

CHAPTER IV

4. RESULTS

4.1 Data Loss and Exclusion

At the end of the data collection, we had collected the data from both eyes of 259 subjects or 518 eyes. Unexpectedly, a hard drive failure of the HRT instrument had occurred. About 25% of the data had been lost (65 subjects, 119 eyes). In addition, 66 eyes of 38 subjects were excluded according to the exclusion criteria. This leaves with 333 eyes of 172 subjects. Of the 172 subjects, 161 subjects had two eyes for analysis (two-eyed subjects) and 11 subjects had one eye for analysis (one-eyed subjects). Table 4.1 summarized the reasons for exclusion and subjects with data loss. There were 7 subjects (5 subjects with nerve fiber layer defects and 2 subjects with visual field defects) that qualified as glaucoma and had been referred to the eye clinic for further management.

Table 4.1 Reasons for exclusion and subjects with data loss

Reason	Total eyes	One-eyed subjects	Two-eyed subjects	Total subjects
Systemic disease ¹	8	0	4	4
Previous surgery ²	4	0	2	2
VA < 20/40	16	4	6	10
Ocular diseases	20	4	8	12
Nerve fiber layer defects	9	1	4	5
Visual field defects	4	0	2	2
HRT acquisition difficulty	5	1	2	3
Data loss from hard drive failure	119	11	54	65
Total	185	21	82	103

Remarks: ¹ Three subjects had diabetes mellitus and 1 subject was a treated tuberculosis

² One previous cardiac surgery and one previous kidney surgery

4.2 Baseline Data

4.2.1 Age and Sex

Of the 172 subjects, there were 80 males (46.5%) and 92 females (53.5%). There were 52 subjects (30.2%) with age 30-40 years old (age group 1), 66 subjects (38.4%) with age 40-50 years old (age group 2) and 54 subjects (31.4%) with age 50-60 years old. Table 4.2 tabulates the subjects by age group and sex. Four subjects who were slightly older than 60 years old (the oldest subject is 61.2 years old) were included in age group 3.

Table 4.2 Number and percentage of subjects by age group and sex

Age group (years)	Male		Female		Total	
	N	Row %	N	Row %	N	Column %
1 (30-40)	20	38.5	32	61.5	52	30.2
2 (40-50)	32	48.5	34	51.5	66	38.4
3 (50-60)	28	51.8	26	48.2	54	31.4
Total	80	46.5	92	53.5	172	100.0

4.2.2 Geographic Distribution

There were 6 tambons in Ubolrat district. Map of Ubolrat district can be found in appendix F. The distribution of subjects from these locations categorized by age group is shown in Table 4.3. The majority of subjects (75.6%) were from Khoksung, Thungpong and Bandong.

Table 4.3 Distribution of subjects by tambons and age groups

Tambon	Age group						Total	
	30-40		40-50		50-60			
	N	Row %	N	Row %	N	Row %	N	Column %
1. Kuean	6	40.0	6	40.0	3	20.0	15	8.7
2. Khoksung	11	24.4	17	37.8	17	37.8	45	26.2
3. Thungpong	13	36.1	15	41.7	8	22.2	36	20.9
4. Nakham	3	18.8	3	18.8	10	62.5	16	9.3
5. Bandong	15	30.6	21	42.9	13	26.5	49	28.5
6. Srisuksamran	4	36.4	4	36.4	3	27.3	11	6.4
Total	52	30.2	66	38.4	54	31.4	172	100.0

4.3 Influence of Age on HRT Parameters

Before describing the summary statistics of HRT parameters, it was necessary to explore the relation of age to each of these parameters by regression analysis. If there was significant relationship of age to the HRT parameters, the data had to be calculated as age-group specific values. On the contrary, if there was no significant relationship of age to the HRT parameters, the data could be calculated as a whole and there was no need to calculate the values for each age group.

Because the number of samples from each tambon could be biased from the geographical location and the loss of data as shown in Table 4.3, the regression analysis had been done by adjusting for tambon and taking into account the sampling weights and stratification. Table 4.4 showed the unadjusted and adjusted regression coefficient of age on each of the 12 HRT parameters. There were 5 HRT parameters; hvcontou, rimvol, cupshape, meanrnfl and rnflarea that had statistical significant regression coefficient. However, the regression coefficients of these HRT parameters were very small (ranging from -0.001 to -0.0096) and they were considered not clinically meaningful. The coefficient of determination (R^2) also were very low (ranging from 0.027 to 0.120). This means that very small amount of the variance of the 5 HRT parameters are accounted for by age. This does not mean that such a relationship does not exist, but that it could barely be demonstrated in this study. This

finding is similar to that reported by Saruhan et al.⁵⁸ From this finding, the subsequent statistics and estimations of the HRT parameters will be calculated without specific to age groups.

Table 4.4 Regression coefficients of age on 12 HRT parameters. The adjusted regression coefficients were adjusted for tambon. P values were calculated for the adjusted regression coefficients. The numbers of p value with bold fonts are significant at $p < 0.05$. SE = standard error.

HRT parameters*	Unadjusted Coefficient	Adjusted Coefficient	95% CI		p value	R ²
			Lower	Upper		
diskarea	0.0052	0.0050	-0.0012	0.0112	0.110	0.020
cuparea	0.0046	0.0048	-0.0006	0.0103	0.083	0.024
cdaratio	0.0012	0.0013	-0.0007	0.0033	0.200	0.019
rimarea	0.0006	0.0002	-0.0046	0.0051	0.925	0.010
hvcontou	-0.0017	-0.0017	-0.0028	-0.0006	0.003	0.069
cupvol	0.0010	0.0010	-0.0007	0.0027	0.239	0.016
rimvol	-0.0023	-0.0024	-0.0045	-0.0003	0.027	0.035
meancup	0.0002	0.0003	-0.0010	0.0016	0.665	0.012
maxcup	-0.0020	-0.0016	-0.0049	0.0016	0.328	0.025
cupshape	0.0024	0.0024	0.0013	0.0034	<0.001	0.121
meanrnfl	-0.0020	-0.0020	-0.0028	-0.0011	<0.001	0.137
Rnflarea	-0.0096	-0.0093	-0.0136	-0.0051	<0.001	0.121

*The names and units of the 12 HRT parameters are according to Table 3.3 and will be used in all subsequent tables and figures. The units of the HRT parameters will not be shown in all the following tables.

4.4 Summary Statistics of HRT Parameters

The estimated population means and 95%CI of the 12 HRT parameters for all age groups were summarized in Table 4.5. The calculation was done by taking into account the design effects; the sampling weights and stratification. Table 4.6 summarized the percentiles of the 12 HRT parameters. Sampling weights were taken into account when calculating the percentiles.

Table 4.5 Estimated population means and 95% confidence intervals (95%CI) of 12 HRT parameters (all age groups). SD = population standard deviation, Deff = design effect.

HRT parameters	Mean	SD	95% CI		Deff
			Lower	Upper	
diskarea	2.296	0.362	2.241	2.351	1.015
cuparea	0.442	0.299	0.397	0.487	0.996
cdaratio	0.182	0.107	0.166	0.199	1.054
rimarea	1.854	0.268	1.811	1.897	1.136
hvcontou	0.395	0.066	0.385	0.406	1.091
cupvol	0.098	0.097	0.083	0.113	1.010
rimvol	0.496	0.122	0.477	0.516	1.145
meancup	0.173	0.071	0.162	0.184	1.047
maxcup	0.530	0.185	0.501	0.559	1.078
cupshape	-0.241	0.061	-0.250	-0.232	0.970
meanrnfl	0.256	0.049	0.249	0.264	0.984
rnflarea	1.369	0.260	1.330	1.408	1.009

Table 4.6 Percentiles of 12 HRT parameters (all age groups).

HRT parameters	Min	P2.5	P25	P50	P75	P97.5	Max
diskarea	1.425	1.550	2.044	2.269	2.531	2.972	3.602
cuparea	0.013	0.035	0.195	0.406	0.655	1.092	1.583
cdaratio	0.006	0.018	0.097	0.164	0.262	0.379	0.497
rimarea	1.277	1.426	1.667	1.825	2.028	2.517	2.574
hvcontou	0.217	0.280	0.346	0.394	0.437	0.534	0.622
cupvol	0.000	0.002	0.020	0.064	0.162	0.347	0.559
rimvol	0.215	0.277	0.408	0.491	0.591	0.718	0.911
meancup	0.040	0.063	0.118	0.174	0.221	0.321	0.419
maxcup	0.137	0.188	0.381	0.536	0.666	0.832	1.034
cupshape	-0.419	-0.361	-0.285	-0.242	-0.195	-0.107	-0.073
meanrnfl	0.120	0.149	0.218	0.257	0.290	0.342	0.382
rnflarea	0.532	0.848	1.200	1.382	1.539	1.851	2.054

4.5 Distributions of the HRT Parameters

The distributions of all 12 HRT parameters were explored with histograms, dot plots, outlier box plots, standardized normal probability plot, quantile-normal plot, symmetry plot. The resulting graphs of all HRT parameters were presented in Appendix B. All 12 HRT parameters showed unimodal distributions. From the normal plots there were 5 HRT parameters: cuparea, cdaratio, cupvol, meancup and maxcup that were not normally distributed. The Shapiro-Wilk W test (data not shown) gave the same results. These 5 HRT parameters also showed skewness from the symmetry plots.

From the outlier box plots (Appendix B) there were 9 HRT parameters that demonstrated only 1-2 mild outliers (values not more than the 75th percentile plus 3 times the interquartile range or not less than the 25th percentile minus 3 times the interquartile range) which did not affect the statistical analysis. Three parameters: cdaratio, maxcup, meanrnfl did not show any outliers.

4.6 Reference Intervals (Normal Range)

The 95% reference intervals (95%RI) of the 12 HRT parameters calculated assuming normal distribution were presented in Table 4.7. The lower limits of 95%RI of cuparea, cdaratio and cupvol had negative values which had no meaning clinically. This happened because the distributions of these parameters were not normally distributed and very skew. The other two HRT parameters (meancup and maxcup), that also were not normally distributed, did not have such a negative values for the lower limits of their 95%RI because the distributions were not very skew.

The percentiles technique (distribution free) for estimating the 95%RI could be derived from Table 4.6. The lower limit of the 95%RI was the 2.5th percentile (P2.5) and the upper limit was the 97.5th percentile (P97.5). Table 4.8 summarized the 95%RI of all 12 HRT parameters calculated from both techniques. For those HRT parameters that were normally distributed, results from Table 4.7 based on normal distribution were shown. For those HRT parameters that were not normally distributed, results from Table 4.6 based on the percentile technique were shown.

Table 4.7 Means, 95% reference intervals (95%RI) and 95% confidence intervals (95%CI) of the reference limits of 12 HRT parameters (all age groups) calculated based on normal distribution. The distributions of the parameters with asterisks are not normal.

HRT Parameters	Mean	Lower 95%RI	95% CI of lower RI	Upper 95%RI	95% CI of upper RI
diskarea	2.296	1.586	(1.492 to 1.680)	3.006	(2.912 to 3.100)
cuparea*	0.442	-0.145	(-0.223 to -0.068)	1.028	(0.951 to 1.106)
cdaratio*	0.182	-0.028	(-0.055 to 0.000)	0.392	(0.365 to 0.420)
rimarea	1.854	1.330	(1.260 to 1.399)	2.379	(2.309 to 2.448)
hvcontou	0.395	0.266	(0.248 to 0.283)	0.525	(0.508 to 0.542)
cupvol*	0.098	-0.092	(-0.117 to -0.067)	0.288	(0.263 to 0.314)
rimvol	0.496	0.258	(0.226 to 0.289)	0.735	(0.703 to 0.767)
meancup*	0.173	0.034	(0.016 to 0.052)	0.313	(0.294 to 0.331)
maxcup*	0.530	0.168	(0.120 to 0.216)	0.892	(0.844 to 0.940)
cupshape	-0.241	-0.361	(-0.377 to -0.345)	-0.121	(-0.137 to -0.105)
meanrnfl	0.256	0.160	(0.147 to 0.173)	0.353	(0.340 to 0.366)
rnflarea	1.369	0.859	(0.792 to 0.927)	1.878	(1.811 to 1.946)

Table 4.8 95% reference intervals (95%RI) of 12 HRT parameters (all age groups) calculated with two different methods. Calculation based on normal distribution was used for the parameters that distributed normally (no asterisks). For parameters that were not normally distributed (with asterisks), distribution-free (percentile) technique was used for the calculation.

HRT parameters	Mean/ Median	Lower 95%RI	Upper 95%RI
diskarea	2.296	1.586	3.006
cuparea*	0.406	0.035	1.092
cdaratio*	0.164	0.018	0.379
rimarea	1.854	1.330	2.379
hvcontou	0.395	0.266	0.525
cupvol*	0.064	0.002	0.347
rimvol	0.496	0.258	0.735
meancup*	0.174	0.063	0.321
maxcup*	0.536	0.188	0.832
cupshape	-0.241	-0.361	-0.121
meanrnfl	0.256	0.160	0.353
rnflarea	1.369	0.859	1.878