

# VERION<sup>®</sup> - The influence of expressed image-guided system technology on postoperative astigmatism control

## *VERION<sup>®</sup> - A influência da tecnologia do sistema guiado por imagem expressa no controle pós-operatório de astigmatismo*

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### ABSTRACT

**Objective:** To evaluate the astigmatism induced by cataract surgery through the phacoemulsification (PHACO) technique guided by the VERION<sup>®</sup> surgical planner, in an ophthalmological service of Paraná. **Methods:** This is an observational study with retrospective individualized evaluation of medical records, analyzing 37 eyes of 20 patients who underwent cataract surgery using the PHACO technique using VERION<sup>®</sup> and non-toric intraocular lens implantation at the Hospital de Olhos de Cascavel - PR in May 2016. **Results:** Within our sample of 37 eyes approached with VERION<sup>®</sup> assistance, 43% of study participants (n=16) had reduced initial astigmatism, including elimination of more severe degrees of astigmatism ( $\geq 2.5$  D). **Conclusion:** The impact of VERION<sup>®</sup> was significant as it allowed the correction of previous astigmatism of a part of the sample. In eyes that had surgically induced astigmatism, this complication was less clinically relevant compared to conventional technique corneal incisions.

**Keywords:** Cataract; Phacoemulsification; Astigmatism; VERION<sup>®</sup>

### RESUMO

**Objetivo:** Avaliar o astigmatismo induzido pela cirurgia de catarata através da técnica de facoemulsificação (FACO) guiada pelo planejador cirúrgico VERION<sup>®</sup>, em um serviço oftalmológico do Paraná. **Métodos:** O estudo tem caráter observacional com avaliação individualizada de prontuários de forma retrospectiva, analisando 37 olhos de 20 pacientes operados de catarata pela técnica de FACO com a utilização do VERION<sup>®</sup> e implantação de lente não-tórica no Hospital de Olhos de Cascavel - PR no período de maio de 2016 a novembro de 2018. **Resultados:** Dentro de nossa amostra composta por 37 olhos abordados com assistência do VERION<sup>®</sup>, 43% dos participantes do estudo (n=16) apresentaram redução do astigmatismo inicial, inclusive com eliminação de graus mais graves de astigmatismo ( $\geq 2.5$  D). **Conclusão:** O impacto do VERION<sup>®</sup> foi significativo uma vez que permitiu a correção do astigmatismo prévio de uma parte da amostragem. Em olhos que ocorreram astigmatismo induzido cirurgicamente essa complicação foi menos relevante clinicamente em comparação com incisões corneanas da técnica convencional.

**Descritores:** Catarata; Facoemulsificação; Astigmatismo; VERION<sup>®</sup>

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## INTRODUÇÃO

Cataract affects approximately 75% of the elderly population in the age group 70 years, or older, and it has straight implication in visual acuity reduction.<sup>(1)</sup> Surgery is the golden standard treatment for this type of pathology, and phacoemulsification (PHACO) is the most frequently applied technique.<sup>(2)</sup> New technologies have been created in order to help PHACO's conduction and to mitigate possible undesired consequences triggered by corneal handling, when the incision position - in relation to the meridian showing the wider curve - is not taken into consideration, such as the case of astigmatism.<sup>(3)</sup>

Therefore, the aim of VERION® is to reduce the incidence of astigmatism resulting from PHACO by improving pre- and intra-operative planning based on accurate keratometry values.<sup>(4)</sup>

The aim of the present study was to determine the statistics of induced-astigmatism development caused by cataract surgery through PHACO - guided by VERION®. It was done by analyzing the effectiveness of the corneal incision through the analysis applied to pre- and postoperative corneal topographic exams.

## METHODS

The present study follows the observational design; it was based on the individual retrospective evaluation of medical reports. In total, 37 eyes, from 20 patients who have undergone cataract surgery, through the PHACO technique - with VERION® surgery planner - at Olhos de Cascavel Hospital - PR, between May 2016 and November 2018, were assessed.

Astigmatism was objectively evaluated based on central keratometry values (K1 and K2) shown by topography examination conducted in Nidek® topographer. Exams were carried out in the pre-operative period and repeated at the one-month follow-up.

Refractive astigmatism-related data were not used in order to avoid bias, since this information depends on examiners' subjective clinical evaluation. Astigmatism values were calculated by subtracting the absolute value of K1 and of pre-operative K2; this method is also used in the postoperative period.

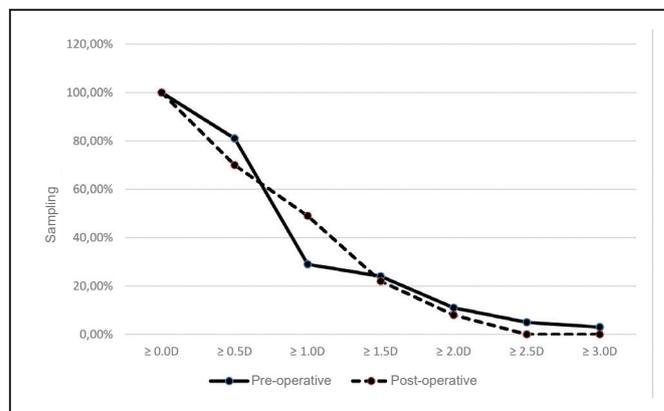
The surgeries were performed by the same surgeon, who made the PHACO's corneal incision in the zone proposed by the VERION® equipment (Alcon®). The corneal incision was performed in all eyes with a 2.75mm blade. Patients were subjected to non-toric intraocular lens implant.

Patients previously subjected to refractive corneal surgery and/or transplantation, who had corneal degenerative diseases, such as keratoconus and/or neural degeneration of the optical nerve; corneal scars, such as suture, pterygium, burn and/or ulcer; and the ones who did not attend the postoperative follow-up and, consequently, did not allow the evaluation of the variables necessary for the study, were excluded from the study.

## RESULTS

In total, 37 eyes were evaluated; 17 right eyes and 20 left eyes. The sample encompassed 8 men and 12 women in the age group 53 to 81 years - the mean age was 68.65 years (standard deviation of 7.47).

Values of astigmatism in diopters (D) were recorded in the pre- and postoperative periods and evaluated in separate; they are shown in Table 1, along with the calculation of the averages. This Table also presents the induced and reduced astigmatism values after the surgical procedure; these values were found by subtracting



**Figure 1:** Pre- and postoperative corneal astigmatism diopeters expressed in percentage

ting the absolute value of the pre- and postoperative astigmatism of each eye, and their respective average.

Astigmatism was described within intervals progressed at 0.5 diopters (D) (Figure 1). Data were assessed by respecting these cuts and expressing the sampling in percentage.

## DISCUSSION

The prevalence and severity of cataract pre- and postoperative age-related astigmatism in a population of 34 eyes were herein described. This population was selected in the ophthalmic hospital of Cascavel - PR. Results have shown that most eyes in this sample, 81% (n=30), presented minimal clinically relevant astigmatism (0.5 D) in the pre-operative period, whereas the rest of the sample presented severe astigmatism, at least 1.0 D (29%) and 2.0 D (10%), n=11 and n=4, respectively.

VERION® stands out among resources available to mitigate corneal intra-operative astigmatism through PHACO. It is a recent technology that enhances the accuracy of pre-operative evaluations of corneal structure and refractive power; thus, it allows better planning the PHACO procedure due to the implantation of a non-toric intraocular lens (IOL).<sup>(4)</sup> The surgeon can assess a crawl overlay image in vivo, at real time, during the surgery - the image can guide the corneal incision and IOL centralization. This is an individual evaluation that allows the incision location to be calculated based on the corneal axis - it aims at reducing possible postoperative damages.<sup>(5)</sup>

Based on Figure 1, 81% (n=30) of the eyes included in the analysis (n=37) presented pre-operative corneal astigmatism  $\geq 0.5$  D - 29% (n=11)  $\geq 1.0$  D, 24% (n=9)  $\geq 1.5$  D and 10% (n=4)  $\geq 2.0$  D. The present study evidenced that the most prevalent post-operative corneal astigmatism values lied within  $\geq 0.5$  D and  $\geq 1.0$  D. The number of severe astigmatism ( $\geq 1.5$  D) decreased; this outcome proves the efficacy of the surgical planner. It is also important highlighting that the highest astigmatism degrees ( $\geq 2.5$  D and  $\geq 3.0$  D) were not observed in the postoperative period - the sample was redistributed, a fact that was responsible for the increased population astigmatism rate  $\geq 1.0$  D.

Values shown in Table 1 indicate that VERION® allowed 43% of patients in the study (n=16) to present improvements in comparison to the initial astigmatism - mean corneal astigmatism reduction of 0.84 D. The rest of the sample (n=21) developed surgical induced astigmatism (SIA) at average of 0.3 D.

**Table 1**  
**values of pre- and postoperative astigmatism in diopters and their respective averages. The two columns separate patients into two groups: the ones who have recovered and those who had their initial astigmatism worsened - which expresses the residual astigmatism of each eye in diopter**

| Eye     | Pre-operative astigmatism | Postoperative astigmatism | Surgically induced astigmatism | Surgically reduced astigmatism |
|---------|---------------------------|---------------------------|--------------------------------|--------------------------------|
| 1       | 0.98                      | 1.25                      | 0.27                           | --                             |
| 2       | 0.71                      | 1.26                      | 0.55                           | --                             |
| 3       | 0.70                      | 0.43                      | --                             | 0.27                           |
| 4       | 1.78                      | 1.70                      | --                             | 0.08                           |
| 5       | 0.63                      | 0.97                      | 0.34                           | --                             |
| 6       | 0.86                      | 0.44                      | --                             | 0.42                           |
| 7       | 0.66                      | 0.32                      | --                             | 0.32                           |
| 8       | 0.57                      | 0.95                      | 0.38                           | --                             |
| 9       | 0.91                      | 1.00                      | 0.09                           | --                             |
| 10      | 0.70                      | 0.69                      | --                             | 0.01                           |
| 11      | 0.16                      | 1.00                      | 0.84                           | --                             |
| 12      | 1.86                      | 1.51                      | --                             | 0.35                           |
| 13      | 2.20                      | 2.23                      | 0.03                           | --                             |
| 14      | 0.96                      | 1.10                      | 0.14                           | --                             |
| 15      | 1.14                      | 1.68                      | 0.54                           | --                             |
| 16      | 0.37                      | 0.24                      | --                             | 0.13                           |
| 17      | 0.64                      | 1.25                      | 0.61                           | --                             |
| 18      | 0.61                      | 0.72                      | 0.11                           | --                             |
| 19      | 3.43                      | 1.25                      | --                             | 2.18                           |
| 20      | 1.67                      | 1.76                      | 0.09                           | --                             |
| 21      | 0.70                      | 0.63                      | --                             | 0.07                           |
| 22      | 0.68                      | 0.86                      | 0.18                           | --                             |
| 23      | 0.37                      | 0.44                      | 0.07                           | --                             |
| 24      | 0.25                      | 0.47                      | 0.22                           | --                             |
| 25      | 1.61                      | 0.40                      | --                             | 1.21                           |
| 26      | 0.28                      | 0.18                      | --                             | 0.10                           |
| 27      | 0.82                      | 0.71                      | --                             | 0.11                           |
| 28      | 1.23                      | 1.34                      | 0.11                           | --                             |
| 29      | 1.99                      | 2.30                      | 0.31                           | --                             |
| 30      | 2.95                      | 2.02                      | --                             | 0.93                           |
| 31      | 0.74                      | 0.24                      | --                             | 0.50                           |
| 32      | 0.79                      | 1.15                      | 0.36                           | --                             |
| 33      | 0.27                      | 1.05                      | 0.78                           | --                             |
| 34      | 0.84                      | 0.18                      | --                             | 0.66                           |
| 35      | 2.28                      | 1.93                      | --                             | 0.35                           |
| 36      | 0.64                      | 0.86                      | 0.22                           | --                             |
| 37      | 0.30                      | 0.48                      | 0.18                           | --                             |
| Average | 1.035                     | 1.000                     | 0.30                           | 0.48                           |

Although, nowadays, SIA is not that relevant for small corneal incision, it was observed that surgical planning through VERION® led to lower induced astigmatism rates. This outcome can be proved by comparing the present data to a recent randomized prospective study conducted with 140 patients, whose SIA average in the group of patients subjected to 2-mm corneal incisions conducted through PHACO was higher than 6.1 D - <sup>(6)</sup> this average was 0.3 D in the present study. A study carried out in Switzerland assessed 55 eyes through SIA in the postoperative period and found average of 0.47 D <sup>(7)</sup> – which was also higher

the that in the present results -, it has corroborated the results in the aforementioned study.

## CONCLUSION

VERION® individually plans the surgery in detail. Almost half of patients in the present study recorded corneal astigmatism reduction. VERION® allowed the number of patients who have developed induced astigmatism to be smaller than that of patients who were subjected to corneal incisions without topography

planning. Such worsening of residual astigmatism in the herein assessed populations can be related to astigmatism posterior to the cornea, which was not approached in the current study.

Data scarcity in the literature about the effectiveness of a surgical planning through topography, in comparison to surgeries performed without the support of this technology, justifies the importance of the present research.

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