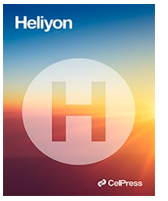
Heliyon 10 (2024) e34873

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon



Research article

Parameters influencing the effectiveness of femtosecond laser-assisted capsulotomy in white cataract surgery

Wenwen Zhang [a,b], Menglian Liao [a,b], Qiongyan Tang [a,b,*]

[a] Aier School of Ophthalmology, Central South University, Changsha, 410015, Hunan, PR China
[b] Department of Ophthalmology, Changsha Aier Eye Hospital, Changsha, 410015, Hunan, PR China

ARTICLE INFO

Keywords:
White cataracts
Femtosecond-laser assisted cataract surgery
Capsulotomy

ABSTRACT

Purpose: To explore the parameters that may influence the effectiveness of femtosecond laser-assisted capsulotomy in white cataract surgery and its cutoff points.
Design: A retrospective case series.
Methods: This retrospective case series study enrolled patients with white cataract who had undergone surgery at Changsha Aier Eye Hospital from July 2018 to January 2020. All patients underwent femtosecond laser-assisted capsulotomy using a contact femtosecond laser device (LenSx, Alcon Laboratories, USA). The sex, age, corrected distance visual acuity (CDVA), intraocular pressure (IOP), axial length (AL), lens thickness (LT), anterior chamber depth (ACD) and mean keratometry (Km) were recorded. All eyes were divided into successful capsulotomy group and unsuccessful capsulotomy group according to the capsulotomy integrity. Both groups were compared and two-sample *t*-test was used in order to find the optimal cutoff points of the parameters.
Results: 60 eyes of 59 patients were included in the study. A successful capsulotomy was achieved in 36 eyes (60 %), while unsuccessful capsulotomy occurred in 24 eyes (40 %). Although no significant differences were observed in sex ($P = 0.704$), AL ($P = 0.598$) and Km ($P = 0.873$) between both groups, LT ($P < 0.01$), ACD ($P = 0.014$) and age ($P < 0.01$) were significantly different; a LT of 5.21 mm was found to be the optimal cutoff point.
Conclusions: Femtosecond laser-assisted capsulotomy in white cataract is safe and effective. LT, ACD and age may influence the effectiveness of femtosecond laser-assisted capsulotomy in patients with white cataracts. LT is the main associated parameter and 5.21 mm is the optimal cutoff point for LT.

1. Introduction

White cataract presents a great challenge when performing a continuous curvilinear capsulorhexis (CCC), even for experienced ophthalmic surgeons, due to the absence of red fundus reflex, increased intralenticular pressure (ILP), fragile capsule and nuclear density. Numerous methods have been employed to facilitate the capsulotomy in white cataracts, eg, staining capsule with dye, [1], two-stage capsulorhexis, [2], lens decompression technique, [3], diathermic high-frequency capsulorhexis, [4], endoilluminators [5] and femtosecond laser-assisted CCC [6]. Although Conrad-Hengerer et al. have reported that femtosecond laser-assisted CCC in white

* Corresponding author. Aier School of Ophthalmology, Central South University, Changsha, 410015, Hunan, PR China.
E-mail addresses: zww0730@163.com (W. Zhang), tangqiongyan@aierchina.com (Q. Tang).

https://doi.org/10.1016/j.heliyon.2024.e34873
Received 29 February 2024; Received in revised form 28 June 2024; Accepted 17 July 2024
Available online 18 July 2024

cataract is safe and feasible, [6], unsuccessful capsulotomy still occurred. The possible factors that may lead to an unsuccessful CCC deserve to investigate.

According to preoperative slit-lamp biomicroscopy, [7], ultrasonographic features, [8], or real-time intraoperative optical coherence tomography (iOCT) images, [9], the white cataract can be divided into different types. Based on preoperative slit-lamp biomicroscopy examination, white cataracts are usually divided into dry white, intumescent and Morgagnian cataracts. However, this classification is subjective and these types may overlap. Therefore, we aim to look for objective preoperative parameters to directly access the effectiveness of the femtosecond laser-assisted white cataract surgery.

Our porpose is to find the objective parameters affecting the effectiveness of femtosecond laser-assisted capsulotomy and to provide a scientific rationale for the optimal cutoff points of the most significant factors influencing the results of white cataract surgery.

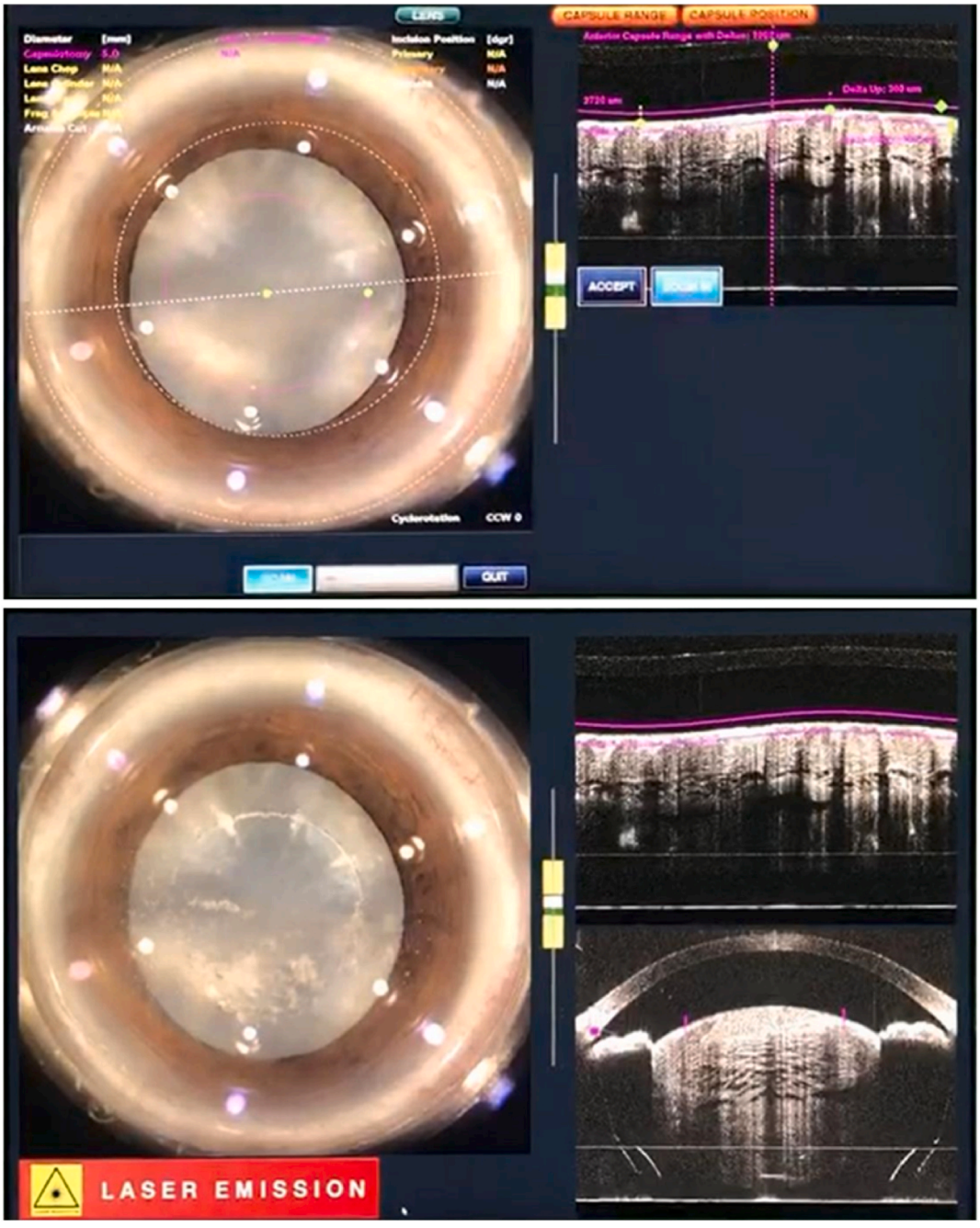


Fig. 1. Real-time intraoperative optical coherence tomography images. (Top) This image presents the orientation before laser emission. (Below) This image presents rapid capsulotomy during laser emission.

2. Material and methods

This retrospective case series enrolled all consecutive patients with white cataract who were admitted to Changsha Aier Eye Hospital from July 2018 to January 2020. This study received approval of the Ethics Committee (2018KYPJ003) of Changsha Aier Eye Hospital, and followed the tenets of the Declaration of Helsinki. All patients have signed informed consent.

The inclusion criteria included patients with a diagnosis of white cataract by two experienced surgeons based on slit-lamp biomicroscopy examination. The exclusion criteria were dilated pupil <6 mm, corneal opacity, lens dislocation, a history of coexisting ocular disease (eg, glaucoma, uveitis, or keratitis), previous ocular traumatism or surgery, askew eye position during the laser treatment and severe systemic disorders.

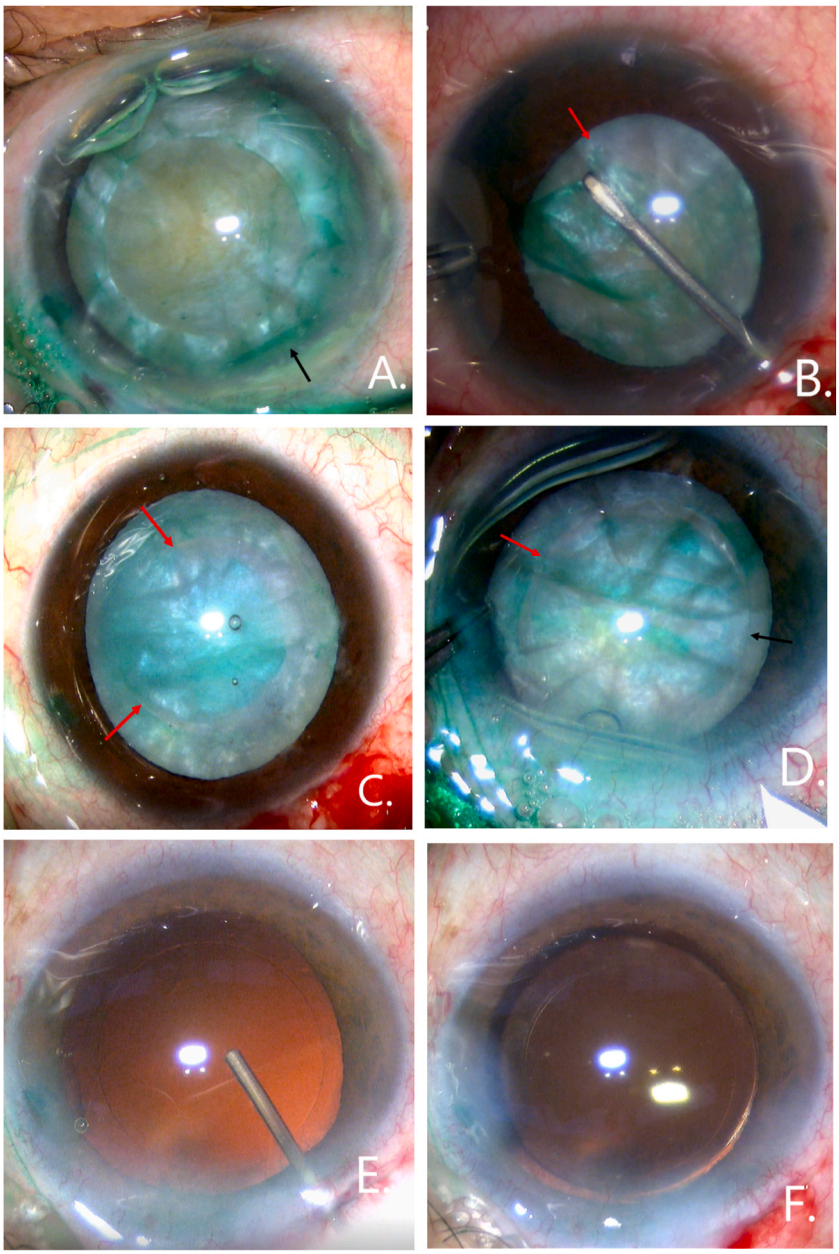


Fig. 2. A: Successful capsulotomy with a continuous 360-degree free flap which was pushed by ophthalmic viscosurgical device into anterior chamber (black arrow). B: Incomplete capsulotomy of the flap with tags at 5 o'clock (red arrows). C: Incomplete capsulotomy of the flap with bridge adhesion at 2–5 o'clock (area between red arrow). D: Incomplete capsulotomy of the flap with tags at 4 o'clock (red arrow) and bridge adhesion at 8–9 o'clock (black arrow). E: An intact anterior capsule after careful secondary separation and phacoemulsification of the same eye as in picture D. F: well centered IOL of the same eye as in picture D.

The primary collected data included patient demographics. Ten consecutive measurements were performed in each eye by a highly skilled technician using the same applanation A-scan (CineScan, Quantel Medical SA) in order to obtain axial length (AL), lens thickness (LT), and anterior chamber depth (ACD); the mean values were taken.

All surgeries were performed by one experienced surgeon (QY Tang) under topical anesthesia and the same the femtosecond laser device (contact femtosecond laser LenSx, Alcon Laboratories, Fort Worth, Texas, USA). The setting parameters were used as follows: capsulotomy diameter of 5.0 mm, horizontal spot spacing of 5 μm, vertical spot spacing of 4 μm, pulse energy of 6 μJ, and incision depth of 600 μm (300 μm capsule delta up and down respectively). After the femtosecond laser-assisted capsulotomy treatment (see Fig. 1), 5 % povidone–iodine was applied on the eye surface for 30 seconds. Indocyanine green was injected into anterior chamber under air bubble to stain the anterior capsule so that the integrity of capsulotomy could be observed clearly. A continuous 360-degree free flap was defined as complete capsulotomy and a flap with tags, bridge adhesion or capsule radial tear was defined as incomplete capsulotomy; we described tags as one or few spot-like adhesion, while bridge adhesion was defined as a broad uncut region (see Fig. 2). A cohesive ophthalmic viscosurgical device (OVD) was injected to displace the dye and air. Afterwards, a capsule needle entered the anterior chamber to carefully separate the capsule edge from the peripheral capsule. This procedure was followed by phacoemulsification (Centurion device, Alcon Laboratories, Fort Worth, Texas, USA) and IOL implantation. Finally, the incisions were hydrated after careful removal of the OVD. Postoperative treatment included topical tobramycin-dexamethasone eye ointment and a patching.

All surgery procedures were documented by a high-definition camera. Intraoperative capsulotomy integrity and surgical complications were recorded. All eyes were divided into two groups according to the capsulotomy integrity: group A as a complete capsulotomy group with a continuous 360-degree free capsule flap and group B as incomplete capsulotomy group of the capsule flap with tags, bridge adhesion or capsule radial tear.

Statistical analysis was completed using SPSS 21.0 software package (SPSS, Chicago, Illinois, USA). Distributions of normality of the ocular biometric parameters were checked with the Shapiro-Wilks (S–W) test and were considered significantly different from normal when the p value was <0.05. Two-sample *t*-test was used to analyze whether the parameters including age, AL, LT, ACD, and Km could be the risk factors of incomplete capsulotomy of femtosecond laser-assisted capsulotomy in white cataract surgery. Chi-square test was used to determine whether sex could be a risk factor. Then the receiver operating characteristic (ROC) analysis was used to analyze the capability of the associated parameters evaluating the effectiveness of femtosecond laser-assisted capsulotomy in white cataract surgery. The area under the ROC curve (AUC) and the Youden index (maximal value of sensitivity + specificity - 1) were utilized to measure the optimal cutoff points. All continuous variables were given mean ± standard deviation (SD), minimum, and maximum values. All $P < 0.05$ were considered statistically significant.

3. Results

3.1. Baseline characteristics

This study enrolled 60 eyes of 59 patients with white cataract who underwent femtosecond laser-assisted cataract surgery. The baseline characteristics are showed in Table 1. Sex was similar, with a majority of men (50.8 %), and mean age 66.9 ± 11.2 years (range, 42–88 years). Of the 60 eyes, 37 (61.7 %) were left eyes, 23 (38.3 %) right eyes. Mean AL, LT, ACD, and Km was 23.65 ± 1.02 mm (range, 21.08–26.46 mm), 5.34 ± 0.70 mm (range, 3.87–7.06 mm), 2.62 ± 0.47 mm (range, 1.69–3.74 mm) and 44.18 ± 1.69 diopters (D) (range, 40.58–48.98 D), respectively.

Preoperative CDVA was light perception in 1 eye (1.67 %), hand motion in 49 eyes (81.67 %) and counting fingers in 10 eyes (16.67 %).

Femtosecond laser-assisted capsulotomy was performed in all eyes within 10–12 s. Incomplete capsulotomy, including tags and

Table 1
The baseline characteristics of the patients.

Parameters	Statistical description
Total(patients/eyes)	59/60
Age(years)	66.9 ± 11.2(42–88)
Sex	
Male,%(n)	50.8(30)
Female,%(n)	49.2(29)
Eye	
Left eye,%(n)	61.7(37)
Right eye,%(n)	38.3(23)
Mean keratometry(D)	44.18 ± 1.69(40.58–48.98)
Axial length(mm)	23.65 ± 1.02(21.08–26.46)
Anterior chamber depth(mm)	2.62 ± 0.47(1.69–3.74)
Lens thickness(mm)	5.34 ± 0.70(3.87–7.06)
Preoperative visual acuity	
Light perception,%(n)	1.67 %(1)
Hand moving,%(n)	81.67 %(49)
Figure count,%(n)	16.67 %(10)

bridge adhesion, was the main complication (36 eyes [60.0 %] in group A and 24 eyes [40.0 %] in group B). Of the 24 eyes in group B, 8 (33.3 %) eyes had tags only, 8 (33.3 %) had bridge adhesion only, 6 (25 %) had both tags and bridge adhesion, 1 (4.2 %) had tags and anterior capsule radial tear, and 1 (4.2 %) had bridge adhesion and anterior capsule radial tear. No posterior capsule ruptures occurred and IOLs were well implanted and centered in the capsular bag in all eyes.

3.2. Two-sample t-test

Two-sample *t*-test suggested that a statistically significant difference can be found in LT ($P < 0.01$), ACD ($P = 0.011$) and age ($P < 0.01$) between both groups (Table 2); however, there was no statistically significant differences regarding AL ($P = 0.598$), Km ($P = 0.873$) and sex ($P = 0.704$).

3.3. Receiver operating characteristic curves

ROC curves suggested the area under the ROC curve (AUC) for LT, ACD and age was 0.753 (95 % CI, 0.630–0.877), 0.672 (95 % CI, 0.535–0.808) and 0.756 (95 % CI, 0.634–0.878) (Fig. 3).

According to the Youden index, the optimal cutoff point of LT was 5.21 mm (sensitivity 82.6 %, specificity 63.9 %); the cutoff points of ACD was 2.425 mm (sensitivity 77.8 %, specificity 50.0 %), 2.655 mm (sensitivity 52.8 %, specificity 75.0 %) and 2.775 mm (sensitivity 44.4 %, specificity 83.3 %); and the cutoff points of age was 59.5 (sensitivity 88.9 %, specificity 50.0 %) and 67.5 (sensitivity 63.9 %, specificity 75.0 %).

4. Discussion

The results showed that LT, ACD and age may affect the effectiveness of femtosecond laser-assisted capsulotomy in patients with white cataract. According to statistics, the area under the ROC curve could be an index to be used to determine the diagnosis capability. The value of AUC varies from 0.5 to 1; a value from 0.5 to 0.7 shows modest diagnosis capability, while a value from 0.7 to 0.9 shows a good diagnosis capability. In our results LT and age both had a good and approximate equal diagnosis capability; however, when the Youden index taken the maximum, there were two or three cutoff values of age and ACD, separately. Therefore, we considered LT is the main associated parameter of the effectiveness of femtosecond laser-assisted capsulotomy in patients with white cataract and the optimal cutoff point was 5.21 mm. To our knowledge, this study is the first time to explore the objective parameters that may influence the effectiveness of femtosecond laser-assisted capsulotomy in white cataract surgery and to get the optimal cutoff points.

Cataract surgery is one of the most routine surgeries worldwide, while this surgery still poses a challenge in some complex cases. The 'Argentinean flag' sign may appear when starting to create the CCC due to the high intralenticular pressure [10]. A successful capsulotomy in white cataract surgery is always one of the main aspects of concern. Since the introduction of femtosecond laser-assisted cataract surgery in 2009, a new choice for ophthalmic surgeons is available. In this study, all eyes underwent femtosecond laser-assisted surgery without severe complications like posterior capsule rupture or vitreous loss. Even incomplete capsulotomy, including tags and bridge adhesion or anterior capsule radial tear, happened in 24 eyes; we successfully separated them from peripheral capsule under the help of indocyanine green dye without additional complications. Our results indicated that femtosecond laser-assisted capsulotomy in white cataract is safe and effective.

The ideal capsulotomy should be circular, central, and reproducible in size to overlap the edge of the IOL [11]. Capsule radial tears may appear in white cataracts because of the increased intralenticular pressure. Once puncturing the anterior capsule with a needle, the intralenticular pressure will be released immediately, which may cause a capsule rupture from the anterior capsule to posterior capsule. This may result in worse outcomes: vitreous loss, lens subluxation or luxation, retinal detachment or even choroidal hemorrhage. However, femtosecond laser can create a capsulotomy in a fast way, [12], so that the intralenticular pressure can be released in a circle rather than a point, decreasing the rate of capsule radial tears. Moreover, previous studies suggest that the speed of the capsulotomy creation in white cataract surgery is the greatest advantage of the femtosecond laser [5,11]. In our study, a continuous, circular, centered and well-sized capsulotomy was achieved in all eyes with the assistance of femtosecond laser. Additionally, we did

Table 2
Two-sample *t*-test between group A and group B.

Parameters	Group A: n = 36 (mean ± SD)	Group B: n = 24 (mean ± SD)	t/χ^2 values	*p* values
Age (years)	70.86 ± 10.17	60.58 ± 10.16	−3.837	<0.01
AL (mm)	23.69 ± 1.02	23.58 ± 1.02	−0.382	0.704
LT (mm)	5.11 ± 0.70	5.68 ± 0.56	3.335	<0.01
ACD (mm)	2.74 ± 0.48	2.44 ± 0.40	−2.630	0.011
Km (D)	44.21 ± 1.51	44.13 ± 1.97	−0.160	0.873
Sex*				
Female	17	13	0.278	0.598
Male	19	11		

Abbreviations: group A: successful capsulotomy with a continuous 360-degree free flap; group B: failure capsulotomy with a flap with tags, bridge adhesion or capsule radial tear; AL: axial length; LT: lens thickness; ACD: anterior chamber depth; Km: mean keratometry; SD: standard deviation.
*Chi-square test was conducted for sex.

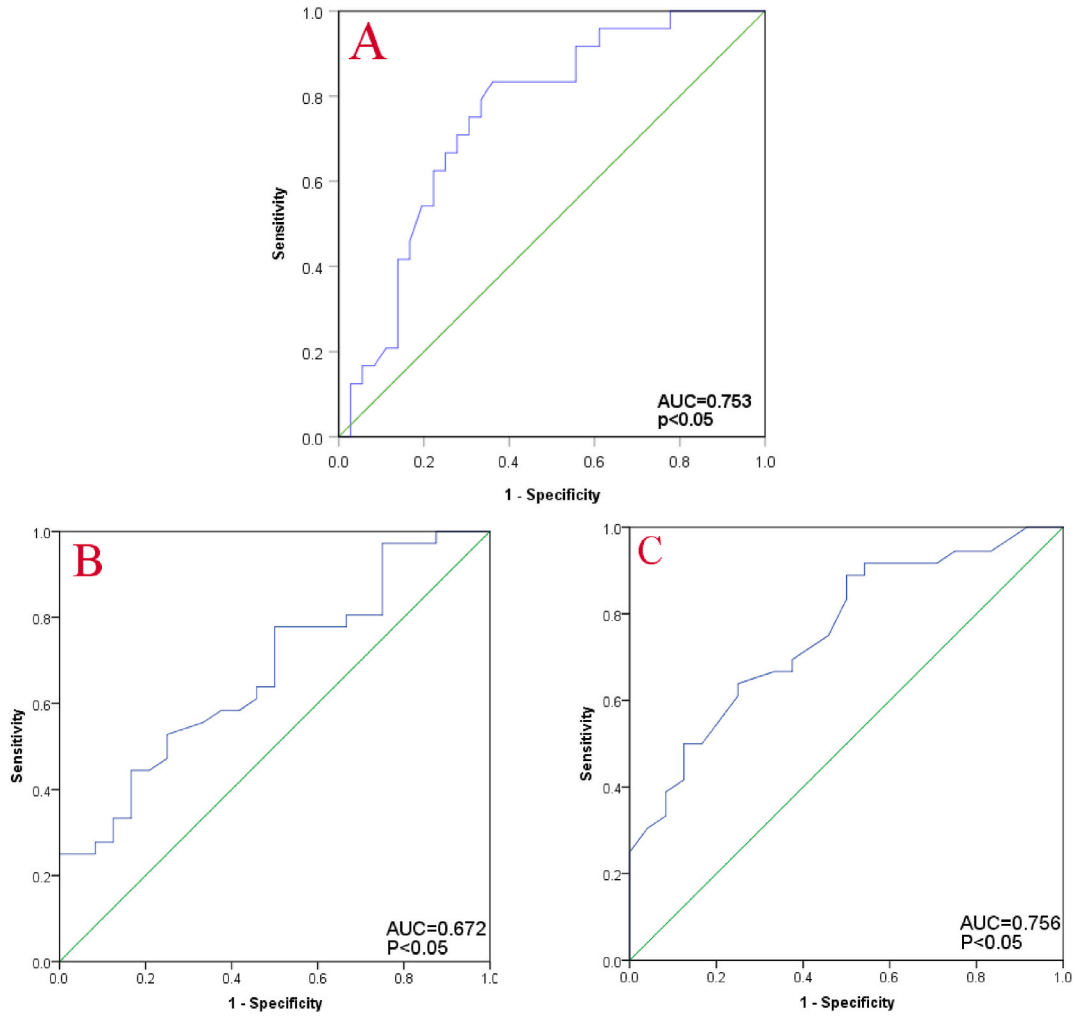


Fig. 3. A: Receiver operating characteristic (ROC) curves for lens thickness. B: ROC curves for anterior chamber depth. C: ROC curves for age. AUC: area under the ROC curve.

not observe worse outcomes, apart from 2 cases with anterior capsule rupture.

The main complication for white cataract manual surgery is incomplete capsulotomy, which happens in 3.85–28.3 % of the procedures [13–15]; on the other hand, it appears in 9.1–48 % of the femtosecond laser-assisted white cataract surgeries [6,16–19]. Our results are in accordance with the previous published reports. Despite a higher incidence of incomplete capsulotomy in femtosecond laser-assisted white cataract surgery, a continuous, circular, centered and well-sized capsulotomy was achieved in more than 95 % of the cases, eventually without severe complications, after careful secondary separateness. The improvement of the proficiency and the upgrade of the software may lead to a decrease in the incidence of incomplete capsulotomy [20,21]. According to Takeshi et al., modifying the thickness setting of the capsulotomy can minimize the incidence of capsulotomy-related problems [22]. The results indicate that femtosecond laser can effectively improve the success rate of capsulotomy in white cataract surgery.

Soon-Phaik Chee et al. reported that the occurrence of incomplete capsulotomy in white cataracts was related with increased LT [18]. However, the specific relationship between the incomplete capsulotomy and increased LT has not been analyzed. In our study, we observed that LT, ACD and age are the parameters influencing the effectiveness of femtosecond laser-assisted capsulotomy in white cataract surgery. We found that LT is the main associated parameter. There were several different stages in the development of a white cataract. At the intumescent white cataract stage, the lens takes up water, the LT is thick and the intralenticular pressure rises. In this period, the position of the anterior capsule may change because of the decrease of the intralenticular pressure and the ejection of the liquefied lens material during femtosecond laser-assisted capsulotomy. Therefore, it can cause incomplete capsulotomy because part of the anterior capsule is beyond the range of femtosecond laser emission [23]. Further studies can investigate the effectiveness of femtosecond laser-assisted capsulotomy in white cataract surgery by increasing the delta value. After the intumescent white cataract, the water may escape through the capsule leaving a shrunken lens. The LT is then reduced and the intralenticular pressure becomes lower. At this time, the incomplete capsulotomy is less frequent. Thus, the thicker the LT, the lower the effectiveness.

Several studies have proven age is positively related to LT [24,25]. Hassan Hashemi et al. reported that LT increases with age in an adult population of Iran [26]. However, the relationship between LT and age was negative in our study. The reason for this variation could be that the change of the LT in white cataract was inconsistent with the processes of the LT in adult population. Besides, the thicker LT in young patients can be attributed to the perception of cataracts at a young age. Younger patients have more possibilities looking for treatments at the early stage, that is, intumescent white cataract with thick LT, while older patients tend to have a longer history, in which the LT may shrunk and be thinner. Previous studies had revealed that with the increase of the LT, the ACD decreases [21–23]. Tehrefore, ACD can be one of the associated parameters because of the main impact of the LT in ACD.

This study provides important information for the ophthalmic surgeon when treating white cataracts and can improve the indication of femtosecond laser-assisted cataract surgery. One potential limitation of our study could be lack of control group, which may make no difference to the results but could cut down the power of the study. Further studies can be focused on the way to manage white cataracts with thick LT and the calculation of the intralenticular pressure.

In conclusion, femtosecond laser can create a reproducible, safe and well-sized capsulotomy in white cataracts. With the increase of LT, the success rate of capsulotomy decreased gradually in femtosecond laser-assisted white cataract surgery. In case of a white cataract, the LT of 5.21 mm is the optimal cutoff point to estimate the effectiveness of capsulotomy based on the ROC curve calculation and can be an objective parameter to provide a more useful information helping surgeons making an individual preoperative decision-making.

Financial support

Supported by Health Research Project of Hunan Provincial Health Commission (grant number: 20201736).

Author disclaimer

None of the authors has a financial or proprietary interest in any material or method mentioned.

Funding

The authors have not declared a financial grant for this research from any funding agency.

Ethics statement

This study received approval of the Ethics Committee (2018KYPJ003), Changsha Aier Eye Hospital, and followed the tenets of the Declaration of Helsinki. All patients have signed informed consent.

Data availability statement

Data will be made available on request.

CRediT authorship contribution statement

Wenwen Zhang: Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Menglian Liao:** Writing – review & editing, Validation, Supervision, Investigation, Formal analysis, Data curation, Conceptualization. **Qiongyan Tang:** Writing – review & editing, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

All authors of this manuscript certify that they have no affiliations with or involvement in any organization or entity with any financial interest.

References

[1] S. Jacob, A. Agarwal, A. Agarwal, et al., Trypan blue as an adjunct for safe phacoemulsification in eyes with white cataract, J. Cataract Refract. Surg. 28 (10) (2002) 1819–1825.
[2] A. Vasavada, R. Singh, J. Desai, Phacoemulsification of white mature cataracts, J. Cataract Refract. Surg. 24 (2) (1998) 270–277.
[3] K.M. Nabil, Lens decompression technique for prevention of intraoperative complications during phacoemulsification of intumescent cataract, Indian J. Ophthalmol. 65 (12) (2017) 1436–1439.
[4] L. Wang, P. Li, X. Guo, Comparison of diathermic high-frequency capsulorhexis and continuous curvilinear capsulorrhexis in white cataract surgery, Int. J. Ophthalmol. 11 (8) (2018) 1317–1321.
[5] T. Akin, U. Aykan, K. Karadayi, et al., Capsulorhexis in white cataract using a green-light endoillumination probe, Ophthalmic Surg. Laser. Imag. 38 (6) (2007) 520–522.

[6] I. Conrad-Hengerer, F.H. Hengerer, S.C. Joachim, et al., Femtosecond laser-assisted cataract surgery in intumescent white cataracts, J. Cataract Refract. Surg. 40 (1) (2014) 44–50.
[7] S. Basti, Different faces of the white cataract: a phaco surgeon's perspective, Aust. N. Z. J. Ophthalmol. 27 (1) (1999) 53–56.
[8] P.D. Brazitikos, I.T. Tsinopoulos, N.T. Papadopoulos, et al., Ultrasonographic classification and phacoemulsification of white senile cataracts, Ophthalmology 106 (11) (1999) 2178–2183.
[9] J.S. Titiyal, M. Kaur, F. Shaikh, et al., Real-time intraoperative dynamics of white cataract-intraoperative optical coherence tomography-guided classification and management, J. Cataract Refract. Surg. 46 (4) (2020) 598–605.
[10] D.M. Perrone, Argentinean flag sign is most common complication for intumescent cataracts, Ocular Surgery News U.S. edition Dec. 15 (2000).
[11] S. Daya, S.P. Chee, S.E. Ti, et al., Comparison of anterior capsulotomy techniques: continuous curvilinear capsulorhexis, femtosecond laser-assisted capsulotomy and selective laser capsulotomy, Br. J. Ophthalmol. 104 (3) (2020) 437–442.
[12] T. Schultz, S.C. Joachim, R. Noristani, et al., Greater vertical spot spacing to improve femtosecond laser capsulotomy quality, J. Cataract Refract. Surg. 43 (3) (2017) 353–357.
[13] A. Chakrabarti, S. Singh, R. Krishnadas, Phacoemulsification in eyes with white cataract, J. Cataract Refract. Surg. 26 (2000) 1041–1047.
[14] S. Jacob, A. Agarwal, A. Agarwal, et al., Trypan blue as an adjunct for safe phacoemulsification in eyes with white cataract, J. Cataract Refract. Surg. 28 (10) (2002) 1819–1825.
[15] N. Kara-Junior, M.R. de Santhiago, A. Kawakami, et al., Mini-rhexis for white intumescent cataracts, Clinics 64 (4) (2009) 309–312.
[16] J.S. Titiyal, M. Kaur, A. Singh, et al., Comparative evaluation of femtosecond laser-assisted cataract surgery and conventional phacoemulsification in white cataract, Clin. Ophthalmol. 10 (2016) 1357–1364.
[17] T. Schultz, H.B. Dick, Laser-assisted mini-capsulotomy: a new technique for intumescent white cataracts, J. Refract. Surg. 30 (11) (2014) 742–745.
[18] S.P. Chee, N.S. Chan, Y. Yang, et al., Femtosecond laser-assisted cataract surgery for the white cataract, Br. J. Ophthalmol. 103 (4) (2019) 544–550.
[19] Y. Zhu, X. Chen, P. Chen, et al., Lens capsule-related complications of femtosecond laser-assisted capsulotomy versus manual capsulorhexis for white cataracts, J. Cataract Refract. Surg. 45 (3) (2019) 337–342.
[20] J.S. Christy, M. Nath, F. Mouttapa, R. Venkatesh, Learning curve of femtosecond laser-assisted cataract surgery: experience of surgeons new to femtosecond laser platform, Indian J. Ophthalmol. 65 (8) (2017) 683–689.
[21] W. Wang, X. Chen, X. Liu, X. Zhang, D. Lyu, K. Yao, Lens capsule-related complications in femtosecond laser-assisted cataract surgery: a study based on video analysis, Br. J. Ophthalmol. 107 (7) (2023) 906–911.
[22] T. Teshigawara, M. Akaishi, Y. Mizuki, et al., Modified technique of setting capsulotomy thickness in reducing capsulotomy-related complications during femtosecond laser-assisted cataract surgery: a prospective, comparative cohort study, Ophthalmol Ther 12 (5) (2023) 2621–2630.
[23] B. Sharma, R.G. Abell, T. Arora, et al., Techniques of anterior capsulotomy in cataract surgery, Indian J. Ophthalmol. 67 (4) (2019) 450–460.
[24] Y. Zeng, X. Liu, T. Wang, et al., Correlation between lens thickness and central anterior chamber depth, Eye Sci. 27 (3) (2012) 124–126.
[25] H. Hashemi, M. Khabazkhoob, M. Miraftab, et al., The distribution of axial length, anterior chamber depth, lens thickness, and vitreous chamber depth in an adult population of Shahroud, Iran, BMC Ophthalmol. 12 (2012) 50.
[26] M.R. Praveen, A.R. Vasavada, S.K. Shah, et al., Lens thickness of Indian eyes: impact of isolated lens opacity, age, axial length, and influence on anterior chamber depth, Eye 23 (7) (2009) 1542–1548.