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Effect of phacoemulsification combined with visual acuity and adverse reactions in diabetic patients with cataract a meta-analysis

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Abstract: *As a common blinding eye disease, cataract is more common in the elderly, and it is also one of the common complications in the diabetic population, which has a serious impact on the daily life of patients. With the continuous improvement of medical level and the increase of people's requirements for quality of life, the treatment of diabetes with cataract has gradually attracted widespread attention. Phacoemulsification, as one of the most effective surgical methods in clinical treatment of cataract, has the clinical advantages of rapid healing, fewer complications and small incision. Most clinical studies have confirmed its clinical effectiveness. Based on this, this study conducted a meta-analysis of related clinical studies on phacoemulsification in the treatment of diabetes with cataract, so as to provide a theoretical basis for subsequent clinical treatment. The results of meta-analysis show that phacoemulsification technology can significantly improve the clinical efficacy, improve visual acuity and reduce adverse reactions in patients with diabetes complicated with cataract, which provides a safe and effective surgical method for further improving the prognosis of such patients.*

Keywords: *phacoemulsification; Diabetes mellitus complicated with cataract; Clinical efficacy; Vision; Adverse reactions*

1. Introduction

As a common and frequent disease worldwide, diabetes is also a chronic and lifelong disease that threatens human physical and mental health. According to incomplete statistics, the incidence of diabetes has reached 425 million people worldwide, and it is on the rise year by year [1]. Data on diabetes in China show that up to 2017, there were 114.4 million people with diabetes in the population aged 20-79 years, which is also the country with the highest incidence of diabetes in the world [2]. The typical clinical manifestations of diabetes as "a little" sanduo, and urine, water quantity, increased food intake and weight loss, but with the development of disease, can cause multiple system damage, leading to the eye, kidney, nerve, blood vessels and other tissues and organs of chronic progressive lesions, and function and failure, serious illness or stress can cause severe acute metabolic disorder [3-4]. Ophthalmic diseases, as the most common complication in diabetic patients, are mainly caused by the fact that the energy in the crystal is derived from glucose in aqueous humor. In hyperglycemia, glucose metabolism is blocked and intracellular permeability is increased, resulting in swelling and opacity of lens fibers [5]. In the initial stage of diabetic cataract, the lens is spotty or snowflake opacity, which can develop into complete lens opacity in a short period of time. At the same time, the eye can also have iris redness, high intraocular pressure, diabetic retinopathy, etc., which aggravate the visual quality impairment and seriously affect the quality of life of patients [6].

At present, surgery is still the main treatment for diabetic patients with cataract in clinical practice, among which phacoemulsification, as the current mainstream treatment, has the characteristics of high cure rate, small incision and fewer complications, which has attracted consistent praise from doctors and patients [7]. Therefore, through a meta-analysis, this study collected the clinical studies of phacoemulsification technology in the treatment of diabetic patients with cataract at home and abroad in the past three years, and analyzed the clinical efficacy, application value of phacoemulsification technology in improving visual acuity and adverse reactions.

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2. Data and Methods

2.1 Literature Search

The types of literature included clinical controlled experiment and dissertation. Ultrasonic emulsification treatment of diabetes with cataract is the main search direction, in ten thousand domestic medicine, hownet, VIP and foreign PubMed aaa in according to the key words search, including with cataract ultrasonic emulsification, diabetes, cataract, clinical efficacy, eyesight, adverse reactions, intraocular pressure, retinal thickness in the macular area center, and meta analysis.

2.2 Literature screening criteria

Inclusion criteria: (1) The study protocol included phacoemulsification; (2) Nationality, age, gender, race and other conditions did not affect the screening results; (3) Approval documents of relevant institutions; (4) Complete data; (5) All patients were confirmed to be diabetic with cataract and met the relevant criteria [8]. Exclusion criteria: (1) There are insufficient literatures such as repetitive content, incomplete data or careless operation; (2) Basic experiment; (3) Other research directions (4) Other literature types.

2.3 Quality evaluation

Jadad scale was used to score ≤3 as low quality and ≥4 as high quality. The total score ranged from 0 to 7.

2.4 Statistical treatment

RevMan5.2 statistical software was used to analyze the research data. The count data were represented by RR, and the analysis statistics were represented by WMD or SMD. All effect sizes were expressed with 95% confidence intervals. Heterogeneity was tested by chi-square.

3. The results

3.1 Literature screening results

A total of 9 articles were included in the Chinese and English contribution database after searching and screening according to keywords and research direction. The retrieval process is shown in Figure 1. A total of 3 articles were of low quality and 6 articles were of high quality. Table 1 shows the basic characteristics and quality assessment of the included articles. There is no obvious bias, as shown in Figure 2-3.

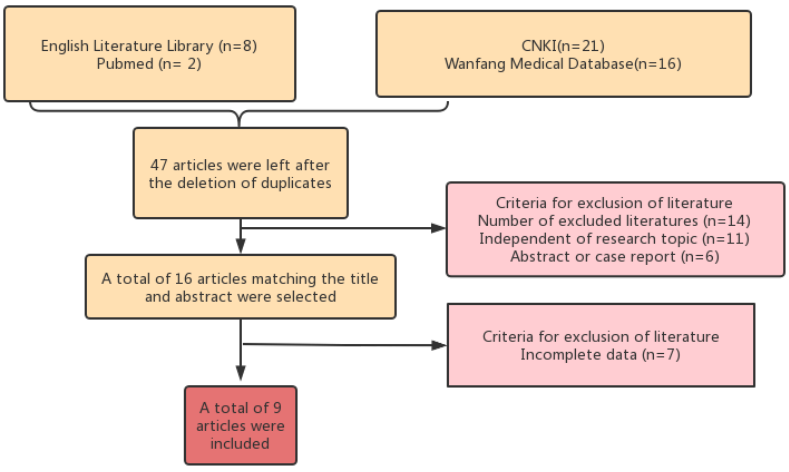

Figure 1 Literature search process

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Table 1 Basic characteristics of the literature

Author	Year	outcome indicator	quality score
Chen xiaojun[9]	2021	③⑤	3
Fang ying[10]	2020	①②④⑤	6
Li xianfeng[11]	2019	⑤	2
Mao yihui[12]	2020	②④⑤	6
Song yu[13]	2022	①②③④⑤	7
Tang L[14]	2021	①②④⑤	7
Wang jia[15]	2021	②⑤	3
Yuan yuan[16]	2020	②③	4
Zhang xiaolan[17]	2020	①⑤	5

Notes: ① Clinical curative effect; ② Vision contrast; ③Contrast of central retinal thickness in macular region; ④ Intraocular pressure contrast; ⑤ Adverse reactions

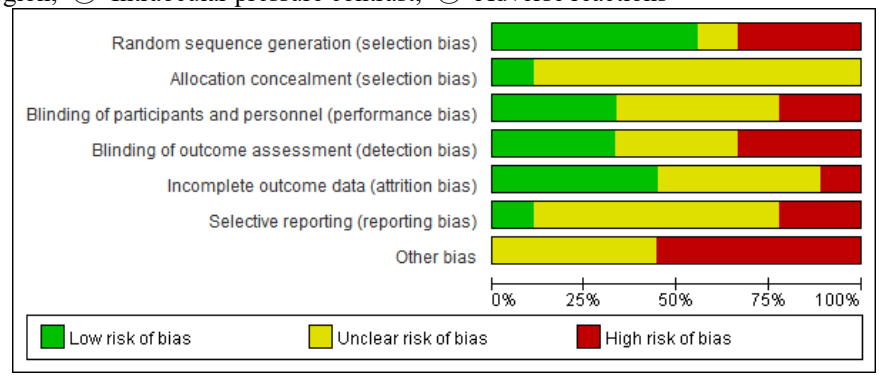

Figure 2 Overall bias of the literature

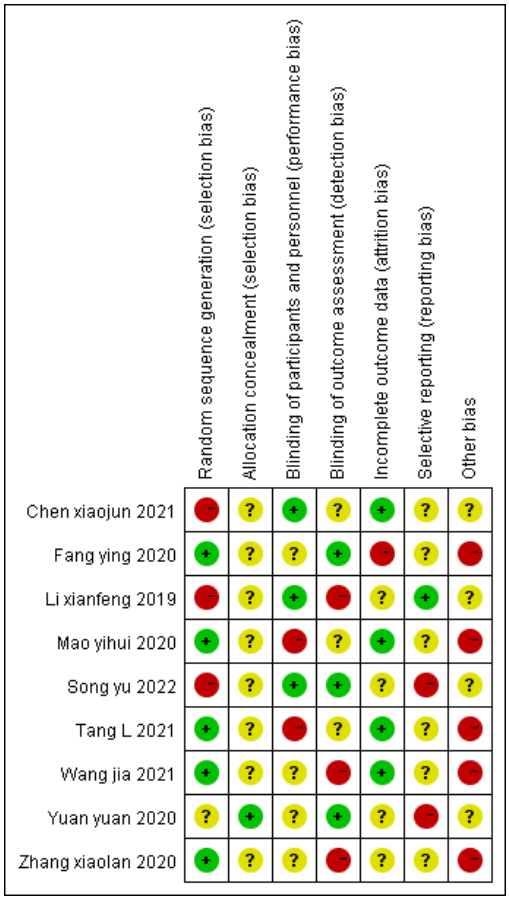

Figure 3 Bias of a single document

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3.2 Comparison of clinical efficacy

A total of 4 literatures were included on the difference of clinical efficacy, and the heterogeneity between literatures was I^2=0.0%. Using the fixed effect model, the results showed that patients with combined phacoemulsification technology had higher clinical efficacy [RR: 0.20, 95%CI: (0.08-0.47), P=0.0002], which further confirmed that phacoemulsification could improve the therapeutic effect of diabetes complicated with cataract, as shown in Figure 4-5.

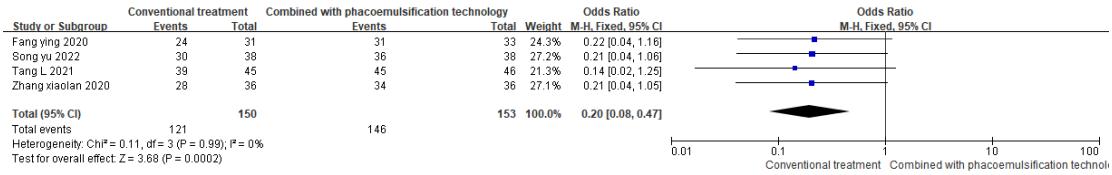

Figure 4 Forest map of clinical efficacy

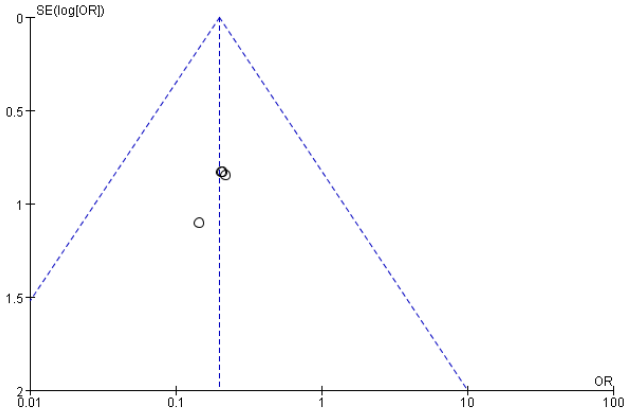

Figure 5 Funnel plot of clinical efficacy

3.3 Visual contrast

A total of 6 literatures on visual acuity differences were included, with heterogeneity I^2=99.0%. The results showed that phacoemulsification combined with phacoemulsification technology could significantly improve the visual acuity of patients [RR: -0.26, 95%CI: -0.28 to -0.24, P < 0.00001], as shown in Figure 6-7.

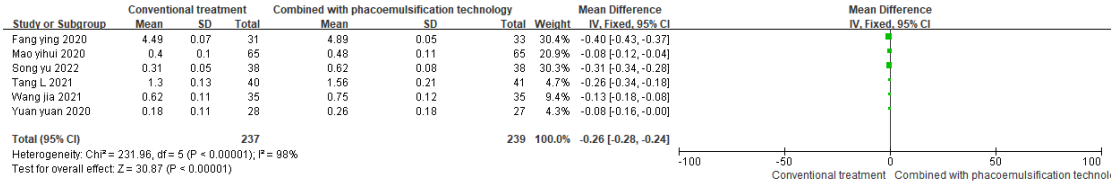

Figure 6 Forest map of visual difference

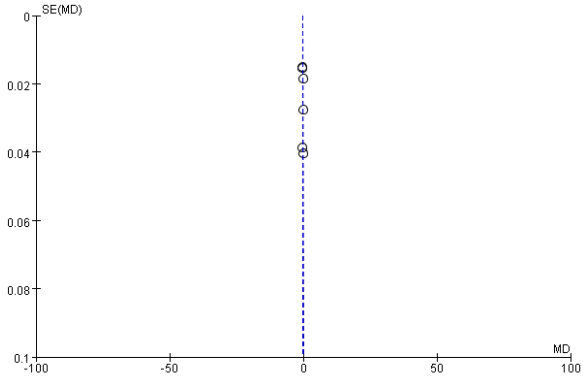

Figure 7 Funnel plot of visual acuity difference

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3.4 Comparison of macular central retinal thickness

A total of 3 literatures were included in the comparison of macular central retinal thickness, with heterogeneity I^2=95.0%. The random effect model was used, and the results showed that the macular central retinal thickness of patients could be reduced by phacoemulsification technology [RR: 20.14, 95%CI: (14.50-25.78), P < 0.00001], as shown in Figure 8-9.

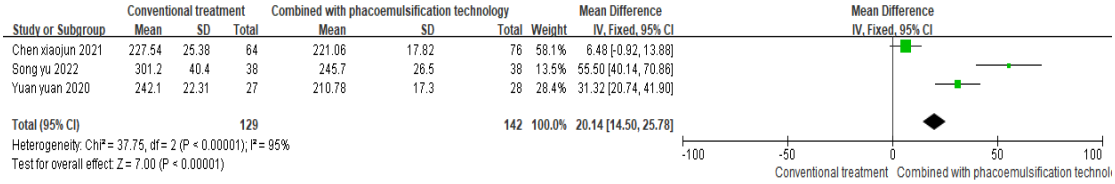

Figure 8 Contrast forest map of central macular retinal thickness

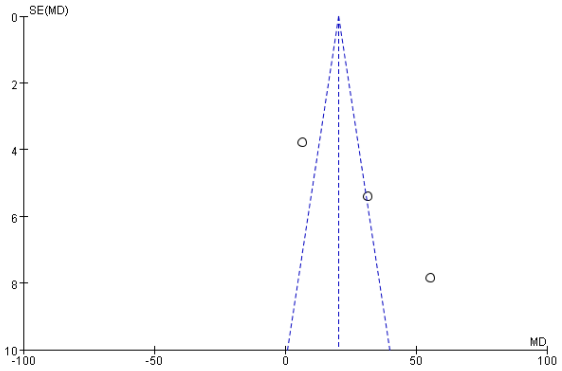

Figure 9 Funnel plot of central macular retinal thickness contrast

3.5 Comparison of intraocular pressure

A total of 4 articles were included on the comparison of IOP, with heterogeneity I^2=99.0%. The random effect model was used, and the results showed that phacoemulsification combined with phacoemulsification technology could effectively reduce IOP in patients [RR: 1.48, 95%CI: (1.14-1.82), P < 0.00001], as shown in Figure 10-11.

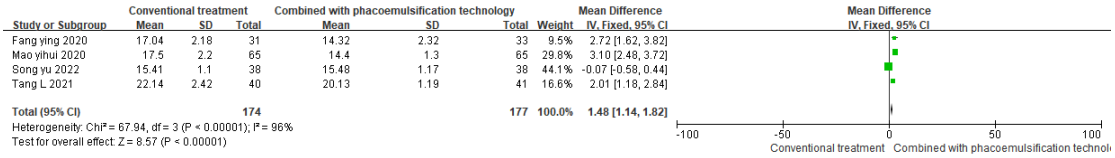

Figure 10 Forest map of IOP contrast

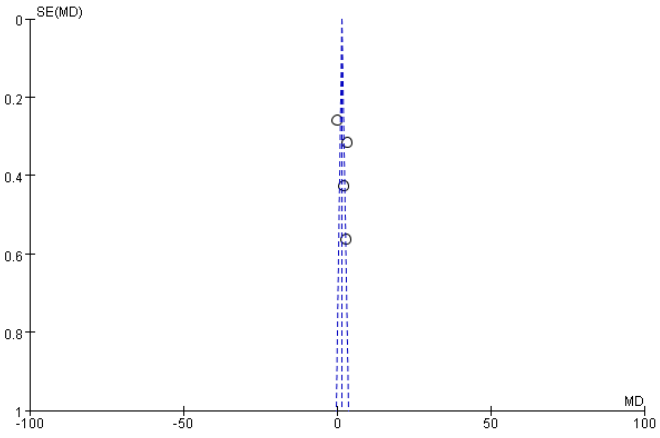

Figure 11 Infundibular plot of IOP contrast

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3.6 Adverse reactions

A total of 8 articles were included in the comparison of adverse reactions, with heterogeneity I^2=67.0%. The random effect model was used, and the results showed that phacoemulsification combined with phacoemulsification technology could effectively reduce the occurrence of adverse reactions [RR: 2.35, 95%CI: (1.70-3.25), P < 0.00001], as shown in Figure 12-13.

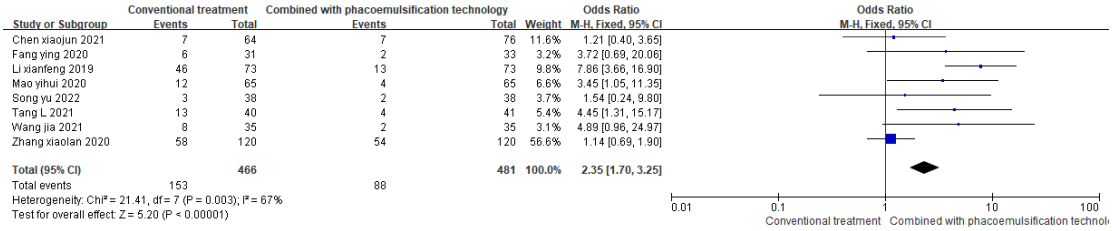

Figure 12 Forest diagram of adverse reactions

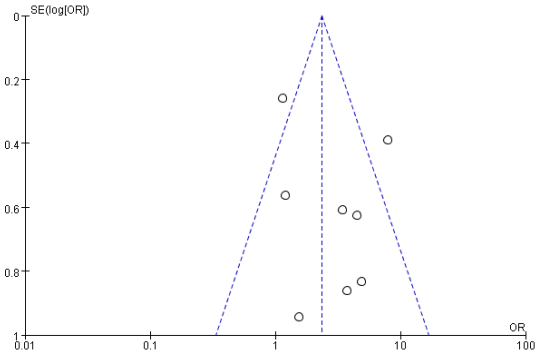

Figure 13 Funnel plot of adverse reactions

4. Conclusion

Diabetes as a chronic disease in the middle-aged and old groups, often with patient age, body resistance and immunity drops, so the disease is getting worse, the resulting microvascular lesions such as retinopathy is developed for diabetic cataract, and compared with cataract patients, simply caused by diabetes mellitus with cataract treatment more difficult. It is mainly due to the abnormal metabolism of retinal tissue caused by the disorder of body metabolism in diabetic patients, which causes sustained damage to the vascular function of the retina, thus causing the accumulation of extracellular fluid within the diameter of the retina, and then leading to retinal thickening and exudation [18]. At present, surgery is still the main treatment for these patients. In view of the particularity of diabetic patients with cataract, and the clinical efficacy is affected by the course of diabetes, blood glucose control and other factors, the selection of safe and efficient surgical methods is extremely important for the treatment of these patients.

At present, phacoemulsification is an effective surgical method for the treatment of diabetic patients with cataract. Compared with traditional extracapsular cataract extraction, phacoemulsification has smaller incision, fewer postoperative complications, higher safety and cure rate, and has been consistently praised by doctors and patients. In this paper, by means of meta-analysis of clinical related studies of diabetic cataract ultrasonic emulsification treatment are analyzed, the results show that ultrasonic emulsification the clinical curative effect of treatment of the disease is higher, and the patients in the postoperative visual acuity, macular area retinal thickness, improved intraocular pressure better, and less postoperative complications.

Firstly, after analyzing the principle of phacoemulsification technology, it is mainly a process in which two or more dissimilar solution bodies are mixed uniformly to form dispersive substances under the action of ultrasonic energy, and one liquid is evenly divided into another liquid to form an emulsion. It can be under the action of strong ultrasound, so that a large number of bubbles in the liquid, small bubbles will gradually grow and increase with the ultrasonic vibration, and then suddenly burst and split, the bubble after the split and continuous growth and collapse. When these small bubbles collapse rapidly, high temperature and high pressure are generated in the bubbles, and strong local shock waves

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are generated in the liquid near the bubbles because the liquid around the bubbles rushes into the bubbles at a high speed, and local high temperature and high pressure are also formed, resulting in ultrasonic crushing and emulsification [19]. In the medical field, the nucleus of the lens is crushed by ultrasound through a 3-5mm corneal or scleral incision using a phacoemulsification apparatus and then aspirated together with the cortex in chylous form. At the end of the operation, the posterior capsule of the lens can be preserved and the posterior chamber intraocular lens can be implanted at the same time.

Through this technology, the vascular density in the overall range of the macular area can be preserved, and optical signal stimulation can be added after effective contact with cataract shape deprivation, so as to change the structure of the fundus, further increase the vascular density of the fundus, and generate effective stimulation to the visual nerve, thereby improving visual acuity [20]. At the same time, the stability of the anterior chamber is higher with phacoemulsification technology, so the fluctuation of intraocular pressure is small and the retinal thickness of the macular area is guaranteed. In addition, due to long-term metabolic disorders of the three nutrients in diabetic patients, the glucose content in aqueous humor fluctuates significantly, which can lead to metabolic acidosis in the stromal layer of the cornea, and then lead to pathological changes in the morphology and function of normal corneal endothelial cells, resulting in the decline of endothelial cell pump function. At the same time, the normal blood-aqueous humor barrier will also appear abnormal function, which leads to postoperative complications such as corneal edema and anterior chamber inflammatory exudation. However, the technical characteristics of phacoemulsification, such as low trauma and small incision, further reduce the fluctuation of aqueous humor, thus further reducing the incidence of complications [21].

In conclusion, phacoemulsification technology can significantly improve the visual acuity, intraocular pressure and macular retinal thickness of diabetic patients with cataract, improve the clinical efficacy and reduce complications, and has good clinical application value.

References

[1] Meigs JB. The Genetic Epidemiology of Type 2 Diabetes: Opportunities for Health Translation. Curr Diab Rep. 2019 Jul 22; 19(8):62.
[2] Ma RCW. Epidemiology of diabetes and diabetic complications in China. Diabetologia. 2018 Jun; 61(6):1249-1260.
[3] Juan J, Yang H. Prevalence, Prevention, and Lifestyle Intervention of Gestational Diabetes Mellitus in China. Int J Environ Res Public Health. 2020 Dec 18; 17(24):9517.
[4] Kelkar A, Kelkar J, Mehta H, et al. Cataract surgery in diabetes mellitus: A systematic review. Indian J Ophthalmol. 2018 Oct; 66(10):1401-1410.
[5] Khan A, Petropoulos IN, Ponirakis G, et al. Visual complications in diabetes mellitus: beyond retinopathy. Diabet Med. 2017 Apr; 34(4):478-484.
[6] Jeong IS, Lee EJ, Kim MS, et al. Incidence and Predictors of Cataract among People with Type 2 Diabetes Mellitus: Using Secondary Data Analysis from the Ansan Cohort of the Korean Genome and Epidemiology Study. J Korean Acad Nurs. 2022 Feb; 52(1):24-35.
[7] Nyström A, Almarzouki N, Magnusson G, et al. Phacoemulsification and primary implantation with bag-in-the-lens intraocular lens in children with unilateral and bilateral cataract. Acta Ophthalmol. 2018; 96: 364–370.
[8] Takahashi T, Okamoto T, Yokota I, et al. The effect of rituximab on the quality of life of children with refractory nephrotic syndrome [J]. Pediatr Int. 2022; 64 (1):e14725.
[9] Chen Xiaojun, Gao Yongjie, Wang Baozhen. Effects of phacoemulsification on retinal thickness and vessel density in macular region [J]. Liaoning Medical Journal, 2021, 35(5):53-55.
[10] Fang Y. Phacoemulsification alone and vitrectomy in the treatment of diabetic retinopathy with cataract [J]. Modern Medicine and Health, 2020, 36(11):1715-1717.
[11] Li Xianfeng. Effect of phacoemulsification combined with intraocular lens implantation in the treatment of diabetic cataract [J]. Clinical Medicine Practice, 2019, 28(3):184-186.
[12] Mao Yihui, Chen Xi. Effect of phacoemulsification combined with Angle separation in the treatment of diabetic cataract with angle-closure glaucoma [J]. Chinese Modern Doctor, 2020, 58(35): 58-61.
[13] Song Yu, Lu Jun, Li Hong. Clinical efficacy and safety of phacoemulsification and intraocular lens implantation combined with intravitreal injection of anti-vascular endothelial growth factor drugs in patients with cataract and diabetic retinopathy [J]. J Clinical Rational Drug Use, 2022, 15(12):149-151.
[14] Tang L, Zhang M. The efficacy of ultrasonic emulsification with IOL implantation in patients with

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primary angle-closure glaucoma combined with cataract. Am J Transl Res. 2021 Jul 15; 13(7): 7874-7881.
[15] Wang Jia. Effect of phacoemulsification combined with intraocular lens implantation on diabetic patients with cataract [J]. Journal of Clinic & Pathology, 2021, 41(2):333-339.
[16] Yuan Yuan, Chen Xupan, Chen Lan. Changes of macular retinal thickness and its effect on visual acuity after phacoemulsification and intraocular lens implantation in diabetic cataract [J]. Current Medicine, 2020, 26(4):93-95.
[17] Zhang Xiaolan, Chen Shengju. Clinical observation of phacoemulsification and intraocular lens implantation in diabetic patients [J]. Journal of Clinical Medicine Electronic Literature, 2020, 7(95):14, 16.
[18] Lai KR, Zhang XB, Yu YH, et al. Comparative clinical outcomes of Tecnis toric IOL implantation in femtosecond laser-assisted cataract surgery and conventional phacoemulsification surgery. Int J Ophthalmol. 2020; 13: 49–53.
[19] Topaloğlu R, Gülhan B, Çelegen K, et al. Rituximab for Children With Difficult-to-Treat Nephrotic Syndrome: Its Effects on Disease Progression and Growth. Front Pediatr[J]. 2019; 7: 313.
[20] Sorkin N, Kreimei M, Einan-Lifshitz A, et al. Stepwise combination of femtosecond astigmatic keratotomy with phacoemulsification and toric intraocular lens implantation in treatment of very high postkeratoplasty astigmatism. Cornea. 2020; 39: 71–76.
[21] Onofre-Déciga PK, Palacio-Pastrana C, Solís-Hernández C, et al. Social impact indicators in patient diagnosed of senile cataract treated with phacoemulsification plus intraocular lens implantation. Cir Cir. 2020; 88: 331–336.