# Population-based versus individual A constant optimisation for refining refractive prediction accuracy in second-eye cataract surgery

Stephen Stewart,[1] Salissou Moutari,[2] Richard McNeely,[1] Jonathan E Moore[1]

[1.] Cathedral Eye Clinic, Belfast, United Kingdom; [2.] School of Mathematics and Physics, Queen's University Belfast, United Kingdom

## Background

In intraocular lens (IOL) power calculations, the concept of the IOL constant is used to adapt a given formula to the characteristics of a specific lens design, the clinical population, the refraction technique and the biometry device.[1] It has previously been reported that adjusting the IOL constant based on the first eye postoperative refraction can improve the refractive outcomes for the second eye.[2] Improving refractive prediction accuracy is paramount when performing refractive cataract surgery or refractive lens exchange.

For published formulas, IOL constants can be directly optimised by rearranging the formula and solving for the IOL constant that will yield a mean prediction error of zero. This is not possible for modern formulas that are not published. However, a recently published webscraping technique can be used to perform the optimisation on a population or individual basis.[3]

This study aimed to ascertain whether optimisation of the IOL constant based on the refractive outcome of the first-operated eye for a given patient will improve the prediction accuracy for the second eye.

## Methods

One hundred and six eyes of 53 patients undergoing delayed sequential bilateral cataract surgery or refractive lens exchange with implantation of a RayOne EMV (Rayner Intraocular Lenses Limited, Worthing, UK) were included in the study. Preoperative biometry was performed with a swept-source optical coherence tomography device (IOLMaster 700, Carl Zeiss Meditec AG, Jena, Germany). Postoperative manifest refraction recorded at the 3-month postoperative visit was used for analysis. Pairs of eyes were included if interocular axial length difference was ≤ 0.3mm.

A retrospective analysis was performed to calculate the refractive prediction accuracy for second eye outcomes, using the Barrett Universal II formula with:

1) Manufacturer-recommended IOL constant
2) IOL constant optimised for the whole population first eye outcomes
3) IOL constant optimised for the fellow eye of each patient

Mean absolute error was compared with the Friedman test and prediction error within 0.25/0.50/0.75/1.00D was compared with the Cochrane Q test. A p value of less than 0.05 was considered statistically significant.

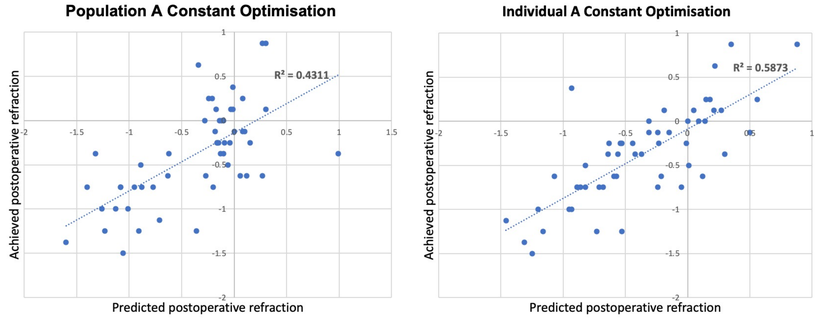
### Results

**Table 1: Refractive predictive outcomes for different IOL constants**

| | Manufacturer Constant 118.6 | Population Optimised 118.51 | Fellow Eye Optimised Range 117.40 – 120.14 | p |
|---|---|---|---|---|
| IOL constant | 118.6 | 118.51 | Range 117.40 – 120.14 | |
| Mean PE (D) | -0.07 | -0.01 | -0.01 | |
| MAE (D) ± SD | 0.34 ± 0.49 | 0.34 ± 0.29 | 0.26 ± 0.26 | 0.07 |
| PE within range (D) | | | | |
| ≤0.25 | 49% | 49% | 58% | 0.32 |
| ≤0.50 | 75% | 79% | 81% | 0.50 |
| ≤0.75 | 89% | 91% | 98% | 0.05 |
| ≤1.00 | 98% | 98% | 98% | 1.00 |

Fellow eye IOL constant optimisation yielded the smallest mean absolute error, although this did not reach statistical significance. This method also yielded a higher proportion of eyes within 0.25, 0.50 and 0.75D than using either the manufacturer-recommended constant or a population optimised constant. This approached significance for eyes within ≤0.75D, but did not reach statistical significance for fellow eye optimization compared to the manufacturer constant following post-hoc analysis with a Bonferroni correction (98% vs 89%, p = 0.062).

**Figure 1: Comparison of refractive accuracy for population vs individual IOL constant optimisation**




## Conclusions

This study demonstrated clinically-significant improvements in refractive prediction accuracy for second-eye surgery when the IOL constant is optimised based on the first eye postoperative refraction for an individual patient. Further work will examine if this improvement is still observed when an earlier postoperative refraction, for example one week post-op, is used to optimise the IOL constant.

### References

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