Title

Median absolute error and interquartile range as a criterion of success against the percentage of eyes within a refractive target in intraocular lens surgery.

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Conflicts of Interest

The authors certify that they have no affiliation with or involvement in any organization or entity with any financial interest in the subject matter or materials discussed in this manuscript.

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Refractive accuracy expectations are continously increasing. The prediction error after cataract and refractive lens exchange has improved since the new intraocular lens (IOL) formulae have appeared. Regarding statistical calculation of prediction error, Hoffer et al.[1] have agreed on standarized protocols for studies of IOL formula accuracy. The use of mean error (ME), mean absolute error (MAE) and median absolute error (MedAE) are also described in detail in the Wang et al. editorial.[2] ME is an unreliable value as it can produce both positive and negative values and therefore can be affected by outliers. In relation to this, MAE and MedAE were lesser affected by outliers. When the results are accurate, most of the errors will be close to zero, so in absolute value the curve would not present a Gaussian distribution. This implies that the statistics that we must use should be non-parametic. In this case, the median and the interquartile range (IQR) would replace the mean and standard deviation (SD)[3] to analyze the results in terms of efficacy and predictability in the studies comparing formulae. SD, by definition, includes the mean in its formula calculation so SD is biased by its own mean. However, IQR represents the 25th and 75th percentiles of the sample without participation of the mean (Figure 1), so in this sense IQR is an excellent measure of dispersion for distributions with positive skewness.

Despite this statistical evidence, when analyzing the prediction of error in the articles that compare IOL power calculators, the currently prevailing criterion that over the MAE and MedAE is the percentage of eyes within a refractive target, established by consensus in the scientific literature at ±0.50 diopters. Previous IOL power calculators studies, published in this journal[4–6], take as a reference value to rank the formulas the percentage of eyes in ± 0.50 diopters. From a statistical point of view, this results as a percentage that is not significant with the total sample, since this data does not give a perspective of how the formula has behaved for all the eyes studied. Among the studies cited above, Cooke and Cooke[4] found that best long eyes formula by percentage of eyes within ± 0.50 diopters was Olsen $_{standalone}$ while MedAE was lowest for Haigis. Cooke and Cooke[7] described a method to optimize rank score between IOL power formulae but currently its use has not been accepted by the scientific community. Kane et al.[5] includes in the discussion a detailed analysis based on the MAE results and finally issues its conclusions based on this criterion. Surprisingly, the results are presented without an established order between IOL power calculators. Finally, Shajari et al.[6] sorts the formulas merely alphabetically. This listing is somewhat misleading, since the IOL power formula with the lowest MedAE is listed seventh out of a total of nine formulas. The lack of homogeneity is evident when presenting the results in a comparison study of IOL powers formulas. In this sense, a study[8] has been described that orders the results according to the standard deviation of the ME.

In conclusion, we propose that the ranking of accuracy results of the IOL power calculator's comparison studies according to MedAE and IQR. Nevertheless, this does not imply the replacement refractive target accuracy values, but rather that they would be complementary to the MAE, MedAE and IQR statistics.

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