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Clinical Effect Analysis of Posterior Chamber Intraocular Lens Implantation for Correcting High Myopia and Astigmatism

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Abstract: *Objective:* To explore the corrective effect of posterior chamber intraocular lens implantation with phakic eyes in the treatment of high myopia and astigmatism. *Methods:* From May 2023, the hospital began to collect the case data of diagnosis and treatment of high myopia and astigmatism. By May 2024, 310 cases were included, all of which were treated with posterior chamber intraocular lens implantation. The visual acuity, astigmatism and axial position of the intraocular lens were observed before and after treatment. *Results:* At different time points after the operation, the patient's vision was significantly improved compared with that before the operation ($P < 0.05$), and the vision level was equal to or greater than the best-corrected vision before the operation. At different time points after the operation, the average rotation of the intraocular lens was less than 5 degrees. Astigmatism was significantly lower than that before the operation ($P < 0.05$). After the operation, the intraocular pressure increased in 11 cases, accounting for 3.55%, with no adverse complications such as lens turbidity, glare and obvious halo occurring. *Conclusion:* The posterior chamber intraocular lens implantation with phakic eyes has an ideal correction effect in the treatment of high myopia and astigmatism, which can effectively improve the vision level of patients and reduce the degree of astigmatism, and has high effectiveness and safety.

Keywords: Posterior chamber intraocular lens implantation in phakic eyes; High myopia; Astigmatism; Corrective effect

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1. Introduction

With the development and wide popularization of electronic products, the problems of myopia and astigmatism in children and adults are becoming more and more serious, and the number of patients is rising, among which the proportion of patients with high myopia cannot be underestimated. For patients with high myopia and astigmatism, wearing contact lenses is an option, but it may cause many complications, such as dry eye and keratitis, which seriously affect eye health [1]. Although wearing high-height frame glasses can correct vision, many patients are not satisfied with their heavy appearance and defects that may affect the imaging quality of the retina. With the continuous progress of microsurgery technology and the continuous innovation

of intraocular lens materials, posterior chamber intraocular lens implantation with phakic eyes has gradually gained wide clinical recognition. This surgical method skillfully avoids damage to the cornea, does not change the natural shape and structure of the eyeball, and does not need to remove the patient's own crystal, thus retaining the natural adjustment function of the crystal [2]. After operation, the magnification of the object image was effectively controlled, which significantly improved the visual quality. At the same time, the operation is excellent in correcting vision and diopter, and the postoperative effect is lasting and stable, which provides an ideal surgical treatment scheme for young patients to treat high myopia and astigmatism. In order to further understand the effectiveness of posterior chamber intraocular lens implantation in the treatment of high myopia and astigmatism, 310 cases of high myopia with astigmatism in our hospital from May 2023 to May 2024 were studied in depth, and the contents are as follows.

2. Data and methods

2.1. General data

From May 2023, the hospital began to collect the case data of high myopia and astigmatism, and by May 2024, 310 cases were included, all of which were treated by posterior chamber intraocular lens implantation with phakic eyes. Among them, there were 165 males and 145 females. The age range was 16–39 years old, with an average age of (25.64 ± 1.71) years old.

Inclusion criteria: (1) Preoperative spherical lens degree is -(12–21) D; The corneal topography showed regular astigmatism, the corneal astigmatism was over -1.5 D, and the refractive state was stable for more than 24 months. (2) No other eye diseases; (3) All of them have read the contents of the informed consent form and signed it voluntarily.

Exclusion criteria: (1) The pupil diameter is more than 5.0 mm, the anterior chamber depth is less than 2.8 mm, and the number of corneal endothelial cells is less than 2,000/mm; (2) Suffering from uveitis, retinal detachment, cataract, glaucoma, lens dislocation and other diseases; (3) Those who have a history of intraocular surgery; (4) There are other factors that affect the treatment.

2.2. Methods

2.2.1. Preoperative preparation

Before the operation, all patients were examined in detail:

(1) The naked eye vision of both eyes was measured;

(2) Get the best-corrected vision through mydriatic optometry;

(3) Measure corneal curvature and corneal diameter (white to white distance);

(4) Using a slit lamp microscope to examine the fundus and measure intraocular pressure, and observe the corneal endothelial state by corneal endoscope [3].

(5) All patients were examined for mydriasis to evaluate the fundus condition comprehensively.

(6) Ensuring the success of the operation provides a guarantee for the safety of patients.

2.2.2. Operation method

(1) In the preoperative preparation stage: The patient needs to use the slit light band to horizontally look up his eyes through the precise positioning of the slit light in the sitting state. At the same time, the key angles of 0°, 90° and 180° were clearly marked on the corneal limbus with a marker.

(2) 30 minutes before the operation: It is necessary to use compound tropicamide eye drops for three times

to ensure that the pupils are fully dilated.

(3) 10 minutes before operation: Eye drops with 0.4% concentration of obucaine hydrochloride should be used twice to further ensure the clear surgical field of vision [4].

(4) During the operation, the intraocular lens is accurately implanted into the eye with the aid of a microscope. When placing the intraocular lens, it is necessary to ensure that its front face is upward, especially the intraocular lens with astigmatism correction function, and it is necessary to carefully identify and determine the direction of its diamond logo. According to the patient's eye, a side incision was made at 6 o'clock (right eye) or 12 o'clock (left eye), and an appropriate amount of viscoelastic agent was injected [5]. Subsequently, a transparent and accurate 3.2 mm main incision was made on the horizontal temporal side, and the intraocular lens was successfully implanted into the anterior chamber through this incision. After the intraocular lens is slowly unfolded in the eye, the four corners of the intraocular lens are carefully pushed into the ciliary sulcus behind the iris by using a special lens adjustment hook [6]. According to the preoperative planning, adjust the axial position of the intraocular lens to the predetermined position. After the implantation and adjustment of the lens, replace the viscoelastic agent in the eye, and carefully check to ensure that the intraocular pressure is within the normal range, and at the same time, ensure that the surgical incision is sealed and no leakage [7]. Finally, tobramycin dexamethasone eye ointment was used to dress the eyes after the operation to ensure the eyes' recovery.

2.3. Observation indicators

All patients were followed up after the operation for 7 days, 1 month, 3 months and 6 months, respectively. The patients' naked vision and best-corrected vision were examined. The improvement of astigmatism was comprehensively analyzed by optometry and slit lamp microscopy. After mydriasis, all patients were observed whether the axial position of the intraocular lens had changed and whether there were any adverse phenomena such as turbidity, glare and obvious halo.

2.4. Statistical methods

SPSS 22.0 was used to analyze the data, and the counting data was expressed as %, with χ^2 test. The measurement data is represented by mean ± standard deviation (SD) and tested by *t*. Kappa test was used for consistency and $P < 0.05$ means there is a statistical difference.

3. Results

3.1. Visual acuity

At different time points after the operation, the patients' naked vision was significantly improved compared with that before the operation ($P < 0.05$), and the vision level was equal to or greater than the best-corrected vision before the operation. See **Table 1** for details.

Table 1. Comparative analysis table of patients' naked eye vision at different time points before and after operation (mean ± SD)

Sight	Before operation	1 month after operation	3 months after operation	6 months after operation
Uncorrected vision	0.078 ± 0.046	0.961 ± 0.121*	0.989 ± 0.122*	0.979 ± 0.311*
Best-corrected vision	0.878 ± 0.329	1.029 ± 0.197*	1.039 ± 0.189*	1.041 ± 0.179*

* indicating $P < 0.05$, and the difference is significant.

3.2. Astigmatism and axial position of intraocular lens

At different time points after the operation, the average rotation of the intraocular lens was less than 5 degrees. Astigmatism was significantly lower than that before the operation ($P < 0.05$). See **Table 2** for details.

Table 2. Comparative analysis table of astigmatism and axial position of intraocular lens at different time points before and after operation (mean ± SD)

Index	Before operation	7 days after operation	1 month after operation	3 months after operation	6 months after operation
Astigmatism (D)	2.42 ± 0.93	0.44 ± 0.14*	0.31 ± 0.18*	0.38 ± 0.08*	0.36 ± 0.24*
Axial change of intraocular lens (degree)	-	1.77 ± 0.83	2.23 ± 1.14*	2.57 ± 1.12*	3.27 ± 1.25*

* indicating $P < 0.05$, and the difference is significant.

3.3. Complications after operation

In 11 cases, the intraocular pressure increased, accounting for 3.55%. After local intraocular pressure reduction treatment, all patients recovered to normal intraocular pressure in about 2 days. After 6 months of follow-up, there was no visual decline caused by the rotation of the intraocular lens, and all patients did not have any adverse phenomena such as lens turbidity, glare and obvious halo.

4. Discussion

Currently, the main means are lenses and surgery for patients with high myopia and astigmatism. However, lens correction methods are often limited by their inherent aberration, leading to patients' unsatisfactory visual quality and difficulty obtaining ideal correction results. This limitation makes many patients have low acceptance of it, which further affects the effective correction of vision. Because the vision cannot be improved properly for a long time, the visual function of patients often tends to decline, which leads to a series of complex pathological changes in the eyes [8]. Therefore, surgery is the main correction method for treating high myopia and astigmatism, but many patients are not suitable for corneal surgery because of their high myopia or thin cornea. Clear lens replacement is affected by the age of the patient, and it is easy to lose accommodation after surgery, accompanied by a high risk of retinal detachment, which has great limitations in the clinic. However, the implantation of the posterior chamber intraocular lens (IOL) in the correction of myopia with astigmatism has achieved the goal of one-time completion and ensured the integrity of corneal tissue. After surgery, the cornea can keep its normal physiological structure without the suture of corneal tissue, which has become one of the ideal choices to correct astigmatism at present. The operation has excellent predictability and brought good news to many patients [9].

The results of this study show that the naked eye vision of patients at different time points after the operation has been significantly improved compared with that before the operation, and the vision level is equal to or greater than the best-corrected vision before the operation. Astigmatism was significantly lower than that before the operation. It is suggested that the posterior chamber intraocular lens implantation has the characteristics of a stable diopter after the operation, and its correction can accurately achieve the expected goal before the operation. The therapeutic effect on corneal astigmatism is also remarkable, showing excellent predictability. In addition, it can keep the visual state stable so as to effectively meet the visual needs of daily life.

The key factors that lead to its displacement or rotation are the model and placement position of the intraocular lens and whether there is a cyst in the iris. Therefore, it is particularly important to accurately

measure the corneal diameter before the operation, which is a key step to ensure the success of the operation and the recovery of patients' visual quality. In this study, the astigmatism and axial changes of the intraocular lens were followed up after the operation. The average rotation of the intraocular lens was less than 5 degrees at 7 days, 1 month, 3 months and 6 months after the operation. It is suggested that the intraocular lens has excellent rotational stability after half a year of follow-up. It is believed that during the operation, the doctor skillfully sucked out the viscoelastic agent between the intraocular lens and the transparent lens to ensure no residue. At the same time, doctors strictly follow the operating specifications and strive to be accurate in every step, thus avoiding any damage to corneal tissue and transparent lens [10]. These meticulous operations together ensure that the intraocular lens can remain stable after operation, bringing a more comfortable and clear visual experience to patients. Within half a year after the operation, all patients did not have any adverse phenomena such as lens turbidity, glare and obvious halo, which further showed that this operation was safe after operation.

5. Conclusion

To sum up, posterior chamber intraocular lens implantation with phakic eyes has an ideal correction effect in treating high myopia and astigmatism, which can effectively improve the vision level of patients and reduce the degree of astigmatism, and has high effectiveness and safety.

Disclosure statement

The authors declare no conflict of interest.

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