Journal français d'ophtalmologie (2018) 41, e1—e9

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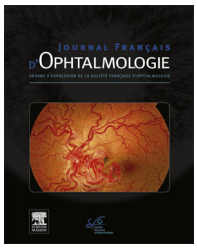

ORIGINAL ARTICLE

Toric lens implantation in cataract surgery: Automated versus manual horizontal axis marking, analysis of 50 cases☆

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Received 28 August 2017; accepted 14 November 2017
Available online 10 January 2018

KEYWORDS
Astigmatism;
Toric intraocular lens;
Cataract;
Refractive surgery;
Toric IOL alignment tools;
Tracking

Summary
Subject. — The main objective of our study was to evaluate the contribution of automated conjunctival registration in the alignment of toric intraocular lenses by comparing automated registration optimized with Callisto® to manual marking of the horizontal axis.
Materials and methods. — We performed a prospective, descriptive, monocentric study on patients undergoing cataract surgery with a toric intraocular lens (Asphina 709 Zeiss), performed by a surgeon with good experience in toric implants, between September 2016 and March 2017. We analyzed the agreement between the manual marking of the 0—180° axis versus the one automatically generated by the Callisto™, as well as the alignment of the IOL and the refractive results at 1 month.
Results. — We included 50 eyes of 38 patients. The mean corrected astigmatism was 1,9 D. The mean difference between the 2 axes was 4,7° [0—12.3°]. Only 50 % of the preoperative manual markings were consistent with the automated measurement (< 5°). At one month, the mean rotation recorded was 4,3° [0—29°]. The alignment was identical for 70 % ($n = 35$) of the IOLs (≤ 5°). As for residual subjective astigmatism, the mean was 0.58 D. The mean visual acuity without correction was 8/10 and 55 % saw 10/10 without correction.
Discussion. — Refractive performance depends on preoperative measurement, correct alignment of the IOL and its stability in the bag. Our study shows the value of automated conjunctival registration in the determination of the intraoperative axis of alignment, even with an experienced surgeon. This precision is essential for a good refractive result, especially since residual astigmatism in the case of misalignment will increase with the power of the implant.

☆ Oral presentation presented at the 123rd Congress of the French Society of Ophthalmology in May 2017.

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https://doi.org/10.1016/j.jfo.2017.11.002

Conclusion. — Our study shows excellent refractive results, regardless of the initial astigmatism, using automated alignment. Precision of toric implantation opens the way to toric multifocal implantation under the best conditions.

Introduction

Cataract surgery is the most commonly performed surgical procedure in France [1].

In the case of corneal astigmatism over 1 diopter (D), good distance vision requires glasses, despite correction of the spherical component of the refraction by an intraocular lens (IOL).

Correction of this astigmatism is possible at the time of the procedure and several options have already been available since the commercialization of toric platforms using virtual reality technology for alignment of the IOLs under the operating microscope.

We were interested in these technologies, which allow automated detection of the target axis of astigmatism, and studied their contribution in real life.

The primary goal of our study was to evaluate the role of conjunctival registration in the alignment of toric IOLs by a surgeon experienced in toric IOLs, comparing the axis generated automatically by conjunctival registration by Callisto® (Zeiss) to the manual axis based on an initial marking of the 0—180° axis by marking pen in a seated position as the reference axis for the Callisto®.

Materials and methods

This was a prospective, single-center, non-randomized, descriptive study from September 2016 to March 2017.

The patients included had to be eligible for cataract surgery, with corneal astigmatism equal to at least 0.75 diopter (D) against the rule or oblique, or greater than or equal to 1 D with the rule.

Exclusion criteria involved ophthalmologic comorbidities, which might limit total visual rehabilitation, such as congenital or acquired amblyopia, macular disease (age-related macular degeneration, diabetic maculopathy, atrophy...) and corneal abnormalities (irregular or progressive astigmatism, central corneal scars...).

All surgeries were performed by a single surgeon experienced with toric IOLs, with implantation of an AT TORBI 709 Zeiss® intraocular lens.

The surgeries were uneventful and the postoperative course unremarkable for all patients.

Preoperative work-up

All patients underwent a complete preoperative dilated ophthalmologic examination after biometry (performed prior to dilation).

Corneal topography was performed systematically to delineate the astigmatism (corneal component, lenticular component, axis, regularity and symmetry...) and rule out progressive corneal disease, which was an exclusion criterion.

Biometry was performed on an IOL master 700®, from which the spherical and cylindrical powers of the IOL were determined using an online calculator (https://zcalc.meditec.zeiss.com/zcalc/#login). A reference image of the white of the eye and conjunctival vessels was taken during the visit.

Surgical procedure

Transfer of the preoperative data to the operating room was achieved using the FORUM Cataract Workplace® platform (Carl Zeiss Meditec), imported automatically by the Callisto® through the hospital network.

All patients underwent marking of the horizontal axis with a surgical felt tip marker in a seated position by the single surgeon for this study, with the patient's head straight and fixating on a reference mark on the wall 3 meters away with the fellow eye. After supine positioning, this manual axis was compared (on the preoperative photo) with the horizontal axis generated automatically by the Callisto from the conjunctival registration (acquired at the preoperative visit from an image of the eye during biometry with the IOL Master 700® [Carl Zeiss Meditec]). The Callisto® automated mode performs a ''match'' between the preoperative photograph of the limbal vessels (seated position) and the (supine) image under the operating microscope, to account for the natural cyclotorsion of the eye.

The intraoperative photographic data comparing the two axes of implantation were transferred at the conclusion of the procedure by FORUM® (Carl Zeiss Meditec) for subsequent analysis.

All implantations were performed using conjunctival registration.

The corneal incisions were performed in three incision technique: a 2.2 mm clear corneal primary incision on the 120° meridian along with two side ports calibrated at 1 mm, perpendicular to the primary incision (30° et 210°).

Surgically induced astigmatism was 0 with the rule and +0.2 against the rule and oblique.

The capsulorhexis, centered on the pupil, with a diameter of 5 to 5.5 mm was also assisted by Callisto®.

Once the IOL was positioned near the desired axis, the viscoelastic was aspirated from behind the optic, then the IOL was placed in its final position.