMO-MRW)

Dear Editor,

The neuro-retinal rim is separated from vitreous by the inner limiting membrane (ILM) of Elschnig. ILM is an objective inner boundary of neuroretinal rim tissue that is consistently detected by spectral-domain optical coherence tomography (SD-OCT). Currently, methods for neuro-retinal rim width measurement in SD-OCT employs the Bruch's membrane opening (BMO) as the anatomical border of the rim, referenced to a BMO horizontal reference plane, termed as "BMO-horizontal rim width" (BMO-HRW).[1] In contrast, the Spectralis OCT (Heidelberg Engineering, Germany) Glaucoma Module Premium Edition (GMPE) provides a new, objective method of optic nerve head (ONH) analysis using BMO, but the neuro-retinal rim assessment is performed from the BMO to the nearest point on the internal limiting membrane (ILM) rather than on the horizontal reference plane [Fig. 1]. This minimum distance measured between the BMO and the ILM in the ONH

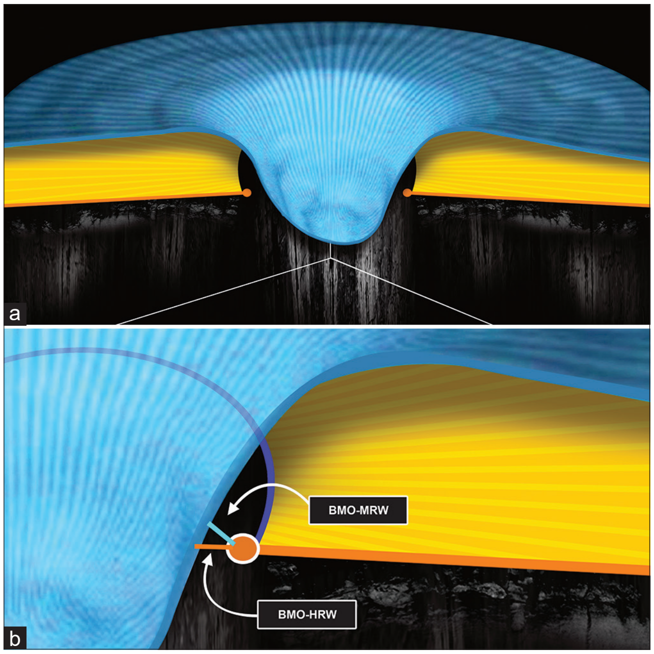

Figure 1: (a) Three dimensional OCT view of the optic nerve head depicting the internal limiting membrane (blue), Bruch's membrane (brown) and Bruch's membrane opening (brown dot). (b) Magnified view of the same OCT of the optic nerve head depicting BMO-MRW (blue line) and BMO-HRW (brown line)

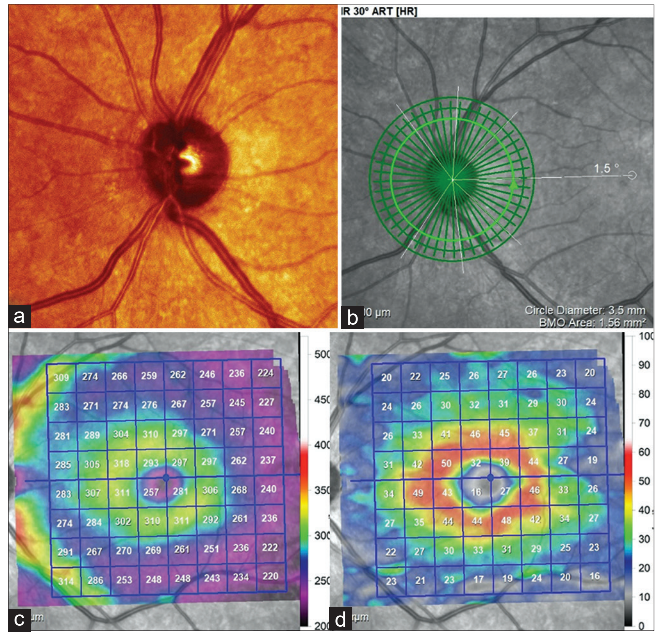

Figure 2: Normal non-glaucomatous optic nerve head. (a) Fundus photograph. (b) Infra red image with the FoBMOC of +1.5 degree (plus sign depicts macula is above the fovea). (c) Retinal nerve fibre layer (RNFL) thickness map reveals normal thickness. (d) Ganglion cell layer thickness map reveals normal thickness

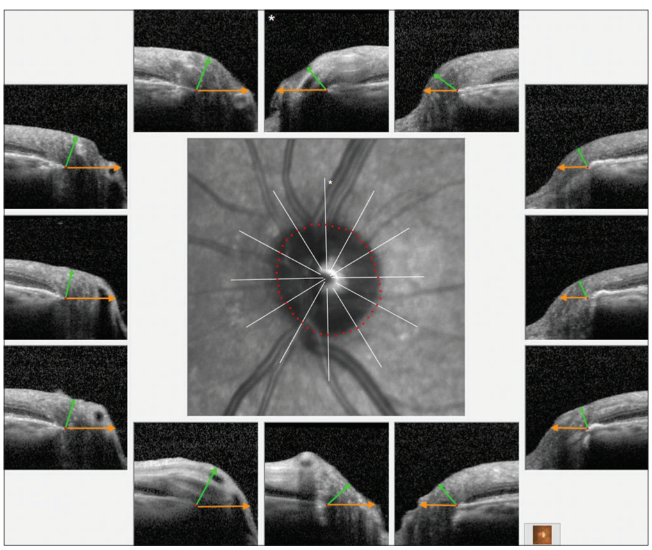

Figure 3: 360 degree section scan of the same normal non-glaucomatous ONH reveals the BMO-MRW (green arrow) and BMO-HRW (orange arrow). The BMO-MRW is normal and healthy in all the slices

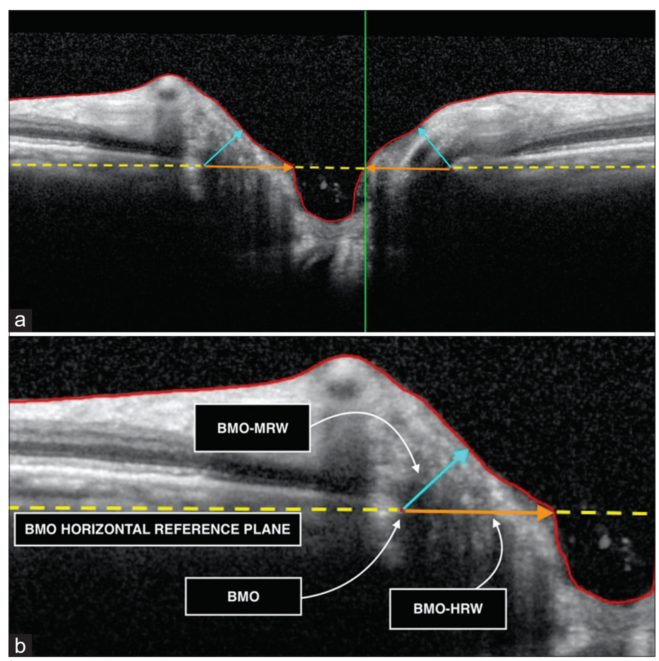

Figure 4: (a and b) OCT disc of the same normal non-glaucomatous ONH reveals BMO (red dot), BMO-MRW (blue arrow), BMO-HRW (orange arrow) and BMO horizontal reference plane (yellow dotted lines)

is defined as "BMO-minimum rim width" BMO-MRW [Fig. 1]. This parameter considers the orientation of the neuroretinal rim tissue relative to the point of measurement, and also takes into consideration the highly variable anatomy of the ONH between individuals, and quantifies the rim width perpendicular to the trajectory of axons. Applicative examples of the GMPE software in normal [Figs. 2-4] and glaucoma patients [Figs. 5-7] are shown. Additionally, this new software provides an anatomic positioning system [Figs. 2b and 5b] where acquisition of data is based on fovea-to-BMO-center axis (FoBMOC Axis), reducing the intra-individual variability, as the same piece of tissue is examined every-time during followup.[1-3] By automatically, aligning relative to the individual's FoBMOC axis at follow-up, accuracy is achieved to detect changes as small as one micron in the BMO-MRW, thus creating a new world in glaucoma diagnosis. Because of the varying orientation of the retinal

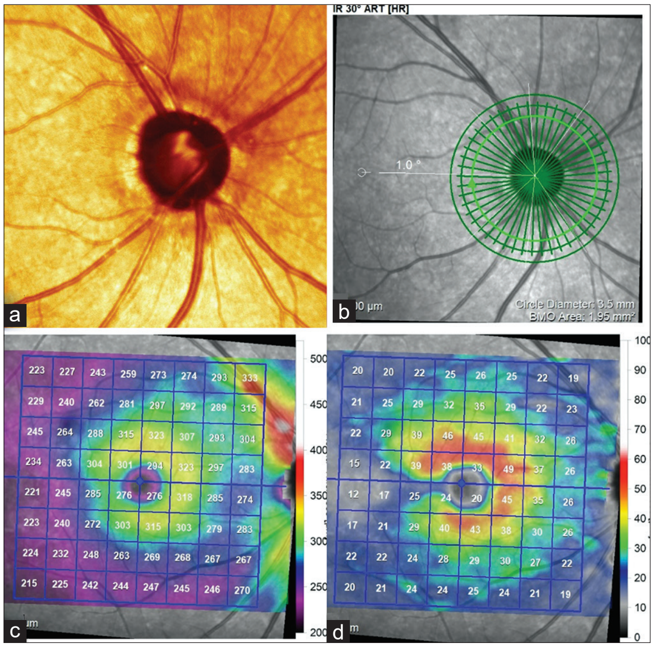

Figure 5: Glaucomatous optic nerve head. (a) Fundus photograph reveals infero-temporal glaucomatous notch. (b) Infra red image with the FoBMOC of +1.0 degree (plus sign depicts macula is above the fovea). (c) RNFL thickness map reveals inferior RNFL defect. (d) Ganglion cell layer thickness map reveals inferior GCL defect

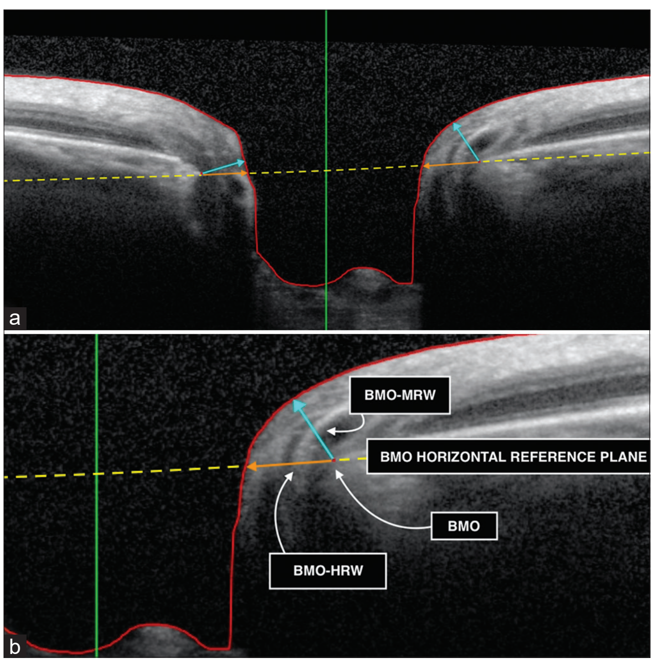

Figure 7: (a and b) OCT disc of the same glaucomatous ONH reveals BMO (red dot), BMO-MRW (blue arrow), BMO-HRW (orange arrow) and BMO horizontal reference plane (yellow dotted lines)

ganglion cell (RGC) axons upon their entry into the neural canal relative to the BMO, Povzay *et al*. & Chen and collaborators proposed that the minimum distance from BMO-Retinal Pigment Epithelium complex to the ILM represents the most accurate measurement of the axonal content in the neuro-retinal rim.[2]

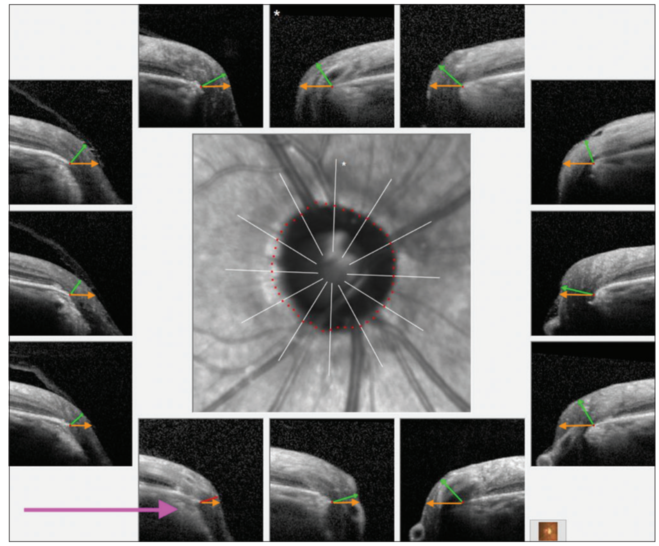

Figure 6: 360 degree section scan of the same glaucomatous ONH reveals the BMO-MRW (green arrow) and BMO-HRW (orange arrow). The BMO-MRW is normal in all slices except the one on the bottom left (pink arrow) depicting the thinning of BMO-MRW (red arrow) due to inferior temporal notch

Every decision for something (BMO-MRW), is a decision against something else (BMO-HRW) [Figs. 4 and 7]. The same goes with choosing BMO-MRW over the traditional BMO-HRW, but the choice is for the better. Higher sensitivity in early glaucoma detection is reported with BMO-MRW compared to BMO-HRW.[1] Furthermore, the structure–function relationship is enhanced with BMO-MRW compared to BMO-HRW, because of geometrically accurate properties of BMO-MRW, indicating a new promising structural marker [Figs. 3 and 6] for the detection of glaucoma.[4] This concept is relatively new and interesting, but a promising one which will definitely improve the accuracy in the qualitative and quantitative evaluation of ONH.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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