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Research Article

VERION vs IOLMaster: Which is More Accurate in Predicting Post-op Spherical Equivalent Outcomes for Phacoemulsification with IOL Implant Surgery?

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Abstract

Purpose: The authors aimed to analyse the accuracy in post-operative spherical equivalent outcomes for intraocular lenses implanted for both IOLMaster and VERION systems.

Methods: A retrospective audit was carried out of 80 sequential eyes of patients who had cataract surgery using AMO Tecnis monofocal lenses under the care of the senior author using both the IOLMaster and VERION systems from March 2017-November 2017 at Nuffield Health Hereford. A database was used to analyse the results. The patients were measured using both the IOLMaster and VERION systems and the pre-operative spherical predictions were obtained. The actual post-operative spherical equivalent was calculated from the post-operative refraction data and compared to the predictive spherical outcome values using the SRK/T formula for both the IOLMaster and VERION systems. A paired T-test was performed to calculate the statistical significance of the results.

Results: There was a mean difference of -0.0496D (95% CI -0.143 to 0.0439) in the post-operative spherical equivalent outcome compared to the IOLMaster prediction and a mean difference of -0.0464D (95% CI -0.14 to 0.0476) compared to the VERION prediction. The range of differences in the post-operative spherical equivalent outcomes was -

1.255 to +0.935D compared to the IOLMaster predictions, and -1.305 to +0.89D compared to the VERION predictions. These results did not differ significantly ($p > 0.05$).

Conclusion: There was no significant difference in accuracy between the two systems. In addition to its role in astigmatism management, the VERION may be used to help refine postoperative spherical refractive predictions from the IOLMaster.

Keywords: Verion; IOLMaster; Post-operative spherical outcome; Cataract; Intraocular lenses

1. Introduction

Pre-operative planning for cataract surgery involves reliable and accurate measurements of the globe, including corneal curvature (keratometry) and axial length to choose the appropriate power of intra-ocular lens (IOL) to implant. With the increasing use of toric and other premium IOLs, there is even more emphasis on the accuracy of keratometric measurements. The IOLMaster (Carl Zeiss Meditec, Jena, Germany) is well established for use within cataract surgery due to the high repeatability in keratometric measurements proven within the literature [1-3]. The advent of a new system, VERION (Alcon Laboratories Inc. Fort Worth, TX), has provided a need to assess the accuracy and reliability of this new device. One study analysed the repeatability of keratometric and white-to-white distance measurements using the VERION system and these results were compared with the results from the IOLMaster [4]. The authors determined that the VERION system demonstrated high repeatability and the measurements agreed with the IOLMaster, however, the results also highlighted that further studies into the post-operative outcomes of patients measured with the VERION image guided system are needed. A disadvantage of the VERION system is that it cannot measure the axial length of eyes and therefore requires the axial length from the IOLMaster to be inputted. However, IOLMaster measurement for axial length is well known to be accurate with appropriate calibration and proper signal-to-noise ratio evaluation [5]. Both the IOLMaster and the VERION systems use the same A constant and thus, for the same formulae, any difference in the post-operative spherical equivalent refractive outcome must be explained by different keratometry results between the IOLMaster and VERION.

2. Materials and Methods

Subject to the inclusion criteria below, 80 sequential eyes of patients who attended Nuffield Health Hereford from March 2017-November 2017 for cataract surgery pre-assessment were measured both with the IOLMaster and the VERION systems. The patients were examined in a seated position with their chin on a chinrest and their foreheads against a rest to stabilise them during measurements. During each individual pre-assessment, the patient was examined on both machines by the same examiner and then followed-up approximately 6 days post-operatively by the same examiner on the VERION image guided system, as well as the TopCon KR-800S autorefractor. Calculations for the predictive spherical outcome values for both the IOLMaster and VERION systems were made using the SRK/T formula with the same A constant.

The inclusion criteria were all eyes with:

- Pre-operative IOLMaster and VERION scans
- Post-operative auto-refractions
- Monofocal lenses (made by AMO) implanted.

The exclusion criteria were eyes with:

- Multifocal lenses implanted
- Serious retinal pathology i.e. severe AMD (however drusen are acceptable)
- Corneal pathology, including a measurement of total corneal irregular astigmatism on the

Pentacam imaging system of greater than 0.3 micrometers (WFA HO RMS, 4mm zone).

- Axial lengths <22 mm or >26 mm.

The demographic data of the included eyes were collected along with the data generated by the IOLMaster and VERION systems pre and post-operatively and entered onto a database using an Excel spreadsheet (Microsoft Corporation, Redmond, WA). Calculations were made via the spreadsheet to determine the mean of the difference in the post-operative spherical outcomes compared to the post-operative prediction made by the IOLMaster and by the VERION systems for all 80 eyes. The ranges of these differences were also calculated along with the standard deviations of each data set. A statistical paired t-test was carried out between the two datasets to determine the statistical significance of the results.

3. Results

The two data sets from the IOLMaster and VERION were analysed and compared to each other using the spreadsheet for calculations. Axial length measurements from the IOLMaster averaged 23.71mm with a range of 22.21 to 25.95mm. The mean post-operative spherical equivalent outcome compared to the IOL master predictions was -0.0496D (standard deviation 0.427), ranging from -1.255 to +0.935D. The mean post-operative spherical equivalent outcome compared to the VERION predictions was -0.0426D (standard deviation 0.429), ranging from -1.305 to +0.89D. These findings are summarised in the normal distribution curves [Figure 1], which also indicates the proximity to which both the IOLMaster and VERION predictions were to each other. For both systems, there was a slight myopic surprise in the post-operative spherical equivalent outcome compared to the predictions. A paired t-test was carried out to assess the statistical significance of the differences between both data sets using the database. The p-value was calculated as 0.913 (<0.05) demonstrating no statistical significance in the difference between the data sets.

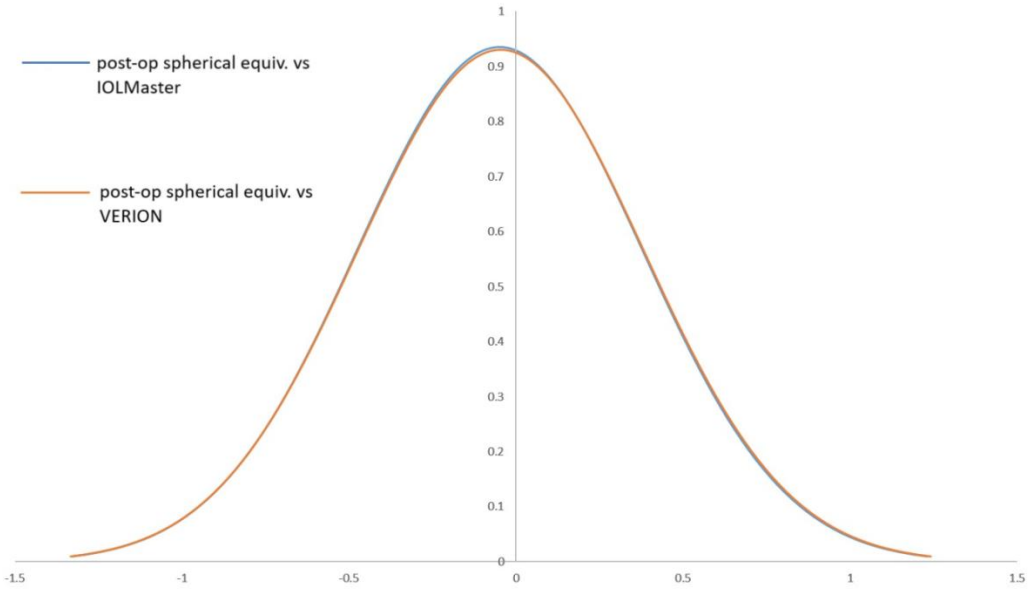

Figure 1: Normal distribution curves representing the post-operative spherical equivalent compared with the IOLMaster (blue) and VERION (orange) systems.

4. Discussion

Assessing the suitability of a new device in cataract surgery relies upon high repeatability of measurements and post-operative outcomes which has been well established for the IOLMaster, with several papers within the literature demonstrating a high repeatability of keratometric measurements [1-3]. The VERION system is a much newer device and has been shown to demonstrate a high repeatability of keratometric measurements and white-to-white distance measurements with high correlations of these measurements compared with those from the IOLMaster in a recent study [4]. A few outliers within this recent study highlighted the fact that the IOLMaster and VERION sometimes measured different keratometric parameters and therefore revealed the need for further studies to determine a potential preference in systems to use in cataract surgery by assessing post-operative results. The primary function of the VERION image guided system is to refine and reduce astigmatism post-operatively via keratometric assessment, digital markers and intra-operative guidance [6]. There have been studies to highlight the efficiency in the VERION system at reducing residual astigmatism following cataract surgery [7]. Therefore, the absolute values obtained from the VERION's keratometer are of high accuracy.

In planning for cataract surgery, the senior author tended to look at both predictions from the VERION and the IOLMaster; given both are as accurate as each other. It was therefore found that sometimes having two machines allowed for further refinement of the spherical outcome over and above one machine's predictions. The VERION system still requires axial length values to be inputted from another device, the IOLMaster being used in this study. Thus, for the same A constant, any differences in postoperative predicted outcomes must be explained by differences in the actual measurements of the keratometry. The authors aimed to analyse post-operative spherical equivalent outcomes for both IOLMaster and VERION systems in cataract surgery and determine the correlation and significance of the results. Our study results conclude that both the IOLMaster and the VERION systems have a place in the estimation of postoperative spherical outcomes after cataract surgery as post-operative predictions had a high correlation to one another with statistically insignificant differences between them. With further potential developments in technology and new devices, the VERION may enjoy an increasing role in cataract surgery.

Conflict of Interest

There are no conflicts of interest to declare for either author.

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