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EDITORIAL

Medical Education and Practice in Malaysia, Quo Vadis?

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As of June 2016 there are 28 medical schools [1] in both private and public sectors in Malaysia offering more than twice as many programs [2] with yearly graduates of about 4500 including those that graduated from overseas. This magnitude is beyond the usual capacity of Ministry of Health (MOH) that is entrusted to accord preregistration training posts to the graduates as the whole process of allocation to available places in public hospitals nationwide is painfully slow. It is already a tragedy having to wait 6 months on average for a placement but words that a delay for up to a year can occur is totally unacceptable when the actual training places available at grade DU41 preregistration house officers is said to be more than the graduate number [3]. Delay can be detrimental to the training itself because waiting is a waste of talent and potential, a disincentive to a young aspirant, tacitly is a testimony of system failure and deprives the public of highly trained graduates to serve in our healthcare system that ironically suffers from chronic and ever growing wait but yet we have excess medical graduates. Some of them have taken a simple and quick route out of the mess by migrating to our neighbours near and far, not entirely their faults, but their thresholds to despair seem very low indeed. The need for a speedy and right solution to the delay is long overdue and this is nothing more than what the public and the young doctors deserve.

How did we get to this? Not unexpectedly but the magnitude stemmed from the unusually large number of *Sijil Pelajaran Malaysia* (SPM; Malaysia Certificate of Education) leavers that opted to study medicine, in part made easy by the many medical schools in the country and those that have been accredited abroad. This was augmented by the constant reminder of the need for more doctors, parental or hype pressure perhaps for whatever reasons, and also the ease with which scholarships were available to study medicine. The principle driver for the whole mess was money initiated by those who wish to make profits under these “fortunate” circumstances [4]. The resulting deluge of medical graduates clogged the system up and unfortunately created many of the unnecessary challenges that we face today. Paradoxically despite this excess our doctor population ratio is still lower than the Organization for Economic Cooperation and Development (OECD) average and our more prosperous neighbour in the south. These veiled and unscrupulous drivers are addressing the gap in ratio with such a speed that it strains the system to almost breaking point and had somewhat ruffled both Ministry of Higher Education (MOHE) and MOH.

The doctor number that we need should ideally be planned or rather managed at this point and this can only be done by addressing all the factors that had led us to this. For a start we should look at the basic question of what the country needs in the future (2020 and beyond) and then work backwards. This sounds simple enough but in practice this is where the challenge lies. Two ministries MOH and MOHE are both looking at the issue albeit with different focus but inevitably with some overlapping jurisdiction. The MOH concerns with the nation’s health issues and MOHE deals with medical education and consequently doctor number, although seemingly separate but in actual fact they will converge. Whatever the number of medical students approved at Malaysian Qualifications Agency (MQA) / Malaysian Medical Council (MMC) or sponsored by *Jabatan Perkhidmatan Awan* (JPA; Public Services Department) /MOHE the final tally in five years will be the medical graduates that will have to be allocated to training places. Too many medical graduates too soon appear to be the main problem and therefore it is high time that we try to regulate the number that goes into training. Immediate actions are required too to restore public confidence in the light of unsympathetic media comments. This includes policies that require hard choices such as derecognizing some foreign medical schools in the archaic list of schedule 2 and introducing the right to practice examination for those who have graduated from abroad. Both can regulate number and consequently emphasize quality.

The next challenge is the specialist number now that doctor number at lower grades will address the gap in ratio in time. Although a lot has improved but by most estimates the number of specialists must double to take up the challenges of a developed nation status and we need to add to this the question of disparity (uneven number by specialty) and geographical mal-distribution, unfortunately the issues remain despite numerous incentives introduced by MOH over the years. An easier question of churning up specialist number can be addressed rather immediately because we have a robust, economical, and internationally respected system within our midst that is the Master in Medicine (MMED). But when the issue of increasing the specialist number is debated, the discourse mystically takes a pathetic course to the times when postgraduate medicine began in the country in the 60s, a return to our colonial ancestry for training opportunities and supervision. When postgraduate medicine first started we indeed relied heavily on the hospitals in the United Kingdom (UK) and their college exams but these are things of the past. Except for stated and specific niche areas for training and education, or occasional exception, by and large we have existed and trained our specialist independently from the system in the UK for more than three decades. For the record, to date more than 8000 specialists have graduated from MMED system and for a rapidly growing Malaysia this number is huge. Especially so for the surgical based specialties that are the most challenging to train and in all domains the surgeons have been at par with the very best in the world. In fact from our own survey, MMED trained specialists are the backbone of doctors that service the public hospitals and clinics in Malaysia.

Despite this apparent regression, the universities that offer MMED are in the process of institutionalizing the training pathway and system to maintain the quality and improve the process further. Steps are taken to formalize the training pathway via MQA and MOHE to reinforce public perception of the system and in preparation for soon to be implemented trade and economic liberalization in ASEAN. For practical purposes the MMED system essentially has two types; one that is based on the presence of the faculty's own teaching hospital and the other on the absence of one and thus reliance on the state hospital as the faculty's affiliated teaching hospital. Both models have achieved success and maintained the quality and competency required by a robust comprehensive assessment system that includes standardized examinations attended by a wide selection of examiners in the country and abroad. In the next 5 years or so, the training environment to some extent the MMED will undergo a significant change with the completion of another 7 teaching hospitals and the incorporation of a consortium of university teaching hospitals. With an estimated number of nearly 10000 tertiary care beds at peak activity this will provide an excellent opportunity to train more specialists and partake in subspecialty training. This includes research and teaching activities that will enhance the return on investment to the public.

Based on the cumulative years of experience and a much more organized MQA the future of medical education for both undergraduate and postgraduate looks very promising indeed but the main lingering issues in both must be addressed. For undergraduate medicine the need to maintain a robust and stringent control on quality is paramount and data shows that the emphasis of this is mainly on graduates from some foreign medical schools because the local ones are subject to very stringent accreditation exercise and compliance audit, therefore quality is assured. Another strategy to achieve this is the introduction of fitness to practice examination for foreign medical school graduates. Both will help control number. The main issue that is affecting postgraduate education is the need to institutionalize the MMED for the future and the creation of teaching hospitals consortium by working closely with MQA and MOHE. This will ensure the best deal for the public. The future is in our hands.

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ORIGINAL ARTICLE

Agreement Analysis of Pentacam and Lenstar in Measurement of Keratometry, Anterior Chamber Depth and Lens Thickness

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ABSTRACT

Introduction: To assess the agreement of the Scheimpflug camera system Pentacam with the optical low-coherence reflectometry (OLCR) device LENSTAR LS900 in measuring anterior segment biometry. **Methods:** This is a prospective, non- randomized, comparative analysis study. Patients with age-related nucleus sclerosis cataract who fulfilled the inclusion criteria and attended the Ophthalmology Clinic in University of Malaya Medical Centre (UMMC) between December 2011 and March 2012 were recruited. The keratometer, anterior chamber (AC) depth and lens thickness were measured with both methods Pentacam and Lenstar. **Results:** 223 eyes of 125 patients were analysed. There was an agreement in the keratometer, anterior chamber depth and lens thickness measurement between the two devices. There was a significant correlation between K-reading as measured by both devices, at 0.05 significant level, with correlation coefficient of 0.904 and $p < 0.001$. The correlation coefficient of AC depth measurement between Pentacam and Lenstar at 0.05 significant level was 0.992 ($p < 0.001$). From the 124 eyes in which the lens thickness were measureable with both Pentacam and Lenstar, a positive correlation was noted (*correlation coefficient of 0.585, p-value of* < 0.001). There was no significant difference in the three parameters between males and females and among Malay, Chinese and Indian patients. **Conclusions:** There is a statistical agreement in the anterior segment biometry measurements between the Pentacam and the Lenstar.

KEYWORDS: Anterior segment biometry, pentacam, lenstar, anterior chamber depth, keratometry, lens thickness, ophthalmology

INTRODUCTION

Ultrasonic biometry, namely the A-scan biometry is the commonest method used for ocular biometry in this country due to its accessibility and affordable price of the machine, short learning curve to be used, relative portability and acceptable level of accuracy in its measurement. It is being used in the measurement of parameters such as anterior chamber depth, lens thickness and the axial length of the orbit for the calculation of intraocular lens power calculation. In A-scan biometry, an ultrasound probe is either put in direct contact on the anaesthetized cornea of the patient or via an immersion chamber. Measurements are best taken in non-dilated eyes. A thin and parallel ultrasound frequency of 10 MHz will be emitted from the probe, will pass through the media of the eye namely the cornea, anterior chamber, posterior chamber, lens, vitreous humour, retina and lastly reflected back by the choroid/scleral interface to the probe. Every time the ultrasound beam hit an interface, which is the junction between any two media of different densities and velocities, an echo of sound will be bounced back to the probe.

These echoes will be converted by the biometer into a graphic and numerical values, in which a greater difference in density between two media at an interface will produce a strong echo and a higher spike compared to the interface of media with similar density [1]. The result will be printed out to assist the intraocular lens selection later. The disadvantage of an ultrasonic biometry is it requires contact examination that might be uncomfortable to the patient and poses risk of transmitting infection if not appropriately sterilized after each use. The reading is also relatively inaccurate and difficult to be obtained when the interfaces are compromised such as in cornea scar, dense cataract, post-vitrectomized eye and when silicone oil has been used in previous surgery. Among the newer devices in the market to overcome these disadvantages of ultrasonic biometry are the Pentacam and Lenstar.

The Pentacam (*Oculus*) is an automatically rotating Scheimpflug camera system and it is able to capture to a maximum of 50 Scheimpflug images of the anterior segment of the eye within two seconds. The examination is released automatically and it is user independent. During the scanning process the patient's eye motions are captured using a second camera and mathematical compensation will be done automatically, with optical distortions compensated by ray tracing. The Scheimpflug images produced by the Pentacam give a clear representation of lens opacity. The cataract analysis is also combined with the PNS (Pentacam Nucleus Staging), which is a unique feature of this camera system, and the data obtained will be compared to the Lens Opacity Classification System III (LOCS III) cataract grading system. It is one of the few machines that can measure the lens density reliably and objectively, but it is not widely available in Malaysia.

The Lenstar LS900 is an optical low-coherence reflectometry (Haag-Streit), which uses the effect of time domain interferometric or coherent superposition of light waves to measure the ocular distances within the eye. It uses an 820-nm superluminescent diode with a Gaussian-shaped spectrum to provide a high axial resolution. During examination with the Lenstar, patients will be seated with their heads stabilized using a chin rest and brow bar. Patients then were asked to fixate on the internal fixation light while the measurements were taken. The instrument's alignment will be done using the image of the eye on the computer monitor. Patients were asked to blink just before measurements being taken to maintain corneal clarity and prevent blinking during the examination. Blinking or loss of fixation was detected automatically by the instrument, and in this case and if required, the measurements were repeated. The instrument takes 16 consecutive scans per measurement without the need for realignment, and 5 measurements were taken for each eye as recommended by the manufacturer. The internal software calculated the mean of these 5 readings for both Central Corneal Thickness (CCT) and Anterior Chamber Depth (ACD), and these values were then used in subsequent analyses [2].

Both Pentacam and Lenstar are non-contact examination method, thus have the advantage of minimal risk of infection transmission and more comfortable for the patients. Both devices provide accurate measurements in post-vitrectomy eyes, but only Pentacam can be used in conditions such as cornea scar and dense cataract, whilst Lenstar still has limitation in the mentioned conditions. Pentacam can only measures ACD and LT accurately in dilated pupils and very dense cataract will also yield inaccurate measurements. However both Pentacam and Lenstar are bulky and heavy thus are not portable, compared to ultrasonic biometry device such as the A-scan.

This study aims to find a correlation between anterior segment biometry measurement agreement between the Pentacam and Lenstar. Should a positive statistical agreement is established, the two devices can be used interchangeably. Among the parameters measured were keratometer, AC depth and lens thickness.

METHODS

This was a prospective, non- randomized, comparative analysis study. The study adhered to the Declaration of Helsinki and Good Clinical Practice guidelines. Institutional Review Board approval was obtained from the Medical Ethics Board of the University Malaya Medical Centre (Reference number: 829.9). The study received funding from the University of Malaya Research Grant and was conducted in the eye clinic of UMMC from December 2011 until March 2012. The patients were selected randomly (probability sampling) and there were no follow up required for the patients for this study.

The inclusion criteria was at least 40 years old of age, able to give informed consent and had age related cataract eyes (nucleus sclerosis) from clinical examination. The exclusion criteria were significant cortical cataract, anterior subcapsular cataract and posterior subcapsular cataract (the former two may interfere with the light scattering from the Pentacam and presence of posterior subcapsular cataract may increase the lens thickness and gives a false positive result), previous glaucoma history, previous history of ocular trauma, previous retinal detachments with or without surgical intervention, prior intraocular surgery of any type, patients with pre-existing pathological corneal opacity that may interfere with the light transmission in the eye and lastly pregnant women.

The first author obtained informed consent from the patients, gave out the patient information sheets and did the initial screening and examination with a slit lamp biomicroscopy to ascertain that patients have nucleus sclerosis and not the other types of cataract listed in the exclusion criteria. Patients' Best Corrected Visual Acuity (BCVA) was taken and routine history taking was carried out. After anterior segment examination were carried out on the slit lamp biomicroscopy, the patients' eyes were dilated with topical mydratics , 1% tropicamide (*Mydriacyl, Alcon, FT Worth, TX*) and 2.5% phenylepherine hydrochloride (*Mydfrin, Alcon, Ft. Worth, TX*). Full ophthalmologic examination (dilated fundus examination) was then performed on all patients.

The patients' eyes were then photographed with the Pentacam Scheimpflug system in a dark room. Lens thickness, keratometer and anterior chamber depth measurement were obtained from the Pentacam software, specifically at the 184° cut to ensure uniformity amongst all subjects. The Scheimpflug images for lens density (LD) were acquired using the 25 image acquisition 3D scan protocol under maximal pupillary dilation. Mean LD was calculated using average of LD in all 25 meridians measured on beta version 2.73r05 of the Pentacam software. During this measurement, an area of 1.6 cm × 1.6 cm on the centre of the lens nucleus carefully selected to ensure accuracy. All the measurements were taken three times and the mean was considered for calculation.

Then, keratometry and further biometric examination of lens thickness, keratometer and anterior chamber depth measurement with a Lenstar were performed. An average of five readings was taken. Lastly, the patients' intraocular pressure was measured with a Goldmann Tonometer. The IOP examination was performed at the end of the procedure is to avoid cornea staining prior to the cataract photo capture by the Pentacam.

Statistical Analysis

Correlation between keratometer, anterior chamber depth (ACD) and lens thickness (LT) were statistically analysed by SPSS version 13. P value of less than 0.05 is considered statistically significant. Correlation coefficient by Spearmans' Rho is used to find correlation between two non-parametric data e.g. LT by Pentacam and LT by Lenstar. Kruskal Wallis Test is used to compare the difference between LT, K-reading and AC among the races (more than 2 groups). Mann-Whitney U Test is used to compare the difference between LT, K-reading and AC between the genders (2 groups). Bivariate correlation is used to correlate between LT & LD, LT and age etc.

RESULTS

Two hundred and twenty three eyes of 125 patients were recruited. The mean age was 61.87 (range from 40 to 84). 51.2% (n = 64) of the patients were male. With regards to their ethnicity, 36 were Malays, 43 were Chinese while 46 were Indian. Details of the demographic data according to ethnicity are summarized in Table 1.

Table 1 Demographic distribution of participants in the study

Race	Gender		Total
	Male	Female	
Malay	14	22	36
Chinese	25	18	43
Indian	25	21	46
Total	64	61	125

Keratometry Study

All 223 eyes were included in this study. The average keratometer reading (K-reading) measured by Pentacam was 44.08 (SD 2.15) and Lenstar was 44.13 (SD 1.62). There is a general agreement in the K-reading measured with both machines, with a significant correlation between K-reading by Pentacam and K-reading by Lenstar at 0.05 significant level (Correlation coefficient = 0.904, $p < 0.001$) (Figure 1).

The keratometry study had also find a positive correlation between K-reading and gender, in which K-reading appears to be greater in male compared to female, with p-value of 0.002, measured with both machines, and tested with Mann Whitney U test. However, there was no significant difference in the K reading amongst subjects of difference races. The P-value for K-reading measured with Pentacam and Lenstar was 0.581 and 0.210 respectively, tested with Mann-Whitney U test.

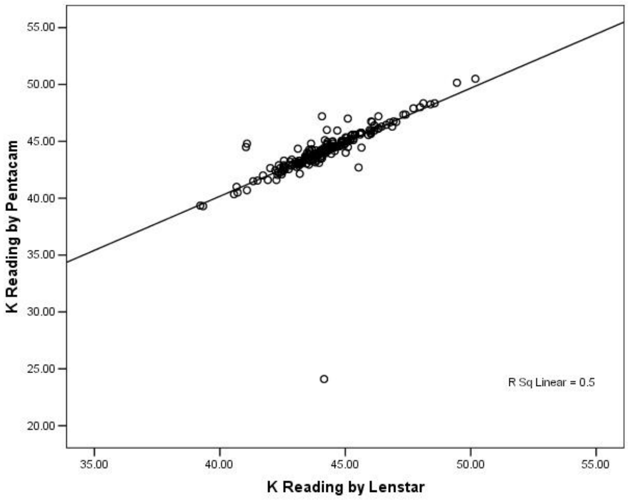

Figure 1 There is significant correlation between K-reading by Pentacam and K-reading by Lenstar at 0.05 significant level.
Correlation coefficient = 0.904, p < 0.001

Anterior Chamber Study

The mean anterior chamber (AC) depth for the 223 eyes recruited in this study was 2.72 mm (SD 0.34) measured with Pentacam and 2.70 mm (SD 0.36) measured with Lenstar. There is a significant correlation between AC depth measurements by Pentacam and Lenstar at 0.05 significant level with correlation coefficient of 0.992 and p < 0.001, in which the two methods has a statistical analysis agreement (Figure 2).

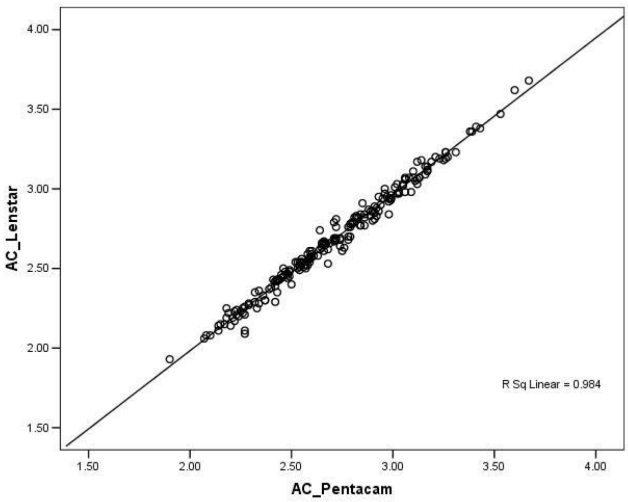

Figure 2 There is significant correlation between AC depth measured with Pentacam and Lenstar.
Correlation coefficient of 0.992 and p < 0.001

Male AC appeared deeper and there is a significant difference of AC depth (mm) between male and female at 0.05 significance level, with a p-value of 0.022 measured with Pentacam, and a p-value of 0.010 measured with Lenstar (Mann Whitney U test). The mean AC depth for Malay, Chinese and Indian patients were 2.7122 mm (SD 0.345), 2.745 mm (SD 0.357) and 2.687 mm (SD 0.318) by Pentacam respectively. Measured by Lenstar, the mean AC depth were 2.731 mm (SD 0.381) for Malay, 2.708 mm (SD 0.384) for Chinese and 2.674 mm (SD 0.302) for Indian patients (Table 2 and Table 3). A Kruskal-Wallis test shows that there was also no significant difference of anterior depth (mm) among the races at 0.05 significant level, with a p-value of 0.768 measured with Pentacam, and a p-value of 0.890 measured with Lenstar.

Table 2 Mean Anterior Chamber Depth (ACD) -amongst patients according to races, measured with Pentacam

AC_Pentacam	AC Depth (mm)		
	N	Mean	Std. Deviation
Malay	60	2.712	0.345
Chinese	77	2.745	0.357
Indian	80	2.687	0.318

Table 3 Mean Anterior Chamber Depth (ACD) -amongst patients according to races, measured with Lenstar

AC_Lenstar	AC Depth (mm)		
	N	Mean	Std. Deviation
Malay	64	2.731	0.381
Chinese	71	2.708	0.384
Indian	77	2.674	0.302

Lens Thickness Study

From the 124 eyes in which the lens thickness were measureable with both Pentacam and Lenstar, a positive correlation was noted in between the two parameters, with correlation coefficient of 0.585, with p-value of < 0.001 (Figure 3).

There is no significant difference in lens thickness between male and female patients as measured by Pentacam, analysed by Mann Whitney U Test (p-value 0.919, significant value as p > 0.05). However, when measured with Lenstar, there is a significant difference between the two genders as p-value was 0.001 (significant level p-value > 0.05, using Mann Whitney U test). These values could be further validated with a bigger sample size should this study being extended.

Racial comparison was also made and a Kruskal-Wallis test with significant level of 0.05 showed no significant difference in lens thickness among the three major races, measured with Pentacam (p-value 0.663) and Lenstar (p-value 0.462).

There is a correlation between lens thickness and AC depth, in which the AC depth decreases as the lens thickness increases when the two parameters were measured with both Pentacam and Lenstar (*0.05 significant level, correlation coefficient = -0.473, p < 0.001*) and Lenstar (*0.05 significant level, correlation coefficient = -0.583, p < 0.001*).

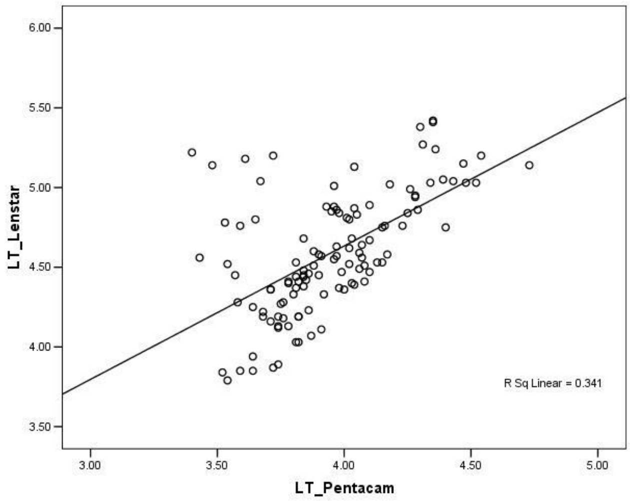

Figure 3 Correlation between lens thickness, measured with Pentacam, and lens thickness measured by Lenstar.
Correlation coefficient of 0.585, with p-value of < 0.001

CONCLUSIONS

This prospective cross-sectional observational study is to compare statistical agreement between the Pentacam and Lenstar in anterior segment measurement of the eye. The agreement between the Pentacam and Lenstar in the anterior segment biometry including corneal thickness (CCT) and anterior chamber depth (ACD) has been previously reported [3], but not in lens thickness measurements. This study showed high agreement in the lens thickness measurement in these two machines and thus the measurements are interchangeable.

The Pentacam is a highly reliable tool to measure the keratometer and corneal power, as reported by Jau-Der Ho et al [4]. The Keratometry Study part of this study showed high agreement in the K-reading between Pentacam and Lenstar, thus it is interchangeable and only one keratometer is required in patients who need long term follow up [5]. There is steeper K-reading acquired amongst male subject but there is no interracial difference in this parameter among the three major races in Malaysia.

The reliability of Pentacam in anterior segment biometry has been reported in numerous studies [6, 7, 8]. The Anterior Chamber part of this study showed decrease in AC depth with increase in lens thickness, as expected, and the mean AC depth in this study amongst Malay, Indian and Chinese are in agreement to multiple population based studies [9, 10, 11].

Conflicts of Interest

Authors declare none.

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