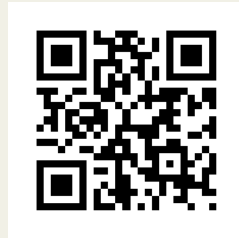


# limits to the use of preoperative anterior corneal astigmatism for predicting astigmatic treatment axis during cataract surgery

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*No financial interest*



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# Introduction

The axis of astigmatic management during cataract surgery is determined using direct measurement of preoperative anterior corneal astigmatism.

Advanced nomograms such as the Barrett Nomogram refine the treatment axis by predicting the most likely additional effect of posterior corneal astigmatism.

The recommended adjustment is against the rule (ATR) compared with the anterior corneal steep axis, in the absence of significant corneal incisional effect.

# Introduction

This study assessed the consistency with which the anterior corneal steep axis predicts the ideal astigmatic treatment axis.

Our analysis specifically addressed how frequently shifting the axis of treatment against the rule relative to the steep corneal axis improved postsurgical astigmatic outcomes, and how often this strategy made outcomes worse.

# Introduction

Unlike the natural lens, the non-toric intraocular lens does not contribute an astigmatic vector to the eye.

The ideal astigmatic treatment axis can therefore be identified retrospectively by finding the postoperative subjective refractive astigmatic axis in patients who underwent cataract surgery without astigmatic management.

# Methods

224 patients with 0.50 to 2.00 Diopters of preoperative regular anterior corneal astigmatism were included in the study. Patients with corneal pathology or history of corneal refractive surgery were excluded. Surgeries were performed by a single surgeon using an astigmatically neutral 2.9 mm temporal corneal limbal incision. All surgeries used the Alcon SN60WF intraocular lens implanted within the intact capsular bag. No astigmatic management was performed.

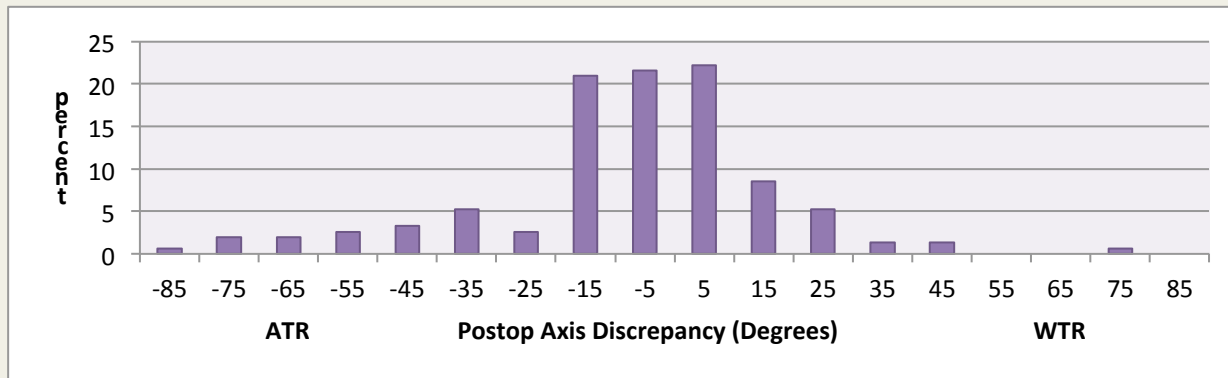
Preoperative anterior corneal astigmatism was measured by averaging two readings using a Nidek corneal topographer. Postoperative subjective refractive astigmatism was measured at least 5 weeks after surgery. Patients without measurable postoperative subjective refractive astigmatism were secondarily excluded.

The preoperative anterior corneal steep axis served as the baseline. The postoperative subjective refractive astigmatic axis was then compared to the preoperative anterior corneal steep axis. Data was broken into patients with **low** (0.50-1.00 D, N = 153) and **moderate** (1.01-2.00 D, N = 71) preoperative anterior corneal astigmatism.

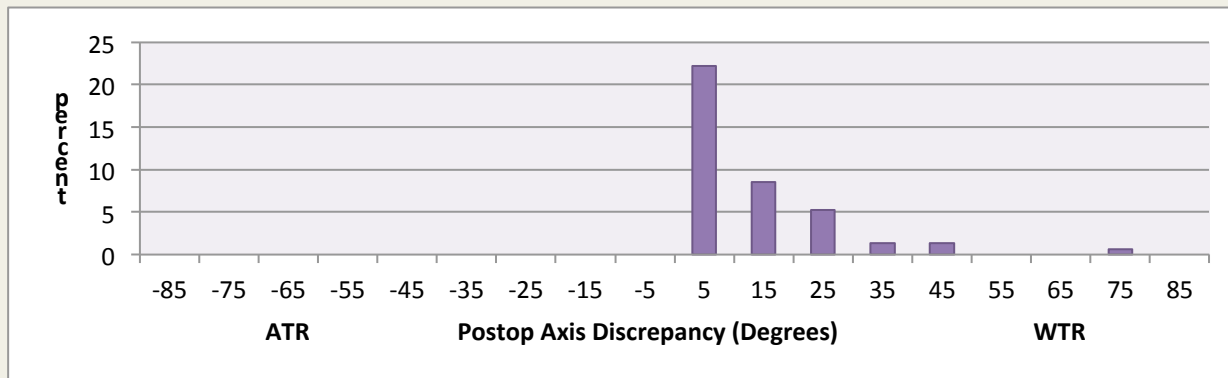
# Results

## Low (0.50 – 1.00 D) Preop Astigmatism

**Histogram 1a** shows the percentage of patients in which specific axis discrepancies occurred in patients with **low (0.50-1.00 D)** preop anterior corneal astigmatism. ATR discrepancies are to the left, and WTR discrepancies are to the right.



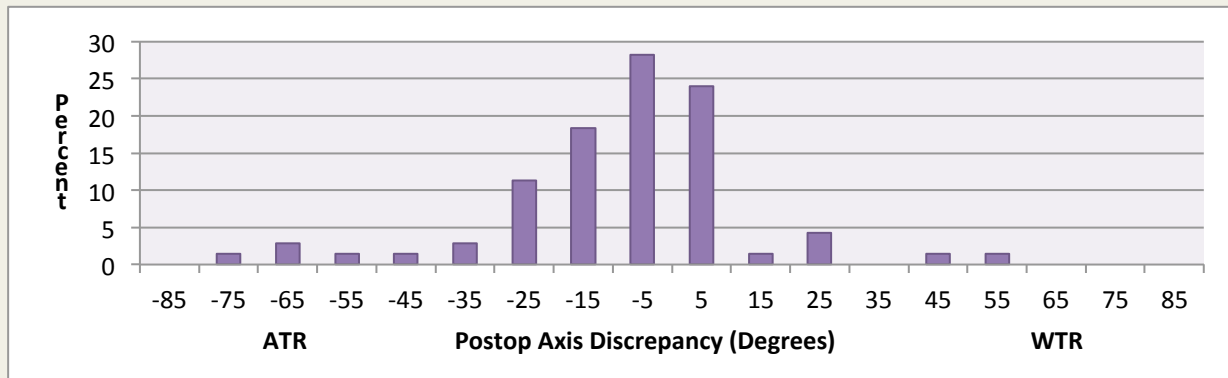
**Histogram 1b** shows the **38%** of cases from above in which the axis discrepancy was **WTR**.



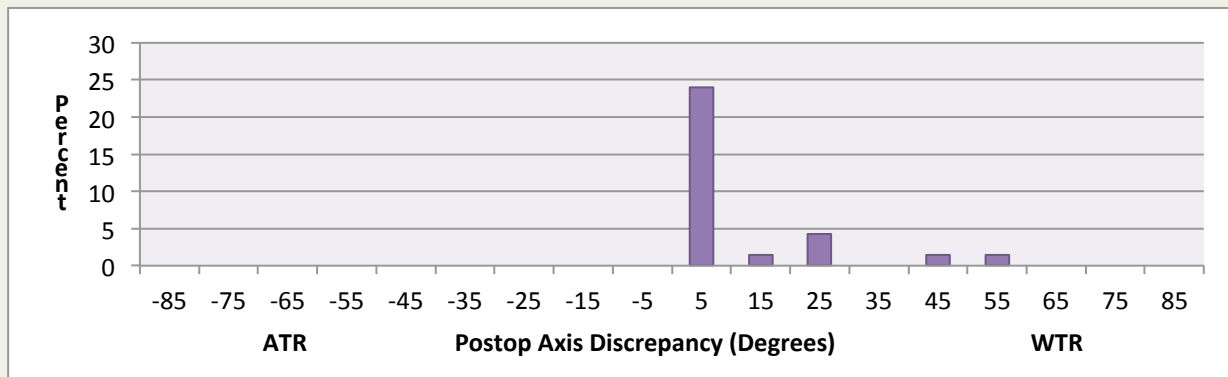
# Results

## Moderate (1.01 – 2.00 D) Preop Astigmatism

**Histogram 2a** shows the percentage of patients in which specific axis discrepancies occurred in patients with **moderate (1.01-2.00 D)** preop anterior corneal astigmatism. ATR axis discrepancies are to the left, and WTR discrepancies are to the right.



**Histogram 2b** shows the **36%** of cases from above in which the axis discrepancy was **WTR**.



# Results

The data from the histograms is summarized below:

## Figure 1: Direction of Axis Shift

### 1A. Low preoperative astigmatism (0.50-1.00 D)

For patients with **low preop anterior corneal astigmatism** (0.50 to 1.00 Diopter), the average change from the preoperative anterior corneal steep axis to postoperative subjective refractive astigmatic axis was **8 degrees ATR**. The direction of the axis shift is shown below:

|                   |     |
|-------------------|-----|
| WTR or zero shift | 38% |
| ATR shift         | 62% |

### 1B. Moderate preoperative astigmatism (1.01-2.00 D)

For patients with **moderate preop anterior corneal astigmatism** (1.01 to 2.00 Diopter), the average change from preoperative anterior corneal steep axis to postoperative subjective refractive astigmatic axis was **8 degrees ATR**. The direction of the axis shift is shown below:

|                   |     |
|-------------------|-----|
| WTR or zero shift | 36% |
| ATR shift         | 64% |



# Conclusions

For this study population, shifting the treatment axis ATR relative to the preoperative anterior corneal steep axis would have at best improved outcomes in **62%** of cases with low preop anterior corneal astigmatism (0.50 to 1.00 D), and **64%** of the cases with moderate preop anterior corneal astigmatism (1.01-2.00 D).

Shifting the treatment axis ATR relative to the preoperative anterior corneal steep axis would have **worsened** outcomes at least **38%** of the time for cases with low preop anterior corneal astigmatism, and at least **36%** of the time for cases with moderate preop anterior corneal astigmatism.

# Conclusions

In patients with low to moderate preop anterior corneal astigmatism, the anterior corneal steep axis was usually relatively close to the ideal treatment axis, but large WTR and ATR axis discrepancies occurred in a significant minority of cases.

Shifting the astigmatic treatment axis ATR relative to the steep anterior corneal axis is overall superior to on-axis treatment. However, this strategy does not always improve outcomes, and in fact frequently worsens them.

# Conclusions

The discrepancies found in this study between the preoperative anterior corneal steep axis, and the retrospectively identified ideal astigmatic treatment axis, demonstrate limitations in our ability to preoperatively identify the optimal astigmatic treatment axis if the effect of posterior corneal astigmatism is inferred rather than directly measured.

# Acknowledgements

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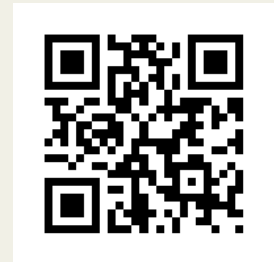
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