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Original Article

# Effect of High Myopia on Optic Nerve Head by Confocal Scanning Laser Ophthalmoscopy in Nepalese Eyes

Sameer Bhaila[1], Sagun Narayan Joshi[2], Madhu Thapa[2], Gauri Shankar Shrestha[2]

[1]*Department of Ophthalmology, Civil Service Hospital, Minbhavan, Kathmandu, Nepal*
[2]*BP Koirala Lions Centre for Ophthalmic Studies, Institute of Medicine, Maharajgunj Medical Campus, Kathmandu, Nepal*

**Purpose:** To compare parameters of confocal scanning laser ophthalmoscopy (Heidelberg Retinal Tomograph [HRT] II) in high myopia with age- and sex-matched emmetropes.

**Methods:** A hospital-based cross-sectional study was conducted among Nepalese subjects aged 18 to 35 years at BP Koirala Lions Centre for Ophthalmic Studies, Institute of Medicine, Maharajgunj, Kathmandu from November 2015 to October 2016. Fifty consecutive subjects with high myopia (spherical equivalent ranging from -6.00 to -12.00 diopters) and age- and sex-matched emmetropic subjects were enrolled for comparison. Correlations between disc area and other HRT parameters, asymmetry between the right and left eyes, and comparisons between male and female subjects in both high myopic and emmetropic groups were evaluated.

**Results:** Disc area was not significantly ($p$ = 0.11) larger in high myopic eyes than in emmetropic eyes. HRT parameters in highly myopic eyes involved smaller cup parameters and greater rim parameters compared with emmetropic eyes. Disc area was found to be significantly positively correlated with inter disc parameters and significantly negatively correlated with rim to disc area ratio in the high myopia group. Disc area and other intra-disc parameters showed significant correlations between right and left eyes in both high myopia and emmetropia, and no significant differences between males and females from a Nepalese population.

**Conclusions:** Characteristics of HRT parameters in high myopic eyes involved smaller cup parameters and greater rim parameters compared with emmetropic eyes in a Nepalese population. The effect of disc area on HRT parameters differed significantly only in height variation contour by emmetropic eyes.

**Key Words:** Confocal scanning laser ophthalmoscopy, High myopia, Optic cup, Optic disc

Evaluation of the human optic nerve head is important in myopia, because myopia seems to notably affect the size and shape of the optic disc and retinal nerve fiber layer (RNFL) [1-3]. The size of optic nerves varies with specific optic nerve diseases, age, sex, ethnicity, and refractive errors [4]. The large variation in optic nerve head appearance makes for an even greater challenge in detecting quantitative morphologic changes in high myopia. Moreover, myopia-induced changes in the retina and optic disc such as oblique insertions of the optic disc, peripapillary atrophy or the presence of a tigroid fundus pose a significant challenge in the diagnosis of glaucoma in high myopia.

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Corresponding Author: Gauri Shankar Shrestha, M.Optom, FIACLE. BP Koirala Lions Center for Ophthalmic Studies, Institute of Medicine, Maharajgunj Medical Campus, Tribhuvan University, PO Box 5889, Kathmandu, Nepal. Tel: 977-9841019594, Fax: 977-14720142, E-mail: gs101lg@hotmail.com

The Heidelberg Retinal Tomography (HRT; Heidelberg Engineering, Heidelberg, Germany) provides a three-dimensional picture of the optic nerve head and RNFL [5-7], facilitating objective evaluation of their three-dimensional shape.

The present study sought to present normative data of optic disc stereometric parameters for high myopic eyes compared with age- and sex-matched emmetropic subjects in healthy adults in a Nepalese population.

## Materials and Methods

### Research design and sample size

A descriptive cross-sectional study was conducted among subjects aged 18 to 35 years receiving a regular eye examination at the BP Koirala Lions Centre for Ophthalmic Studies, Institute of Medicine, Kathmandu over a 1-year period (November 2015 to October 2016). Data collection took place for 16 weeks during this period. We enrolled 50 consecutive patients with high myopia (spherical equivalent [SE], ≥-6.00 diopters [D]) [8]. Similarly, another 50-consecutive age- and sex-matched absolutely emmetropic (SE, 0.00 D) subjects were enrolled in the same way for comparison (Table 1).

Only the right eyes of both high myopic and emmetropic subjects were selected for comparison of ten different stereometric disc parameters. The investigation adhered to the tenets of the Declaration of Helsinki. The study protocol was approved by the institution ethics board of the Institute of Medicine, Kathmandu, Nepal. Informed consent was obtained from all participants after the objectives of the study were explained and we ensured participant confidentiality and anonymity.

### Assessment

Unaided, presenting, and best spectacle-corrected visual acuity were taken using internally illuminated Snellen's multiple optotypes at a 6-m distance. The Tumbling E-chart was used for two illiterate patients. Detailed anterior segment evaluation with a slit lamp (Haag Streit 900; Haag-Streit Diagnostics, Harlow, UK) was carried out. Objective refraction with a retinoscope (Heine Beta 200, Heine Optotechnik, Herrsching, Germany) and subjective refraction were performed to obtain best corrected visual acuity. Evaluation of the fundus, optic disc and posterior pole was performed with a direct ophthalmoscope (Heine Beta 200) and slit lamp and +90 D lens (Volk Optical, Mentor, OH, USA) after dilatation of pupils using a topical mydriatic (tropicamide 0.5% + phenylephrine 2.5%) solution.

### Sample selection

Normal eyes based on screening and detailed examinations were included in the analysis. Subjects with high myopia (SE ranging from -6.00 to -12.00 D) had best spectacle corrected visual acuity 20 / 20 or better after refractive error correction, normal intraocular pressure of 20 mmHg or less, an optic disc with a normal appearance, normal visual field based on the Humphrey perimetry (24-2), no previous laser surgery or intraocular surgery, and no substantial ocular disease. Eyes with a refractive error (SE) of -12.00 D or more or astigmatism greater than 2.00 D, all cases with glaucoma, suspected glaucoma, ocular hypertension, pseudoexfoliation, or congenital disc anomalies were excluded. During screening, the glaucoma specialist independently evaluated the optic disc of each subject for any abnormal findings. Emmetropic subjects with absolutely no refractive error (SE, 0.00 D), unaided visual acuity of 20 / 20, normal intraocular pressure below 20 mmHg, normal optic

**Table 1.** Demographic data from 50 eyes with high myopia and 50 age and sex matched eyes with emmetropia

| | High myopia | Emmetropia | *p*-value |
|---|---|---|---|
| Male : female | 22 : 28 | 22 : 28 | Matched |
| Age (yr) | 21.60 ± 4.6 | 21.38 ± 3.8 | 0.76 |
| Axial length (mm) | 26.02 ± 0.85 | 22.88 ± 0.57 | 0.00* |
| Refractive error (diopter) | -7.5 ± 1.3 | - 0.05 ± 0.20 | 0.00* |

Values are presented as number or mean ± standard deviation.
*Significance of comparisons between highly myopic and emmetropic eyes determined by independent *t*-test.

disc appearance, normal visual field based on the Humphrey perimetry (24-2), no ocular surgery and no eye diseases were selected as controls.

The criteria for suspected glaucoma were a vertical cup-to-disc ratio of 0.6 or more, a difference in the vertical cup-to-disc ratio of 0.2 or more between both eyes, a rim width at the superior (11 to 1 clock hours) and inferior portions (5 to 7 clock hours) of 0.2 or less of the disc diameter, a nerve fiber layer defect, or a splinter disc hemorrhage [9]. Similarly, the retina specialist independently evaluated the retina for any pathological high myopic retinal changes. Cases were excluded if any abnormality was detected.

### HRT II optic disc measurements

The HRT II was used to assess the topographic images of the optic disc with undilated pupils, as described by Tsutsumi et al. [9]. A well-trained optometrist drew the optic disc contour line in all cases to mark the edge of the optic disc using a digital photographic disc image to aid contour placement. The contour line was reviewed in the 3-D topographic view, reflectance images in movie view and the height profile graph included in the instrument. The stereometric disc parameters included in the study were disc area, cup area, rim area, cup volume, rim volume, cup-to-disc area ratio, rim-to-disc area ratio, mean cup depth, height variation contour, cup shape measure, and mean RNFL thickness [9].

### Data analysis

Fifty normal eyes of 50 subjects with high myopia and 50 normal eyes of 50 emmetropic subjects were assessed, and the internal consistency reliability coefficient (Cronbach's alpha of HRT II parameters) was 0.85. The normality of data related to HRT II findings among subjects with high myopia was assessed using the Shapiro-Wilk test, which showed disc area ($p = 0.22$), rim area ($p = 0.07$), cup to disc area ratio ($p = 0.26$), mean cup depth ($p = 0.25$), cup shape measure ($p = 0.57$), height variation contour ($p = 0.39$) and mean RNFL thickness ($p = 0.89$) were normally distributed whereas disc ovality index ($p < 0.0001$), cup area ($p = 0.003$), cup volume ($p < 0.0001$), rim volume ($p = 0.001$), cup disc area ratio ($p = 0.05$) and rim disc area ratio ($p = 0.04$) were not. Comparisons of mean values between groups (high myopia and emmetropia), between right and left eyes, and between males and females were analyzed with a paired sample *t*-test for parametric data and the Wilcoxon sign rank test for non-parametric tests. Correlation between the right and left eye, and between males and females was analyzed with Pearson's correlation coefficient for normally distributed data and Spearman correlation coefficient for normally non-distributed data. A *p*-value of ≤0.05 was considered significant (IBM SPSS Statistics ver. 21.0; IBM Corp., Armonk, NY, USA).

## Results

HRT II parameters were compared between 50 highly myopic eyes and 50 age- and sex-matched emmetropic eyes. Disc area was not significantly ($p = 0.11$) larger in high myopic eyes than in emmetropic eyes (Table 2). The values for rim area ($p = 0.002$), rim volume ($p \leq 0.0001$), rim to disc area ratio ($p \leq 0.0001$) and cup shape measure ($p = 0.005$) were significantly larger for high myopia than in emmetropia. Mean RNFL thickness was not significantly larger in high myopic eyes than emmetropic eyes ($p = 0.24$), although this value in HRT parameters shows a contour of the disc but does not represent the true value.

The average values for cup area ($p < 0.0001$), cup volume ($p < 0.0001$) and cup to disc area ratio ($p = 0.04$) were significantly smaller for high myopia in comparison to emmetropia. However, mean cup depth ($p = 0.06$) and height variation contour ($p = 0.58$) were not significantly smaller for high myopia in comparison to emmetropia.

Correlation between HRT parameters and disc area is presented in Table 3. Disc area was significantly positively correlated with inter-disc parameters of cup area ($p < 0.001$), rim area ($p < 0.001$), cup volume ($p < 0.001$), rim volume ($p < 0.001$), and cup to disc area ratio ($p < 0.001$) and significantly negatively correlated with rim to disc area ratio ($p < 0.001$) in the high myopia group. Similarly, disc area was significantly positively correlated with intra-disc parameters of cup area ($p < 0.001$), rim area ($p < 0.001$), cup volume ($p < 0.001$), rim volume ($p < 0.001$), cup to disc area ratio ($p < 0.001$), mean cup depth ($p < 0.001$) and height variation contour ($p < 0.001$), and significantly negatively correlated with rim to disc area ratio ($p < 0.001$) in the emmetropic group.

There was no significant difference in refractive errors between right and left eyes in the high myopia group ($p = 0.55$) (Table 4). Table 5 shows the correlation coefficients

**Table 2.** Average Heidelberg retina tomograph parameters between 50 highly myopic eyes and 50 age and sex matched emmetropic eyes

| Parameter | High myopia | Emmetropia | $p$-value | Mean difference |
|---|---|---|---|---|
| Disc area (mm$^2$)* | 2.934 ± 0.624 | 2.711 ± 0.640 | 0.11 | 0.223 ± 0.960 |
| Cup area (mm$^2$)† | 0.462 ± 0.347 | 0.549 ± 0.350 | <0.0001 | -0.087 ± 0.529 |
| Rim area (mm$^2$)* | 2.472 ± 0.494 | 2.162 ± 0.453 | 0.002 | 0.310 ± 0.686 |
| Cup volume (mm$^3$)† | 0.105 ± 0.161 | 0.120 ± 0.111 | <0.0001 | -0.154 ± 0.212 |
| Rim volume (mm$^3$)† | 0.780 ± 0.243 | 0.633 ± 0.218 | < 0.0001 | 0.147 ± 0.310 |
| Cup to disc area ratio* | 0.149 ± 0.097 | 0.191 ± 0.099 | 0.04 | -0.042 ± 0.139 |
| Rim to disc area ratio† | 0.850 ± 0.096 | 0.809 ± 0.099 | <0.0001 | 0.041 ± 0.138 |
| Mean cup depth (mm)* | 0.176 ± 0.069 | 0.204 ± 0.080 | 0.06 | 0.028 ± 0.104 |
| Cup shape measure* | -0.249 ± 0.066 | -0.175 ± 0.165 | 0.005 | -0.075 ± 0.180 |
| Height variation contour* | 0.446 ± 0.099 | 0.455 ± 0.091 | 0.58 | -0.009 ± 0.116 |
| Mean RNFL thickness (mm)* | 0.308 ± 0.071 | 0.293 ± 0.058 | 0.24 | 0.015 ± 0.092 |

Values are presented as mean ± standard deviation.
RNFL = retinal nerve fiber layer.
*Significant at $p < 0.05$ by independent $t$-test; †Significant at $p < 0.05$ by Wilcoxon signed-rank test. The mean difference indicates the difference between the averages of particular parameters between the two groups.

**Table 3.** Correlation between Heidelberg retina tomograph parameters with disc area

| Parameter | Correlation with disc area | | | |
|---|---|---|---|---|
| | High myopia | $p$-value | Emmetropia | $p$-value |
| Cup area* | 0.65 | <0.0001 | 0.613 | <0.0001 |
| Rim area† | 0.914 | <0.0001 | 0.824 | <0.0001 |
| Cup volume* | 0.568 | <0.0001 | 0.526 | <0.0001 |
| Rim volume* | 0.491 | <0.0001 | 0.498 | <0.0001 |
| Cup to disc area ratio† | 0.384 | <0.006 | 0.432 | <0.002 |
| Rim to disc area ratio* | -0.407 | <0.003 | -0.425 | <0.002 |
| Mean cup depth† | 0.294 | 0.038 | 0.516 | <0.0001 |
| Cup shape measure† | -0.093 | 0.522 | 0.165 | 0.25 |
| Height variation contour† | -0.033 | 0.819 | 0.448 | <0.001 |
| Mean RNFL thickness† | -0.150 | 0.299 | 0.225 | 0.12 |

n = 50 eyes in both age and sex matched groups.
RNFL = retinal nerve fiber layer.
*Significant at $p < 0.05$ by Spearman correlation; †Significant at $p < 0.05$ by Pearson correlation.

and absolute differences between right and left eyes for HRT parameters in the high myopia and emmetropia groups. Disc area and other intra-disc parameters showed significant positive correlations between right and left eyes in both high myopia and emmetropia. The only intra-disc parameter which did not have a significant correlation was the cup shape measure. There was no significant absolute difference in average values of the optic disc parameters between right and left eyes in the high myopia group, except for mean cup depth. We also found significant absolute differences in disc area, rim area, rim volume and cup shape measure between fellow eyes in the emmetropia group.

Table 6 compares HRT parameters between male and female eyes. There was no significant difference in HRT parameters between males and females in myopic samples from the Nepalese population. However, disc area, cup area, cup volume and cup to disc area ratio were significantly smaller in female eyes.

**Table 4.** Mean (±standard deviation), correlation coefficients, and absolute differences between right and left eyes in refractive error (spherical equivalent) in the high myopia and emmetropia groups

| Group | Refractive error right eye (diopter) | Refractive error left eye (diopter) | Correlation coefficient between right and left eyes (*p*-value) | Absolute difference between right and left eyes (*p*-value) |
|---|---|---|---|---|
| High myopia | -7.45 ± 1.29 | -7.50 ± 1.30 | 0.858 (<0.001) | 0.05 (0.55) |
| Emmetropia | -0.05 ± 0.17* | -0.05 ± 0.17* | * | 0.00 (*) |

*The correlation could not be computed in the emmetropic group because the standard error of the difference was zero.

**Table 5.** Correlation coefficients and absolute differences between right and left eyes in Heidelberg retina tomograph parameters in the high myopia and emmetropia groups

| Parameter | Correlation coefficient between right and left eyes (*p*-value) | | Absolute difference between right and left eyes (*p*-value) | |
|---|---|---|---|---|
| | High myopia | Emmetropia | High myopia | Emmetropia |
| Disc area | 0.804 (<0.0001)* | 0.787 (<0.0001)* | -0.007 (0.91)† | 0.132 (0.03)† |
| Cup area | 0.808 (<0.0001)‡ | 0.778 (<0.0001)‡ | 0.022 (0.295)§ | 0.002 (0.72)§ |
| Rim area | 0.660 (<0.0001)* | 0.671 (<0.0001)* | -0.0285 (0.64)† | 0.130 (0.02)† |
| Cup volume | 0.745 (<0.0001)‡ | 0.790 (<0.0001)‡ | 0.013 (0.388)§ | 0.011 (0.32)§ |
| Rim volume | 0.462 (0.001)‡ | 0.562 (<0.0001)‡ | 0.005 (0.843)§ | 0.085 (0.04)§ |
| Cup to disc area ratio | 0.768 (<0.0001)* | 0.734 (<0.0001)* | 0.009 (0.31)† | 0.007 (0.52)† |
| Rim to disc area ratio | 0.762 (<0.0001)‡ | 0.726 (<0.0001)‡ | 0.008 (0.229)§ | 0.009 (0.48)§ |
| Mean cup depth | 0.742 (<0.0001)* | 0.722 (<0.0001)* | 0.019 (0.007)† | 0.003 (0.74)† |
| Cup shape measure | 0.510 (<0.0001)* | 0.078 (0.59)* | 0.006 (0.47)† | 0.054 (0.03)† |
| Height variation contour | 0.589 (<0.0001)* | 0.411 (0.003)* | 0.001 (0.93)† | 0.010 (0.49)† |
| Mean RNFL thickness | 0.580 (<0.0001)* | 0.360 (0.01)* | 0.006 (0.49)† | 0.001 (0.93)† |

Values are shown for the right and left eyes with high myopia (n = 50 subjects) and for eyes with emmetropia (n = 50 subjects); All correlation coefficients in the high myopia and emmetropia groups were significant ($p < 0.05$) except for the cup shape measure for emmetropia.
RNFL = retinal nerve fiber layer.
*Significant at $p < 0.05$ by Pearson correlation; †Significant at $p < 0.05$ by independent *t*-test; ‡Significant at $p < 0.05$ by Spearman correlation; §Significant at $p < 0.05$ by Wilcoxon signed-rank test.

Scatterplots (Fig. 1A, 1B) show the relationship between refractive error (SE) and disc area or cup shape measure in high myopia. There was no significant correlation between the refractive error and the disc area in highly myopic eyes (Pearson's correlation coefficient = -0.054, $p = 0.591$). The only inter-disc parameter showing a significant correlation with SE was the cup shape measure in highly myopic eyes (Pearson's correlation coefficient = 0.226, $p = 0.008$).

## Discussion

We report ten stereometric disc parameters of confocal scanning laser ophthalmoscopy (HRT II) among high myopic subjects for the first time and compared them with results from age- and sex-matched emmetropic subjects.

High myopic eyes tend to have a larger disc area as indicated by fundus photographs [10-12] or HRT III [13]. However, Tsutsumi et al. [9] reported that the disc area was significantly smaller in high myopia subjects (2.00 ± 0.53 vs. 2.14 ± 0.46 $mm^2$, $p = 0.02$) [9]. In the present study, mean disc area was larger in the high myopia group than in the emmetropia group (2.934 ± 0.624 vs 2.711 ± 0.064 $mm^2$) but not significantly so ($p = 0.11$). This discrepancy could result from differences by age, race or magnification correction of imaging for different devices [14]. The mean age of high myopic subjects in the study by Tsutsumi et al. [9] was 48.7 ± 6.8 years, while the average age in our study of

**Table 6.** Comparison of Heidelberg retina tomograph parameters between male and female eyes

| Parameters | High myopia | | $p$-value | Emmetropia | | $p$-value |
|---|---|---|---|---|---|---|
| | Male | Female | | Male | Female | |
| Disc area* | 3.018 ± 0.768 | 2.855 ± 0.619 | 0.41 | 3.11 ± 0.667 | 2.625 ± 0.537 | 0.006 |
| Cup area† | 0.516 ± 0.329 | 0.458 ± 0.261 | 0.49 | 0.702 ± 0.294 | 0.432 ± 0.299 | 0.008 |
| Rim area* | 2.502 ± 0.589 | 2.39 ± 0.501 | 0.49 | 2.416 ± 0.568 | 2.194 ± 0.390 | 0.11 |
| Cup volume† | 0.095 ± 0.086 | 0.0893 ± 0.089 | 0.82 | 0.174 ± 0.142 | 0.098 ± 0.113 | 0.042 |
| Rim volume† | 0.792 ± 0.273 | 0.779 ± 0.186 | 0.85 | 0.746 ± 0.414 | 0.695 ± 0.268 | 0.60 |
| Cup to disc area ratio* | 0.162 ± 0.088 | 0.155 ± 0.073 | 0.79 | 0.221 ± 0.103 | 0.155 ± 0.091 | 0.02 |
| Rim to disc area ratio† | 0.838 ± 0.088 | 0.845 ± 0.074 | 0.77 | 0.779 ± 0.103 | 0.848 ± 0.092 | 0.016 |
| Mean cup depth* | 0.194 ± 0.068 | 0.196 ± 0.064 | 0.90 | 0.222 ± 0.071 | 0.195 ± 0.085 | 0.23 |
| Cup shape measure* | -0.229 ± 0.057 | -0.254 ± 0.061 | 0.15 | -0.232 ± 0.062 | -0.225 ± 0.068 | 0.71 |
| Height variation contour* | 0.442 ± 0.087 | 0.448 ± 0.109 | 0.81 | 0.444 ± 0.091 | 0.445 ± 0.098 | 0.98 |
| Mean RNFL thickness* | 0.312 ± 0.075 | 0.317 ± 0.066 | 0.81 | 0.288 ± 0.058 | 0.295 ± 0.071 | 0.69 |

Values are presented as mean ± standard deviation.
RNFL= retinal nerve fiber layer.
*Significant at $p < 0.05$ by independent $t$-test; †Significant at $p < 0.05$ by Wilcoxon signed-rank test.

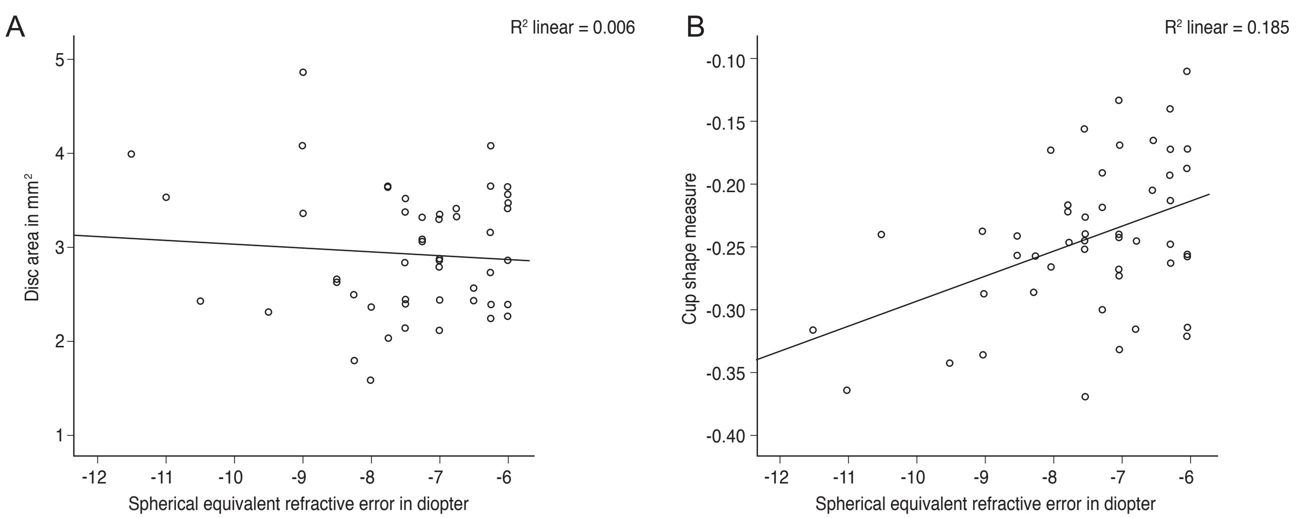


**Fig. 1.** (A) Scatterplots showing relationship of refractive error (spherical equivalent) with disc area in high myopic eyes. (B) Scatterplots showing relationship of refractive error (spherical equivalent) with cup shape measure in high myopic eyes.

high myopic Nepalese subjects was only 21.6 ± 4.6 years. Aging may have some effect on the structure of the optic nerve head and, subsequently, disc parameters. In terms of racial differences, a previous study demonstrated that a normal Chinese population had larger disc areas than a Japanese population by HRT III [13].

Issues regarding the magnification correction in fundus photography and HRT have also been discussed [14]. The HRT magnification correction is reported to be better than the method of Littmann; HRT magnification correction incorporates all refraction, keratometry, and axial length data whereas Littmann uses refraction and keratometry [7]. However, the HRT II requires full compensation of the magnification of the fundus image, especially among high myopic eyes. Lack of this compensation could result in differences in the optic disc area between subjects with emmetropia and high myopia.

Most importantly, placement of the reference plane also influences calculated volumes in HRT image analysis. For example, the cup volume is arbitrarily marked as a space between the flat reference plane and the topographic nerve head surface. Even with stable recording of optic nerve head mapping, a smaller cup volume may result from a more posterior placement of the reference plane [7,15]. As in a previous study by Tong et al. [7], HRT II uses software that automatically places a reference plane at 50 μm below the mean peripapillary vertical height along the temporal sector between 350° and 356°. In the same way, the optic cup border is lowered by 50 μm below the optic disc contour line to adjust for the possibility of inter-individual variability of optic nerve head topography. Inappropriate placement of the reference plane may result in greater rim area and rim volume as well as smaller cup area volume.

The cup shape measure refers to the slope of the cup wall, which could be steeper in myopic eyes compared to emmetropic eyes and gets even steeper with the degree of myopia (Fig. 1B). Tong et al. [7] reported that tilting of the optic disc was associated with a smaller cup, rim or disc area, cup to disc area ratio, and cup volume, but larger rim volume, rim to disc area ratio, height variation contour, RNFL thickness and a more negative cup shape measure. In our study, the correlation coefficient for cup shape measure with the disc area was not significant for high myopia ($r = -0.093$, $p = 0.522$) and emmetropia ($r = 0.165$, $p = 0.25$) as well as between myopia and emmetropia ($r = 0.012$, $p = 0.93$), but the correlation coefficient between cup shape measure and degree of myopia was significant ($r = 0.43$, $p = 0.002$). We excluded cases with tilted discs, chorioretinal atrophy, and parapapillary atrophy, given the possibility of inappropriate positioning of the reference plane [7], but our exclusion was done based on visual inspection during dilated fundus examination. Beyond the application of a temporal sector definition, a novel technique should be revised for the assessment of cup and rim parameters for tilted discs. We assessed optic disc parameters in a healthy clinical population without ocular diseases such as glaucoma or retinal diseases. Consequently, this data provides a reference for normative data in clinical settings.

Our study has several limitations. It was conducted in a hospital setting with a small sample size, so the generalization of findings is limited. The study could be even more meaningful if it was conducted as a comparative study between high myopic glaucomatous and non-glaucomatous subjects, particularly since myopia is a significant risk factor for the development of primary open-angle glaucoma [16-19]. We also did not measure the real effect of disc tilting on optic disc parameters, and further study is needed to explore this relationship further.

In conclusion, we found that high myopic eyes had smaller cup parameters (cup area, cup volume, cup to disc area ratio, and cup shape measure) and greater rim (rim area, rim volume, and rim to disc area ratio) parameters than age-matched emmetropic eyes in a Nepalese population. The effects of disc area on HRT parameters in high myopic eyes did not differ from those by emmetropic eyes in this Nepalese population, except for height variation contour. Disc area and other intra-disc parameters showed significant positive correlations between right and left eyes in both high myopia and emmetropia. However, there was no significant difference in HRT parameters between male and female Nepalese subjects.

## Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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