Intraocular Lens Power Calculation in Eyes After Myopic Laser Refractive Surgery and Radial Keratotomy: Bayesian Network Meta-analysis

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• PURPOSE: To compare the accuracy of formulas for calculating intraocular lens power in eyes after myopic laser refractive surgery or radial keratotomy.
• DESIGN: Bayesian network meta-analysis.
• METHODS: PubMed, Embase, the Cochrane Data Base of Systematic Reviews, and the Cochrane Central Register of Controlled Trials databases were searched for retrospective and prospective clinical studies published from January 1, 2012, to August 24, 2022. The outcome measurement was the percentage of eyes with a predicted error within the target refractive range (±0.50 diopter [D] or ±1.00 D).
• RESULTS: Our meta-analysis includes 24 studies of 1172 eyes after myopic refractive surgery that use 12 formulas for intraocular lens power calculation. (1) A network meta-analysis showed that Barrett true-K no history, the optical coherence tomography (OCT) formula, and the Masket formula had a significantly higher percent of eyes within ±0.50 D of the goal than the Haigis-L formula, whereas the Wang-Koch-Maloney formula showed the poor predictability. Using an error criterion of within ±1.00 D, the same 3 formulas performed slightly better than the Haigis-L formula. Based on performance using both prediction error criteria, the Barrett true-K no history formula, OCT formula, and Masket formula showed the highest probability of ranking as the top 3 among the 12 methods. (2) A direct meta-analysis with a subset of 4 studies and 5 formulas indicated that formulas did not differ in percent success for either the ±0.5 D or ±1.0 D error range in eyes that had undergone radial keratotomy.
• CONCLUSIONS: The OCT, Masket, and Barrett true-K no history formulas are more accurate for eyes with previous myopic laser refractive surgery, whereas no significant difference was found among the formulas for eyes that had undergone radial keratotomy. (Am J Ophthalmol 2024;262: 48–61. © 2023 The Author(s). Published by Elsevier Inc. This is an open access article under the CC BY-NC license (http://creativecommons.org/licenses/by-nc/4.0/))

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Accurate intraocular lens (IOL) power calculation is key to successful cataract surgery but has also proved challenging for those who have previously had refractive surgery for myopia. This is currently a hot topic in the field, as the majority of myopic patients have high expectations of refractive outcomes after cataract surgery.[1] Unfortunately, conventional methods for IOL power calculation result in a high risk of postoperative hyperopia and even the need for IOL exchange.[2] Inaccuracy in the IOL power selection is due to 3 main factors:[2-4] (1) keratometric index error caused by the altered relationship between the anterior and posterior corneal surface;[5] (2) radius error, which occurs when automated keratometers focusing on the central 3.2 mm of the cornea miss the larger laser treatment optical zone;[4] and (3) estimated lens position error, as the third-generation formula uses inaccurate corneal powers to predict effective lens position.[6]

More than 30 methods have been developed to correct errors in IOL power calculation encountered in eyes with previous myopic refractive surgery. These methods are based on assumptions, regression formulas, and other approaches that attempt to correct for the above 3 sources of error, including historical methods that use previous keratometry or refractive data and nonhistorical methods that only use current biometric data. The clinical history method[4] is the earliest method used to calculate IOL power after corneal refractive surgery. The K value after refractive surgery (Kpost) to calculate the IOL power optical can be achieved accurately by using the K value before refractive surgery (Kpre) minus the change in refraction, and uses the Kpre to estimate the effective lens position.[7,8] Due to loss and inaccuracy in patients' prerefractive data, however, nonhistorical methods are typically more clinically useful, such as Haigis-L,[9] Barrett true-K no history,[10] BESSt,[5] optical coherence tomography (OCT) formula,[11] Sham-

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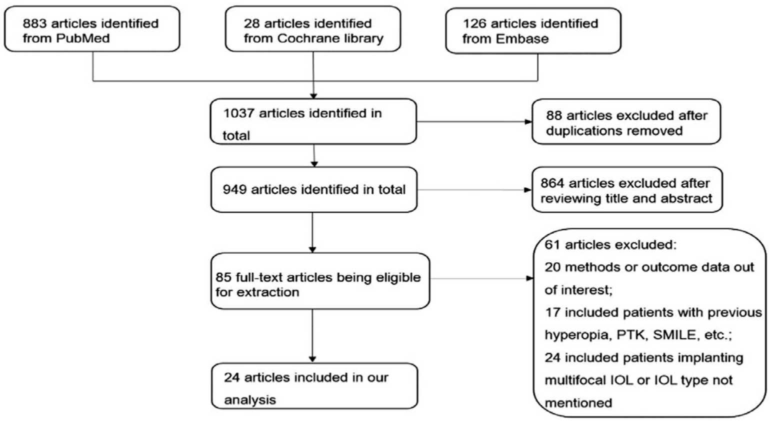

FIGURE 1. Flowchart of literature selection. IOL = intraocular lens, PTK = phototherapeutic keratectomy, SMILE = femtosecond laser small incision lenticule extraction.

mas post laser-assisted in situ keratomileusis (LASIK),[12,13] Wang-Koch-Maloney,[14] and others.

Previous studies trying to assess differences between formulas typically lack significance but also have small sample sizes. Early meta studies by Chen and associates[15] showed that the Haigis-L formula had good accuracy in IOL power calculation after corneal refractive surgery. Barrett true-K no history has been gradually recognized by ophthalmologists in recent years, but its accuracy in previous meta-analyses is still controversial. Li and associates[16] argued that the Barrett true-K no history formula is not superior to other formulas, whereas Wei and associates[17] found that the Barrett true-K, OCT, and optiwave refractive analysis (ORA) methods performed better in IOL power calculation for eyes with myopia laser refractive surgery. No formula exists that is generally accepted to be highly accurate for eyes after refractive surgery. On the other hand, the current meta-analysis of IOL formula selection in eyes with radial keratotomy (RK) is still rare. This meta-analysis aimed to compare the accuracy of formulas for calculating IOL power in eyes after myopic laser refractive surgery and RK.

DATA AND METHODS

• **LITERATURE SEARCH:** PubMed, Embase, the Cochrane Data Base of Systematic Reviews, and the Cochrane Central Register of Controlled Trials were searched for retrospective and prospective clinical studies from January 1, 2012, to August 24, 2022, using the following search terms:

> (Lenses Intraocular [Mesh] OR Intraocular Lens [Title/Abstract] OR Implantable Contact Lens [Title/Abstract] OR IOL [Title/Abstract]) AND (Refractive Surgical Procedures [Mesh] OR Laser Corneal Surgeries [Title/Abstract] OR Laser Keratectomy [Title/Abstract] OR Laser Corneal Surgeries [Title/Abstract] OR Keratomileusis, Laser In Situ [Mesh] OR LASIK [Title/Abstract] OR Laser-Assisted Stromal In Situ Keratomileusis [Title/Abstract] OR Photorefractive Keratectomy [Mesh] OR PRK [Title/Abstract] OR Radial Keratotomy[Title/Abstract] OR RK[Title/Abstract]) AND (calculate* OR formula*)

There was no restriction placed on the language of the publication. Two independent reviewers conducted a preliminary review of the titles and abstracts of all returned studies. Once duplicates were removed and titles and abstracts reviewed, 85 full articles were analyzed to select studies that met the inclusion and exclusion criteria (Figure 1).

• **SELECTION CRITERIA:** The inclusion criteria were as follows: (1) individuals with a corneal refractive surgery history, including laser in situ keratomileusis, photorefractive keratectomy (PRK), laser-assisted subepithelial keratomileusis for myopia, and RK, who were treated with uneventful phacoemulsification and IOL implantation for cataract; (2) at least 2 selected IOL power calculation formulas were used (including Haigis-L, Shammas-PL, Barrett true-K, Barrett true-K no history, Wang-Koch-Maloney, SRK-T, OCT, ORA, Masket, modified-Masket, American Society of Cataract and Refractive Surgery (ASCRS) average, and Holladay 2);[10,11,18-39] and (3) the postoperative refractive results (≥3-week follow-up) provided the percentage of eyes whose prediction error was within the target refraction (% within ±0.50 diopter [D] or % within ±1.00 D).

The exclusion criteria were as follows: (1) patients who had hyperopic refractive surgery or phototherapeutic keratectomy surgery; (2) patients with other vision disorders, for example, glaucoma, uveitis, or macular degeneration; (3) patients using multifocal, extended depth of focus, or piggyback IOL; and (4) review articles or discussion papers, conference abstracts, or studies performed on animals.

• **DATA EXTRACTION:** Two researchers used EndNote X9 to independently screen and enter data into the retrieved literature, and then cross-checked to verify its accuracy. Where disagreement occurred, the researchers discussed it, consulting a third researcher, if necessary, to reach a consensus. The extracted data included first author, year of publication, country, study type, study group, sample size, gender, age, eye axial length (AL), follow-up time, formulas used, outcome index, and study conclusion.

• **QUALITY EVALUATION:** Bias risk and applicability were assessed according to the adjusted QUADAS-2 tool,[16,40] and RevMan v. 5.4.1 was used for meta-analysis.

• **OUTCOME MEASUREMENT:** The outcome measurement was the percentage of eyes with a predicted error within the target refraction range (±0.50 D or ±1.00 D).

• **STATISTICAL ANALYSIS:** Stata v. 16.0 was used to conduct a network meta-analysis of the final included literature. All indicators used were continuous data. On the premise of consistent measurement methods and tools, mean difference is used as the effect scale; otherwise, standardized mean difference is used. Confidence intervals (95% CI) were used for each effect indicator, and the significance level of all statistical analyses was set as $P \leq .05$.

The heterogeneity test used I^2 and P values as follows: if $P < .1$ and $I^2 < 50\%$ = low heterogeneity among studies, a fixed effects model was used; if $P \leq .1$ and $I^2 \geq 50\%$ = high heterogeneity among studies, a random effects model was used. Subsequent subgroup and sensitivity analyses were conducted to find the source of the heterogeneity. Sensitivity analysis was conducted by removing studies one at a time to test for changes in the effect estimate. Stata v. 16.0 was used to produce the network plot and the comparison-correction funnel plot of publication bias. The surface under the cumulative ranking curve (SUCRA) ranking results of each formulas were calculated, and a ranking chart was drawn to rank formulas for accurate IOL power calculation.

RESULTS

• **LITERATURE SELECTION:** Of the 1037 articles retrieved from the search, after screening according to strict inclusion and exclusion criteria, 24 studies qualified for further analysis.[10,11,18-39] A flowchart of the literature screening process is shown in Figure 1.

• **CHARACTERISTICS OF STUDY PARTICIPANTS:** Table 1 shows the basic characteristics of the included studies. In summary, of the 24 studies, 7 were prospective case series studies, 1 was a combination of a prospective and retrospective case series study, and 16 were retrospective case series studies. A total of 1172 eyes that had undergone refractive surgery were analyzed. The enrolled patients ranged in age from 39 to 74 years with a mean AL of 23.80 to 32.93 mm and were followed up for ≥3 weeks. The included studies used 12 formulas: Haigis-L, Shammas-PL, Barrett true-K, Barrett true-K no history, Wang-Koch-Maloney, SRK-T, OCT formula, ORA formula, Masket, modified-Masket, ASCRS average, and Holladay 2.

• **QUALITY ASSESSMENT:** Bias risk and applicability were assessed according to the adjusted QUADAS-2 tool. In terms of patient selection, 3 studies did not introduce the time category of case inclusion, leading to a high risk of bias. Nine studies did not clarify patient enrollment methods, leading to an unclear risk of bias. For reference standard and flow assessment, subjective refraction was performed in 3 studies, and follow-up time was not explicitly mentioned in 3 studies. For the index test, all 24 studies were of high quality (See Supplementary Figure 1 for details). The result, as drawn by RevMan, is shown in Figure 2.

• **NETWORK META-ANALYSIS RESULTS:**

The network plot

A network plot of the original direct comparisons of 11 formulas is shown in Figure 3. Each dot represents a different formula, and dot sizes indicate the number of eyes using the formula. The lines represent direct comparisons between formulas, and their thickness is proportional to the number of studies. Haigis-L (18 studies) and Shammas-PL (17 studies) are the 2 most compared formulas, followed by Barrett true-K no history (9 studies). Recently developed formulas such as OCT were typically compared with current popular methods.

Statistical heterogeneity and inconsistency

A heterogeneity test conducted for the closed loop formed was not statistically significant, but some IF values were on the high side. Direct meta-analysis indicated low heterogeneity, with $I^2 = 26.6\%$, $P > .05$; thus, a random effects model was used for analysis. The Higgins[41] and associates model indicated good consistency. The local inconsistency test conducted using the node-splitting method indicated that studies were consistent ($P > .05$). Therefore, network meta-analysis was conducted under the consistency model (see Supplemental chart 2- 6 for details).

Prediction error within ±0.50 D

Bayesian network meta-analysis was used to evaluate the percentage of eyes within ±0.50 D for the combined direct and indirect comparisons of the 11 methods. Forest plot results of the Bayesian network meta-analysis are shown in Figure 4. The Barrett true-K no history formula (pooled risk ratio [RR] = 1.43; 95% credible interval [CrI]: 1.12-1.81), OCT formula (pooled RR = 1.88; 95% CrI: 1.27-2.80), and Masket formula (pooled RR = 1.78; 95% CrI: 1.17-2.71) were significantly better than the Haigis-L formula, whereas the Wang-Koch-Maloney formula (pooled RR = 0.75; 95% CrI: 0.57-0.99) had poor performance. The Shammas-PL

TABLE 1. Basic Characteristics of the Included Articles

Author	Year	Study Design	Type	Eyes	Mean Age	AL (mm)	Follow-up	Formula										
								Haigis-L	Shammas-PL	BTK	BTK-NH	WKM	SRK-T	OCT	Masket	mo-Masket	ASCRS	Holladay-2
Tang	2012	Prospective	LASIK	16	59.4 ± 11.9	NA	NA	√						√				
Huang	2013	Prospective	LASIK/PRK	46	61.5 ± 8.0	NA	1 mo	√	√					√				
Saiki	2013	Retrospective	LASIK	25	54.0 ± 9.9	26.39 ± 0.99	1 mo	√	√				√		√	√		
Saiki	2013	Retrospective	LASIK	28	54.1 ± 9.8	26.19 ± 1.06	1 mo	√	√				√		√	√		
Saiki	2014	Retrospective	LASIK	24	54.0 ± 10.6	NA	1 mo	√	√				√					
Savini	2015	Prospective	LASIK	30	50.1 ± 9.2	27.06 ± 2.05	NA		√						√			
Wang	2015	Prospective	LASIK/PRK	104	63.0 ± 7.0	25.46 ± 1.30	3 wk-3 mo	√	√		√	√		√				
Wong	2015	Retrospective	LASIK/PRK	62	51.3 ± 9.4	27.70 ± 1.53	NA	√										√
Abulafia	2016	Retrospective	LASIK/PRK	58	NA	25.85 ± 1.35	3 wk	√	√		√	√			√	√	√	
Helay	2016	Prospective and Retrospective	LASIK	45	51.3 ± 7.3	28.66 ± 2.78	1-4 mo	√	√				√					
Ma	2016	Retrospective	RK	65	64.0 ± 6.0	25.50 ± 1.48	4 mo				√			√			√	
Wu	2017	Prospective	LASIK	10	50.3 ± 9.0	30.06 ± 2.87	3 mo	√	√									
Cho	2018	Prospective	LASIK	56	54.6 ± 9.4	27.04 ± 2.36	3 mo	√		√	√	√						
Savini	2018	Prospective	LASIK/PRK	22	56.4 ± 8.3	26.70 ± 1.70	NA		√		√							
Savini	2019	Retrospective	LASIK	50	58.2 ± 7.9	27.17 ± 1.57	NA		√	√					√			
Menon	2020	Retrospective	LASIK	41	48.0 ± 9.0	28.02 ± 2.71	1 mo	√									√	
Turnbull	2020	Retrospective	LASIK/PRK	36	65.0 ± 8.0	24.98 ± 0.87	4-6 wk			√	√							
Fang	2021	Retrospective	LASIK	29	56.1 ± 8.8	30.71 ± 1.14	1 mo	√	√		√		√					√
Dawson	2021	Retrospective	RK	47	66.3 ± 7.5	25.40 ± 1.60	3-4 mo				√							
Sandoval	2021	Retrospective	LASIK	101	67.0 ± 7.0	25.16 ± 1.13	3 wk	√	√		√	√					√	
Yeo	2021	NA	LASIK/PRK	64	56.0 ± 7.0	27.47 ± 1.71	1 mo	√	√		√		√					
Lida	2022	Retrospective	LASIK	59	59.0 ± 9.3	27.01 ± 1.94	1 mo	√	√		√							
Li	2022	Retrospective	LASIK/PRK	31	52.0 ± 8.9	28.52 ± 2.48	6 mo	√	√		√							

AL = axial length, ASCRS = ASCRS average, BTK = Barrett true-K, BTK-NH = Barrett true-K no history, LASIK = laser-assisted in situ keratomileusis, mo-Masket = modified-Masket, NA = not available, OCT = optical coherence tomography formula, PL = post-LASIK, PRK = photorefractive keratectomy, WKM = Wang-Koch-Maloney.

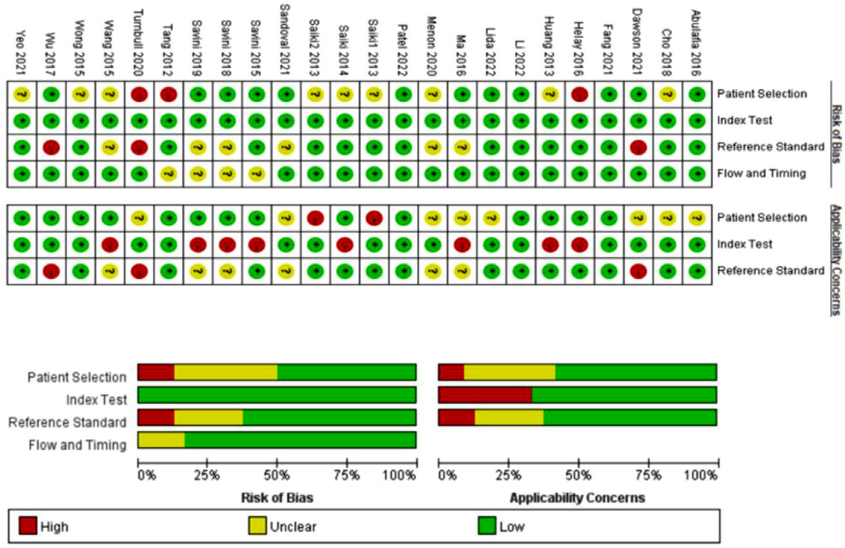

FIGURE 2. Risk of bias of the included studies.

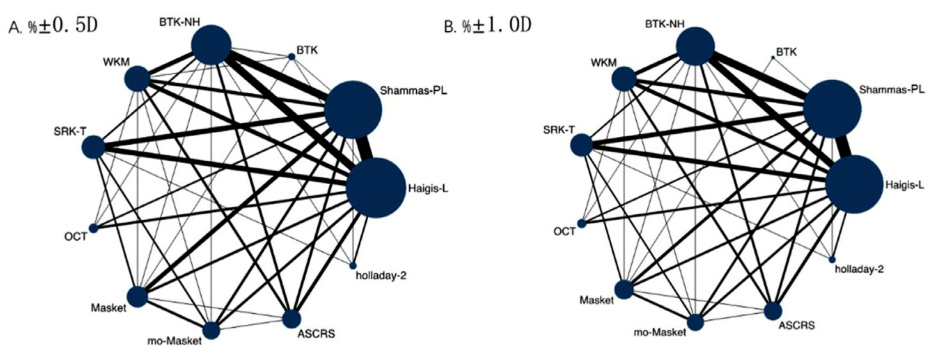

FIGURE 3. A network plot. Different dots represent different formulas, and their sizes represent the number of eyes using the formula. The lines represent direct comparisons between formulas, and their thickness is proportional to the number of studies. A. A network plot of the percentage of prediction error within ±0.50 D of the target refraction (% ±0.50 D). B. A network plot of the percentage of prediction error within ±1.00 D of the target refraction (% ±1.00 D). ASCRS = American Society of Cataract and Refractive Surgery, BTK = Barrett true-K, BTK-NH = Barrett true-K no history, D = diopter, mo-Masket = modified-Masket, OCT = optical coherence tomography formula, ORA = optiwave refractive analysis, WKM = Wang-Koch-Maloney.

formula performed equally well or better than the Haigis-L formula (pooled RR = 1.05; 95% CrI: 0.84-1.30). No significant difference occurred between other formula pairs ($P > .05$; Table 2). The surface under the cumulative ranking curve rank probabilities and Bayesian posterior estimates of the % eyes within ±0.50 D are presented in Figure 5, A. All formulas were ranked from best (1) to worst (11); percentages reveal the probability of each formula being in each rank position (Figure 5, B). To make results more intuitive, we plot the sorting probabilities of the various formulas in Figure 5, C.

Prediction error within ±1.00 D

No significant differences occurred between pairs of formulas ($P > .05$) for the percentage of eyes meeting the error within ±1.00 D criterion (Table 3). For the percentage of eyes within ±1.00 D, the Barrett true-K no history (pooled RR = 1.50; 95% CrI: 0.99-2.26), Masket (pooled RR = 1.98; 95% CrI: 0.96-4.12), and OCT formulas (pooled RR = 1.95; 95% CrI: 0.90-4.20) performed slightly better than the Haigis-L formula. The ranking results of the network meta-analysis were as follows (from best to worst): Barrett true-K (78%) > Masket (77.8%) > OCT formula (77.1%) > Barrett true-K no history (64.6%) > ASCRS average (61.9%) > mo-Masket (61%) > Shammas-PL (46.9%) > SRK-T (36.2%) > Haigis-L (26.2%) > Wang-Koch-Maloney (14.1%) > Holladay-2 (6.1%) (Figure 6).

Risk of bias

The comparison-correction funnel plot for the percentage of eyes within ±0.50 D was created using Stata v. 14.2. All

TABLE 2. Results of Network Meta-analysis on the Percentage of Eyes With Prediction Error Within ±0.50 diopter With Different Formulas

B	C	D	E	F	G	H	I	J	K	A
B	0.66 (0.40, 1.07)	1.36 (1.08, 1.73)	0.72 (0.54, 0.95)	1.12 (0.77, 1.63)	1.80 (1.21, 2.68)	1.70 (1.13, 2.55)	1.25 (0.76, 2.07)	1.21 (0.87, 1.69)	0.92 (0.52, 1.63)	0.96 (0.77, 1.19)
1.52 (0.93, 2.49)	C	2.08 (1.26, 3.43)	1.09 (0.65, 1.83)	1.71 (0.94, 3.09)	2.74 (1.49, 5.03)	2.59 (1.47, 4.57)	1.91 (0.98, 3.74)	1.84 (1.05, 3.23)	1.40 (0.68, 2.90)	1.46 (0.89, 2.39)
0.73 (0.58, 0.93)	0.48 (0.29, 0.79)	D	0.53 (0.39, 0.70)	0.82 (0.55, 1.22)	1.32 (0.87, 1.99)	1.25 (0.81, 1.92)	0.92 (0.55, 1.53)	0.89 (0.63, 1.25)	0.67 (0.38, 1.20)	0.70 (0.55, 0.89)
1.39 (1.05, 1.85)	0.92 (0.55, 1.53)	1.90 (1.43, 2.53)	E	1.56 (1.02, 2.41)	2.51 (1.63, 3.87)	2.37 (1.51, 3.72)	1.75 (1.03, 2.96)	1.69 (1.18, 2.41)	1.28 (0.70, 2.34)	1.33 (1.01, 1.76)
0.89 (0.61, 1.29)	0.59 (0.32, 1.06)	1.22 (0.82, 1.80)	0.64 (0.41, 0.98)	F	1.60 (0.96, 2.69)	1.51 (0.90, 2.55)	1.12 (0.62, 2.02)	1.08 (0.67, 1.73)	0.82 (0.44, 1.54)	0.85 (0.59, 1.24)
0.56 (0.37, 0.83)	0.36 (0.20, 0.67)	0.76 (0.50, 1.15)	0.40 (0.26, 0.61)	0.62 (0.37, 1.05)	G	0.94 (0.55, 1.63)	0.70 (0.38, 1.29)	0.67 (0.41, 1.09)	0.51 (0.26, 0.99)	0.53 (0.36, 0.79)
0.59 (0.39, 0.88)	0.39 (0.22, 0.68)	0.80 (0.52, 1.24)	0.42 (0.27, 0.66)	0.66 (0.39, 1.11)	1.06 (0.61, 1.83)	H	0.74 (0.41, 1.32)	0.71 (0.44, 1.15)	0.54 (0.27, 1.07)	0.56 (0.37, 0.86)
0.80 (0.48, 1.32)	0.52 (0.27, 1.03)	1.09 (0.65, 1.82)	0.57 (0.34, 0.97)	0.89 (0.49, 1.62)	1.44 (0.78, 2.66)	1.35 (0.76, 2.42)	I	0.96 (0.56, 1.67)	0.73 (0.35, 1.53)	0.76 (0.46, 1.27)
0.83 (0.59, 1.16)	0.54 (0.31, 0.95)	1.13 (0.80, 1.58)	0.59 (0.41, 0.85)	0.93 (0.58, 1.49)	1.49 (0.92, 2.42)	1.40 (0.87, 2.27)	1.04 (0.60, 1.79)	J	0.76 (0.41, 1.43)	0.79 (0.56, 1.11)
1.09 (0.61, 1.93)	0.71 (0.34, 1.48)	1.48 (0.83, 2.64)	0.78 (0.43, 1.42)	1.22 (0.65, 2.30)	1.96 (1.01, 3.81)	1.85 (0.94, 3.64)	1.36 (0.65, 2.84)	1.32 (0.70, 2.47)	K	1.04 (0.60, 1.80)
1.05 (0.84, 1.30)	0.69 (0.42, 1.13)	1.43 (1.12, 1.81)	0.75 (0.57, 0.99)	1.17 (0.81, 1.70)	1.88 (1.27, 2.80)	1.78 (1.17, 2.71)	1.31 (0.79, 2.18)	1.27 (0.90, 1.77)	0.96 (0.56, 1.67)	A

A = Haigis-L, B = Shammas-PL, C = Barrett true-K, D = Barrett true-K no history, E = Wang-Koch-Maloney, F = SRK-T, G = optical coherence tomography formula, H = Masket, I = modified-Masket, J = ASCRS average, K= Holladay-2.

TABLE 3. Results of Network Meta-analysis on the Percentage of Eyes With Prediction Error Within ±1.00 diopter With Different Formulas

B	C	D	E	F	G	H	I	J	K	A
B	1.84 (0.51, 6.62)	1.19 (0.79, 1.79)	0.66 (0.41, 1.07)	0.88 (0.52, 1.50)	1.55 (0.71, 3.38)	1.58 (0.78, 3.21)	1.32 (0.56, 2.70)	1.20 (0.64, 2.23)	0.45 (0.19, 1.05)	0.80 (0.56, 1.13)
0.54 (0.15, 1.95)	C	0.65 (0.17, 24.5)	0.36 (0.09, 1.39)	0.48 (0.12, 1.90)	0.84 (0.19, 3.74)	0.86 (0.23, 3.22)	0.67 (0.15, 2.92)	0.65 (0.16, 2.66)	0.25 (0.05, 1.13)	1.43 (0.12, 1.61)
0.84 (0.56, 1.26)	1.55 (0.41, 5.86)	D	0.55 (0.33, 0.92)	0.74 (0.41, 1.34)	1.30 (0.58, 2.94)	1.33 (0.61, 2.86)	1.03 (0.45, 2.37)	1.01 (0.35, 1.92)	0.38 (0.16, 0.90)	0.67 (0.44, 1.01)
1.52 (0.94, 2.45)	2.79 (0.72, 10.78)	1.80 (1.08, 3.01)	E	1.34 (0.69, 2.59)	2.35 (1.01, 5.45)	2.39 (1.08, 5.30)	1.86 (0.79, 4.37)	1.81 (0.93, 3.52)	0.68 (0.27, 1.71)	1.21 (0.74, 1.96)
1.13 (0.67, 1.92)	2.08 (0.53, 8.21)	1.35 (0.75, 24.2)	0.75 (0.39, 1.44)	F	1.75 (0.71, 4.31)	1.79 (0.78, 4.11)	1.39 (0.57, 3.37)	1.35 (0.63, 2.91)	0.51 (0.21, 1.27)	0.90 (0.53, 1.52)
0.65 (0.30, 1.41)	1.19 (0.27, 5.27)	0.77 (0.34, 1.73)	0.43 (0.18, 0.99)	0.57 (0.23, 1.40)	G	1.02 (0.37, 2.83)	0.79 (0.27, 2.32)	0.77 (0.30, 2.00)	0.29 (0.10, 0.87)	0.51 (0.24, 1.11)
0.63 (0.31, 1.29)	1.17 (0.31, 4.37)	0.75 (0.35, 1.63)	0.42 (0.19, 0.93)	0.56 (0.24, 1.29)	0.98 (0.35, 2.73)	H	0.78 (0.30, 2.02)	0.76 (0.31, 1.83)	0.29 (1.10, 0.83)	0.50 (0.24, 1.05)
0.81 (0.37, 1.79)	1.05 (0.36, 6.54)	0.97 (0.42, 2.23)	0.54 (0.23, 1.26)	0.72 (0.30, 1.74)	1.26 (0.43, 3.68)	1.29 (0.50, 3.33)	I	0.97 (0.38, 2.48)	0.37 (0.12, 1.11)	0.66 (0.29, 1.43)
0.84 (0.45, 1.56)	1.54 (0.38, 6.29)	1.00 (0.52, 1.90)	0.55 (0.28, 1.07)	0.74 (0.34, 1.59)	1.30 (0.50, 3.35)	1.32 (0.55, 3.18)	1.03 (0.40, 2.61)	J	0.38 (0.14, 1.02)	0.67 (0.36, 1.24)
2.22 (0.95, 5.16)	4.08 (0.89, 18.72)	2.64 (1.11, 6.25)	1.46 (0.58, 3.67)	1.96 (0.79, 4.87)	3.43 (1.14, 10.31)	3.50 (1.21, 10.15)	2.72 (0.90, 8.27)	2.65 (0.78, 7.19)	K	1.76 (0.79, 3.96)
1.26 (0.89, 1.78)	2.31 (0.62, 8.59)	1.50 (0.99, 2.26)	0.83 (0.51, 1.35)	1.11 (0.66, 1.87)	1.95 (0.90, 4.20)	1.98 (0.96, 4.12)	1.54 (0.70, 3.40)	1.50 (0.81, 2.80)	0.57 (0.25, 1.27)	A

A = Haigis-L, B = Shammas-PL, C = Barrett true-K, D = Barrett true-K no history, E = Wang-Koch-Maloney, F = SRK-T, G = optical coherence tomography formula, H = Masket, I = modified-Masket, J = ASCRS average, K= Holladay-2.

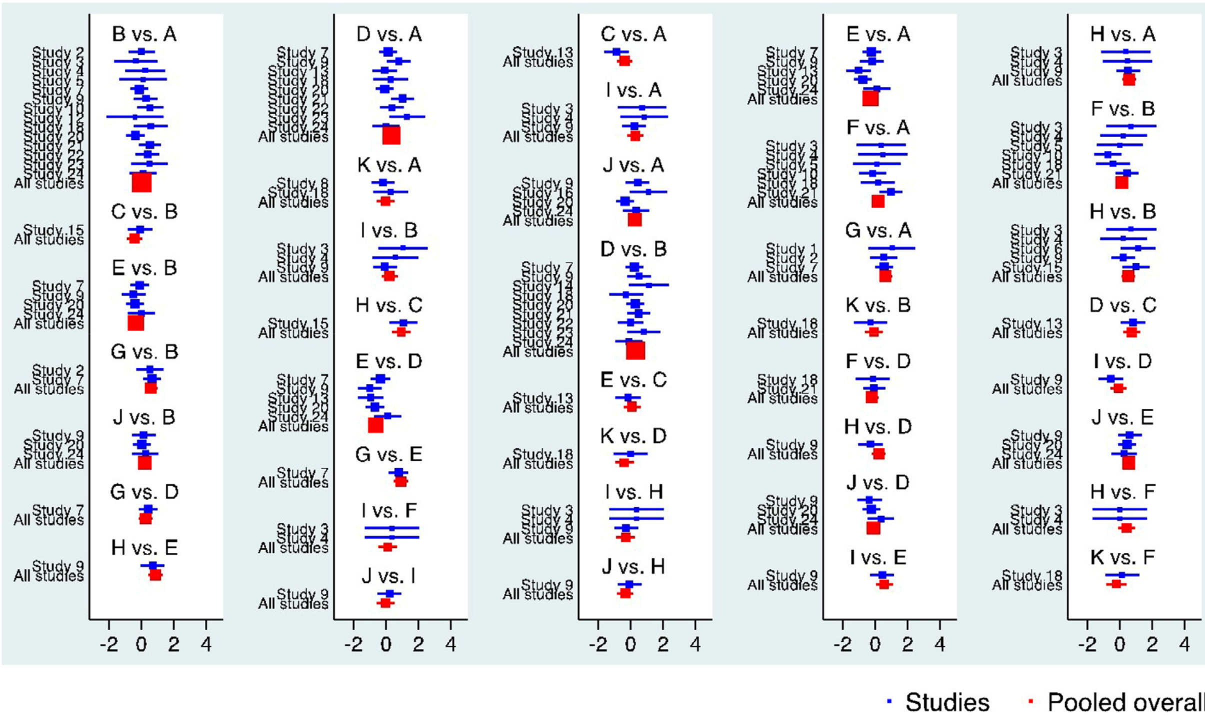

FIGURE 4. Forest plot results of the Bayesian network meta-analysis. A = Haigis-L, B = Shammas-PL, C = Barrett true K, D = Barrett true K no history, E = Wang-Koch-Maloney, F = SRK-T, G = optical coherence tomography formula, H = Masket, I = modified-Masket, J = ASCRS average, K = Holladay-2.

points are distributed centrally in the middle of the funnel plot and symmetric, indicating that a small sample effect or publication bias of studies is less likely (Figure 7).

• **RESULTS FOR PATIENTS WHO HAD RK:** Four studies were included to compare the performance of Barrett true-K, Barrett true-K no history, OCT formula, ORA formula, and ASCRS average.[27,32,34,39] Due to the small amount of data, the network model did not converge. Direct meta-analysis was used for comparison, and the results are shown in Figure 8. There was no significant difference between the formulas for percentage within ±0.5 D or for percentage within ±1.0 D ($P > .05$).

DISCUSSION

For most ophthalmologists, IOL power calculation after myopia laser surgery is undoubtedly difficult. In recent years, this has led many ophthalmologists to develop new formulas. Chen and associates[15] analyzed 9 studies and concluded that the Masket method, the Shammas no history and Shammas-PL formulas, and the Haigis-L method have the highest accuracy. Li and associates[16] compared the accuracy of IOL power calculation formulas after myopia laser surgery without historical data and found that the accuracy of the ASCRS average, Barrett true-K no history, and OCT formulas were the most accurate. Chen and associates[42] found the recommended Haigis-L formula for the calculation of IOL power in eyes with no previous data if available. According to Wen and associates,[43] ORA, BESSt, and Double-K SRK/T were the top 3 no-history formulas in eyes with myopic corneal laser refractive surgery. However, because of the inherent limitations of traditional meta-analysis methods, the above study evaluated the differences between the Haigis-L formula and other formulas and could not directly test which formula was the most accurate in predicting the power of IOL after myopia laser surgery. As an extension of traditional meta-analysis, Bayesian network meta-analysis has the advantage that it can indirectly compare the performances of different IOL power calculation formulas through a common control. After combining the results of direct comparison and indirect comparison, the percentage of eyes falling within prediction errors ±0.50 D and ±1.00 D can be ranked to provide evidence-based medical information for clinical selection of the appropriate IOL power calculation formula.[44] Wei and associates[17] used Bayesian meta-analysis to analyze the performances of 13 methods for calculating the degree of IOL. In order to better solve the problem of IOL measurement in cataract patients after refractive surgery, we screened the formula based on the research of Wei and associates. Some formulas was omitted because of the poor predictability, such as adjusted Atlas 0-3, adjusted Atlas 9000 (4.0 mm zone), and adjusted effective refractive power. The ORA formula is also not in-

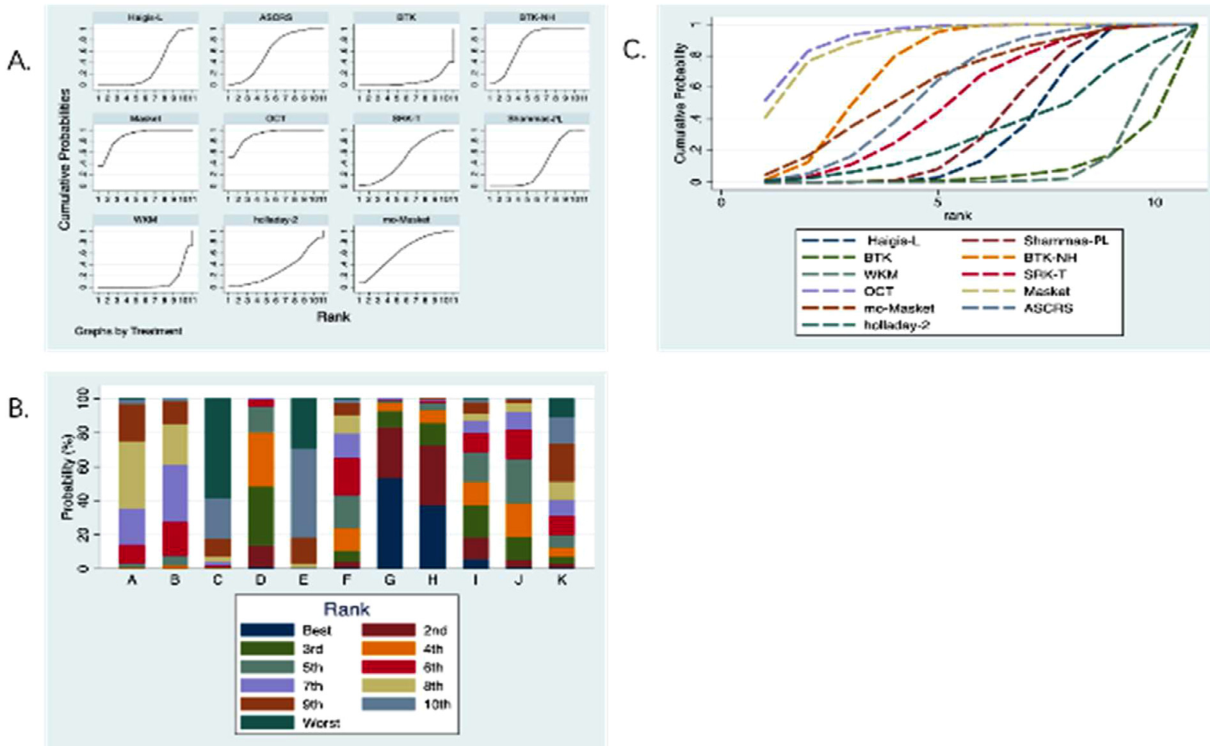

FIGURE 5. SUCRA ranking charts of the percentage of prediction error within ±0.50 D with different formulas. A. The ranking results of network meta-analysis from best to worst were OCT (92.6%) > Masket (88.6%) > BTK-NH (74.4%) > mo-Masket (61.9%) > ASCRS (60.3%) > SRK-T (50.9%) > Shammas NH (38.1%) > Holladay-2 (34.6%) > Haigis-L (32.6%) > WKM (8.8%) > BTK (7.2%). B. Ranking probabilities for the 11 formulas at all positions (ranks 1-11) according to the accuracy performance of the method. C. The ranking of various formulas plotted to make results more intuitive. ASCRS = American Society of Cataract and Refractive Surgery, BTK-NH = Barrett true-K no history, D = diopter, OCT = optical coherence tomography formula, SUCRA = surface under the cumulative ranking curve, WKM = Wang-Koch-Maloney.

cluded because of its relatively small use. The ASCARS formula was also incorporated because of its growing popularity among surgeons. We thus used a Bayesian network meta-analysis to analyze 24 studies conducted in the last decade and compared 12 frequently used IOL calculation power formulas. We conclude that the OCT, Masket, and Barrett true-K no history formulas are most accurate for eyes with previous myopic laser refractive surgery.

Scientists have developed many empirical formulas to calculate IOL power, such as predicting corneal data before surgery or using accurate measuring instruments to measure actual corneal refractive power after surgery. In our study, both the OCT and Masket formulas were superior to other methods within the ±0.5 D and ±1.0 D ranges, and OCT without historical data was better than the Masket formula using prerefractive data, which is consistent with a previous Bayesian meta-analysis.[17]

OCT is a noncontact imaging technology that can simultaneously measure the anterior and posterior corneal power with high axial resolution and accuracy. Tang and associates[11] reported a formula for calculating IOL power based on OCT that requires 6 biological measurements, including AL, anterior chamber depth, lens thickness, central corneal thickness, anterior corneal power, and posterior corneal power. Net corneal power (NCP) was calculated according to the Gaussian thick lens formula. A regression formula was used to convert NCP into effective corneal power (ECP):

$$\text{ECP} = 1.0208 \times \text{NCP} - 1.6622.$$

In eyes that have not undergone refractive surgery or RK, the OCT formula is comparable to the standard theoretical formula and better at predicting refractive outcomes, with 78% of eyes having a prediction error of less than ±0.50 D.

Masket and associates[45] suggested that traditional methods for estimating corneal power after excimer laser ablation were inaccurate and that it was difficult to determine the appropriate IOL power. They proposed a correction formula for calculating the power of IOL:

$$\text{IOL Power Adjustment} = \text{LSE} \times (-0.326) + 0.101,$$

where LSE is the total prior laser treatment, adjusted for vertex distance, in SE. The refractive error of 32 eyes reported

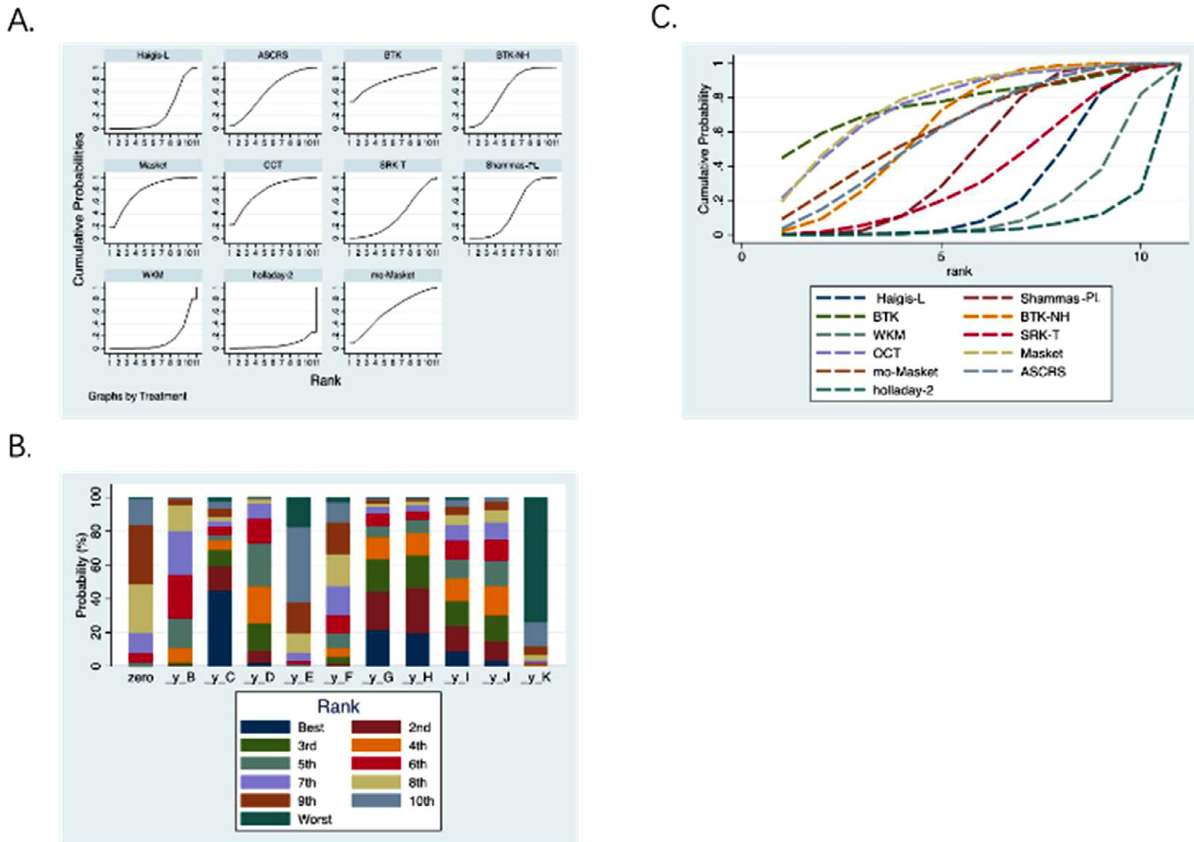

FIGURE 6. SUCRA ranking charts of the percentage of eyes that have prediction error within ±1.0 D with different formulas. A. The ranking results of network meta-analysis from best to worst were Barrett true-K (78%) > Masket (77.8%) > OCT formula (77.1%) > BTK-NH (64.6%) > ASCRS average (61.9%) > mo-Masket (61%) > Shammas-PL (46.9%) > SRK-T (36.2%) > Haigis-L (26.2%) > WKM (14.1%) > Holladay-2 (6.1%). B. Ranking probabilities for 11 methods at all positions (ranks 1-11) according to the accuracy of the method. C. The ranking of various formulas plotted to show results more intuitively. ASCRS = American Society of Cataract and Refractive Surgery, BTK-NH = Barrett true-K no history, D = diopter, OCT = optical coherence tomography formula, SUCRA = surface under the cumulative ranking curve, WKM = Wang-Koch-Maloney.

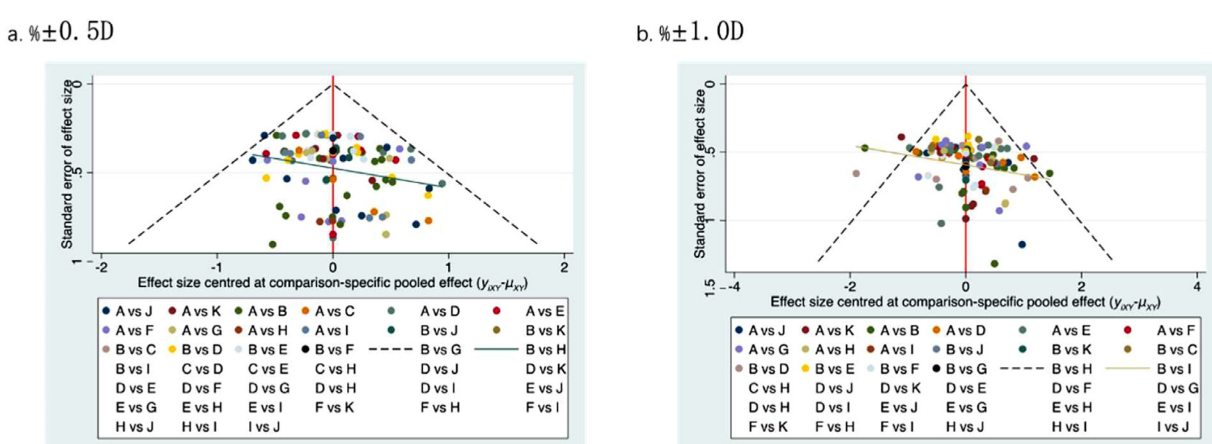

FIGURE 7. Comparison-correction funnel plot. A. Comparison-correction funnel plot for the percentage of eyes within prediction error ±0.50 D of the target refraction. B. Comparison-correction funnel plot for the percentage of eyes within prediction error ±1.00 D of the target refraction. In the figure, the abscissa is the effect size, and the ordinate is the standard error. Points are centrally distributed and symmetric, suggesting no small sample effect or publication bias. A = Haigis-L, B = Shammas-PL, C = Barrett true K, D = Barrett true K no history, E = Wang-Koch-Maloney, F = SRK-T, G = optical coherence tomography formula, H =Masket, I = modified-Masket, J = ASCRS average, K = Holladay-2.

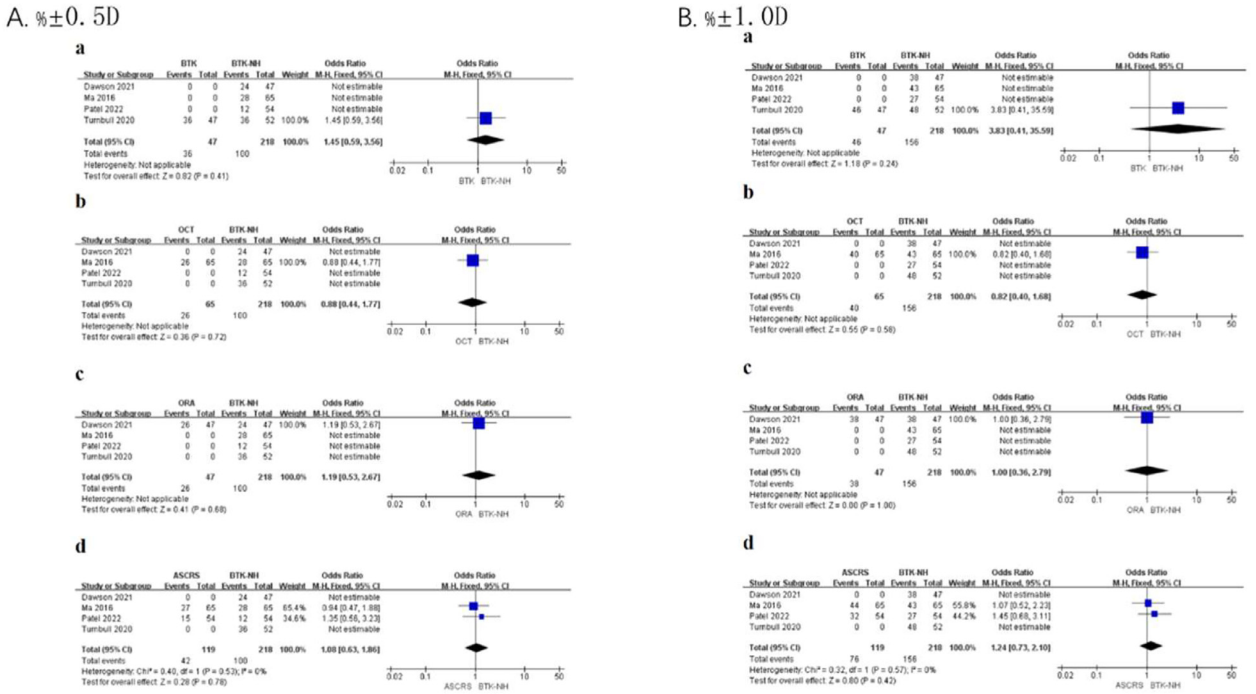

FIGURE 8. Direct meta-analysis. A. Forest plots comparing the percentage of refractive prediction error within ±0.5 D after RK between BTK-NH and (a) Barrett True-K, (b) OCT formula, (c) ORA formula, and (d) ASCRS average. B. Forest plots comparing the percentage of the refractive prediction error within ±1.0 D after RK. ASCRS = American Society of Cataract and Refractive Surgery, BTK-NH = Barrett true-K no history, D = diopter, OCT = optical coherence tomography formula, ORA = optiwave refractive analysis, RK = radial keratotomy.

after LASIK/PRK was within ±0.75 D. The Masket formula requires the use of LASIK/PRK preoperative data and is not applicable for patients without preoperative data. Although the relationship between the anterior and posterior corneal keratometry remains unaltered, the Masket formula is not suitable for eyes after RK. Peripheral weakening causes flattening of the center corneal, making it difficult to obtain accurate direct central corneal power readings.

Different from the study of Li and associates,[16] we found that the performance of the Barrett true-K no history formula was significantly better than that of the Haigis-L formula. The Barrett true-K formula is based on Barrett Universal II. This formula can be used to calculate the corneal keratometry change in eyes after LASIK, PRK, and RK for myopia or hypermetropia with the change in refraction. It can also be used without considering the surgically induced change in refraction because it uses an internal regression formula to calculate an estimated change in manifest refraction when those data are not entered; we refer to this as the Barrett true-K no history formula. Barrett true-K and Universal II formulas, whose design details have not yet been released, are available on the Asia Pacific Association of Cataract and Refractive Surgeons (APARCS) website and are considered the most accurate formulas for calculating IOL power in eyes after corneal refractive surgery.[10,24,46,47]

IOL power calculation in eyes after RK remains a difficult problem and relevant studies are few; our analysis included only 4 such studies. The performances of Barrett true-K, Barrett true-K no history, OCT formula, ORA formula, and ASCRS average were compared. However, no significant differences were found, and their accuracy was not satisfactory. Further research is needed.

Multifocal IOL is increasingly popular in ophthalmic clinical settings. However, patients with multifocal IOL are more likely to complain about halos and glare. Yao and associates[48] stated that although eyes after refractive corneal surgery such as RK, LASIK, and PRK are not absolute contraindications for multifocal IOL implants, patients need to be informed of the risk of poor-quality vision because of significantly reduced contrast sensitivity. Alio and associates[49] noted that residual myopia or hypermetropia should be evaluated by comparing the defocus curve; otherwise, either the distal or proximal focus of a single refractive multifocal IOL can lead to serious errors. For this reason, we did not include studies involving multifocal or extended depth of focus IOL in our analysis. In the late 1990s, optical biometrics as a noncontact technique had a better postoperative refractive prognosis than squishing and immersion biometrics.[50] Therefore, to control heterogeneity and bias, we also excluded studies using ultrasound. With the development of optical biometrics, Pentacam has become a new kind of biometrics instrument because of its ability to measure abundant anterior segment parameters,[51] which is the anterior segment analyzer designed based on the Scheimpflug photographic principle. In recent years, the IOL Master700 based on sweep-source OCT has gained popularity because of its good axial detection rate.[52,53] However, our analysis only included studies using partial coherence interferometry (PCI) to measure optical biometric data and did not compare the difference in residual refraction prediction of different device measurement parameters used in IOL calculation formulas. Further studies are needed to further understand the clinical use of different devices. Scholars have found that in addition to the clinical history method, Orbscan II mean power maps can also be used to obtain accurate corneal power. The specific method is to use Orbscan II–derived mean corneal power at 1.5 mm and combined with IOL calculation formulas, such as the SRK-T formula. It affords an accurate measurement of IOL power for planned cataract surgery. The methods used in various studies to obtain corneal power are different, including Orbscan II, IOL Master700, Pentacam, and so on, which may lead to the lack of consistency in the comparison of the formulas and require further discussion.[54–56]

In recent years, with updated methods for calculating IOL power, the postoperative refractive error for more than 55% of conventional cataract patients was within ±0.50 D.[49,57] Hahn and associates[58] reported in a multicenter prospective study that the overall achievement rate of target refractive outcomes within ±0.5 D at 3 months after cataract surgery was 80%. However, for eyes that have undergone refractive surgery, there is no recognized standard for calculating the power of IOL in China to date, and the accuracy of IOL in the studies we included was lower than this value due to the difficulty of IOL calculation.

There are some limitations to our study: (1) The methodological quality of the included literature is not high. Two-thirds of the studies we included were retrospective case series, and there was also bias caused by the small sample size and variation in IOL type. (2) Femtosecond laser small incision lenticule extraction (SMILE) surgery has been popular for a short time. Thus, not many patients who have had the surgery have yet developed cataracts, and few studies exist. Therefore, we did not include it in our analysis. Lazaridis and associates[59] used a theoretical model involving virtual IOL implantation to assess the predictive error between different IOL calculation formulas after SMILE. Lischke and associates[60] analyzed the first group of patients who received cataract surgery and IOL implantation after SMILE surgery and found that ray tracing increased accuracy in IOL power calculation. (3) Some new formulas (such as the Olsen T formula[61] and the Hill Potvin Shammas formula[62]) were not included in our meta-analysis because of the small number of studies or lack of comparison between formulas. (4) Although the postoperative refractive error of various IOL calculation formulas has been compared and ranked, it is unknown whether the performance of each formula differs for different degrees of myopia. (5) As a joint method may interfere with the specific performance of the explicit formulas, evaluation and analysis of various joint methods were not carried out. (6) The current study is not registered, and there may be a few biases, but we still strictly follow the steps of the systematic review.

In summary, we compare the performance of 12 formulas for calculating IOL power and find that the OCT, Masket, and Barrett true-K no history formulas are more accurate for IOL power calculation after LASIK/PRK surgery. If preoperative historical data are available, the Masket formula is a good choice. If historical data are not available, we recommend using the Barrett true-K no history formula to calculate IOL power after LASIK/PRK or the OCT formula if the required equipment is available. However, given the limited number of research samples, more high-quality, large-sample, randomized controlled trials are needed for further analysis of optimal methods. Therefore, in clinical practice, decision makers should comprehensively consider various factors of patients to select the appropriate formula. In future studies, the combined application of different formulas and the selection of formulas under different degrees of myopia should be evaluated to better meet patient expectations.

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Data Availability: The data sets supporting the conclusions of this article are included within the article and its additional file.

REFERENCES

1. Davis G. The evolution of cataract surgery. *Mo Med*. 2016;113(1):58–62.
2. Seitz B, Langenbucher A, Nguyen NX, Kus MM, Küchle M. Underestimation of intraocular lens power for cataract surgery after myopic photorefractive keratectomy. *Ophthalmology*. 1999;106(4):693–702.
3. Savini G, Barboni P, Zanini M. Correlation between attempted correction and keratometric refractive index of the cornea after myopic excimer laser surgery. *J Refract Surg*. 2007;23(5):461–466.
4. Hoffer KJ. Intraocular lens power calculation after previous laser refractive surgery. *J Cataract Refract Surg*. 2009;35(4):759–765.

5. Borasio E, Stevens J, Smith GT. Estimation of true corneal power after keratorefractive surgery in eyes requiring cataract surgery: BESSt formula. *J Cataract Refract Surg*. 2006;32(12):2004–2014.
6. Hua Y, Pan C, Wang Q. Assessment of total corneal power after myopic corneal refractive surgery in Chinese eyes. *Int Ophthalmol*. 2019;39(11):2467–2475.
7. Odenthal MT, Eggink CA, Melles G, Pameyer JH, Geerards AJ, Beekhuis WH. Clinical and theoretical results of intraocular lens power calculation for cataract surgery after photorefractive keratectomy for myopia. *Arch Ophthalmol*. 2002;120(4):431–438.
8. Randleman JB, Loupe DN, Song CD, GO 3rd Waring, Stulting RD. Intraocular lens power calculations after laser in situ keratomileusis. *Cornea*. 2002;21(8):751–755.
9. Haigis W. Intraocular lens calculation after refractive surgery for myopia: Haigis-L formula. *J Cataract Refract Surg*. 2008;34(10):1658–1663.
10. Abulafia A, Hill WE, Koch DD, Wang L, Barrett GD. Accuracy of the Barrett True-K formula for intraocular lens power prediction after laser in situ keratomileusis or photorefractive keratectomy for myopia. *J Cataract Refract Surg*. 2016;42(3):363–369.
11. Tang M, Wang L, Koch DD, Li Y, Huang D. Intraocular lens power calculation after myopic and hyperopic laser vision correction using optical coherence tomography. *Saudi J Ophthalmol*. 2012;26(1):19–24.
12. Shammas HJ, Shammas MC, Garabet A, Kim JH, Shammas A, LaBree L. Correcting the corneal power measurements for intraocular lens power calculations after myopic laser in situ keratomileusis. *Am J Ophthalmol*. 2003;136(3):426–432.
13. Shammas HJ, Shammas MC. No-history method of intraocular lens power calculation for cataract surgery after myopic laser in situ keratomileusis. *J Cataract Refract Surg*. 2007;33(1):31–36.
14. Wang L, Booth MA, Koch DD. Comparison of intraocular lens power calculation methods in eyes that have undergone LASIK. *Ophthalmology*. 2004;111(10):1825–1831.
15. Chen X, Yuan F, Wu L. Metaanalysis of intraocular lens power calculation after laser refractive surgery in myopic eyes. *J Cataract Refract Surg*. 2016;42(1):163–170.
16. Li H, Nan L, Li J, Song H. Accuracy of intraocular lens power calculation formulae after laser refractive surgery in myopic eyes: a meta-analysis. *Eye Vis (Lond)*. 2020;7:37.
17. Wei L, Meng J, Qi J, Lu Y, Zhu X. Comparisons of intraocular lens power calculation methods for eyes with previous myopic laser refractive surgery: Bayesian network meta-analysis. *J Cataract Refract Surg*. 2021;47(8):1011–1018.
18. Savini G, Hoffer KJ, Schiano-Lomoriello D, Barboni P. Intraocular lens power calculation using a Placido disk-Scheimpflug tomographer in eyes that had previous myopic corneal excimer laser surgery. *J Cataract Refract Surg*. 2018;44(8):935–941.
19. Huang D, Tang M, Wang L, et al. Optical coherence tomography-based corneal power measurement and intraocular lens power calculation following laser vision correction (an American Ophthalmological Society thesis). *Trans Am Ophthalmol Soc*. 2013;111:34–45.
20. Saiki M, Negishi K, Kato N, et al. A new central-peripheral corneal curvature method for intraocular lens power calculation after excimer laser refractive surgery. *Acta Ophthalmol*. 2013;91(2):e133–e139.
21. Saiki M, Negishi K, Kato N, et al. Modified double-K method for intraocular lens power calculation after excimer laser corneal refractive surgery. *J Cataract Refract Surg*. 2013;39(4):556–562.
22. Saiki M, Negishi K, Kato N, Torii H, Dogru M, Tsubota K. Ray tracing software for intraocular lens power calculation after corneal excimer laser surgery. *Jpn J Ophthalmol*. 2014;58(3):276–281.
23. Savini G, Barboni P, Carbonelli M, Ducoli P, Hoffer KJ. Intraocular lens power calculation after myopic excimer laser surgery: selecting the best method using available clinical data. *J Cataract Refract Surg*. 2015;41(9):1880–1888.
24. Wang L, Tang M, Huang D, Weikert MP, Koch DD. Comparison of newer intraocular lens power calculation methods for eyes after corneal refractive surgery. *Ophthalmology*. 2015;122(12):2443–2449.
25. Wong CW, Yuen L, Tseng P, Han DC. Outcomes of the Haigis-L formula for calculating intraocular lens power in Asian eyes after refractive surgery. *J Cataract Refract Surg*. 2015;41(3):607–612.
26. Helaly HA, El-Hifnawy MA, Shaheen MS, Abou El-Kheir AF. Accuracy of corneal power measurements for intraocular lens power calculation after myopic laser in situ keratomileusis. *Middle East Afr J Ophthalmol*. 2016;23(1):122–128.
27. Ma JX, Tang M, Wang L, Weikert MP, Huang D, Koch DD. Comparison of newer IOL power calculation methods for eyes with previous radial keratotomy. *Invest Ophthalmol Vis Sci*. 2016;57(9) Oct162-168.
28. Wu Y, Liu S, Liao R. Prediction accuracy of intraocular lens power calculation methods after laser refractive surgery. *BMC Ophthalmol*. 2017;17(1):44.
29. Cho K, Lim DH, Yang CM, Chung ES, Chung TY. Comparison of intraocular lens power calculation methods following myopic laser refractive surgery: new options using a rotating Scheimpflug camera. *Korean J Ophthalmol*. 2018;32(6):497–505.
30. Savini G, Hoffer K, Barboni P, Balducci N, Schiano-Lomoriello D. Validation of the SToP formula for calculating intraocular lens power in eyes with previous myopic excimer laser surgery. *J Cataract Refract Surg*. 2019;45(11):1562–1567.
31. Menon PR, Shekhar M, Sankarananthan R, Agarwal N, Dhanya CA, Wijesinghe HK. Comparative analysis of predictability and accuracy of American Society of Cataract and Refractive Surgery online calculator with Haigis-L formula in post-myopic laser-assisted in-situ keratomileusis refractive surgery eyes. *Indian J Ophthalmol*. 2020;68(12): 2985–2989.
32. Turnbull AMJ, Crawford GJ, Barrett GD. Methods for intraocular lens power calculation in cataract surgery after radial keratotomy. *Ophthalmology*. 2020;127(1):45–51.
33. Fang X, Ben S, Dong Y, Chen X, Xue W, Wang Y. Outcomes of the Haigis-L formula for calculating intraocular lens power in extreme long axis eyes after myopic laser in situ keratomileusis. *Eye (Lond)*. 2022;36(6):1178–1184.
34. Dawson VJ, Patnaik JL, Ifantides C, Miller DC, Lynch AM, Christopher KL. Comparison of refractive prediction for intraoperative aberrometry and Barrett True K no history formula

in cataract surgery patients with prior radial keratotomy. *Acta Ophthalmol*. 2021;99(6):e844–e851.
35. Sandoval HP, Serels C, Potvin R, Solomon KD. Cataract surgery after myopic laser in situ keratomileusis: objective analysis to determine best formula and keratometry to use. *J Cataract Refract Surg*. 2021;47(4):465–470.
36. Yeo TK, Heng WJ, Pek D, Wong J, Fam HB. Accuracy of intraocular lens formulas using total keratometry in eyes with previous myopic laser refractive surgery. *Eye (Lond)*. 2021;35(6):1705–1711.
37. Iida Y, Shimizu K, Shoji N. Development of a new method for calculating intraocular lens power after myopic laser in situ keratomileusis by combining the anterior-posterior ratio of the corneal radius of the curvature with the double-K method. *J Clin Med*. 2022;11(3):522.
38. Li H, Li J, Song H. Accuracy of modified Haigis method calculates for intraocular lens refractive degree after myopic refractive surgery. *Int Eye Sci*. 2022;22(6):1044–1048 [in Chinese with English abstract].
39. Patel P, Ashena Z, Vasavada V, et al. Comparison of intraocular lens calculation methods after myopic laser-assisted in situ keratomileusis and radial keratotomy without prior refractive data. *Br J Ophthalmol*. 2022;106(1):47–53.
40. Wang Q, Jiang W, Lin T, Wu X, Lin H, Chen W. Meta-analysis of accuracy of intraocular lens power calculation formulas in short eyes. *Clin Exp Ophthalmol*. 2018;46(4):356–363.
41. Barclay D, Higgins C, Thomson R. The Partial Last Squares (PLS) approach to causal modelling, personal computer adoption and use as an illustration. *J Technol Studies*. 1995;2(2):285–309.
42. Chen H, Chen X, Wang H, Fang Z, Yao K. Intraocular Lens power calculation after laser refractive surgery: a meta-analysis. *Sci Rep*. 2020;10(1):2645.
43. Wen D, Yu J, Zeng Z, et al. Network meta-analysis of no-history methods to calculate intraocular lens power in eyes with previous myopic laser refractive surgery. *J Refract Surg*. 2020;36(7):481–490.
44. Wang W, Yang Z, Sun F, Zhan S. Development, elaboration and application of grade summary of finding table for network meta-analysis. *Chin J Evid-Based Med*. 2020;20(12):1471–1476 [in Chinese with English abstract].
45. Masket S, Masket SE. Simple regression formula for intraocular lens power adjustment in eyes requiring cataract surgery after excimer laser photoablation. *J Cataract Refract Surg*. 2006;32(3):430–434.
46. Kang BS, Han JM, Oh JY, Kim MK, Wee WR. Intraocular lens power calculation after refractive surgery: a comparative analysis of accuracy and predictability. *Korean J Ophthalmol*. 2017;31(6):479–488.
47. Barrett GD. An improved universal theoretical formula for intraocular lens power prediction. *J Cataract Refract Surg*. 1993;19(6):713–720.
48. Cataract and Intraocular Lens Group, Ophthalmology Branch of Chinese Medical AssociationExpert consensus on clinical application of multi-focal intraocular lens in China (2019). *Chin. J. Ophthalmol.*. 2019;55(7):491–494 [in Chinese with English abstract].
49. Alio JL, Plaza-Puche AB, Férnandez-Buenaga R, Pikkel J, Maldonado M. Multifocal intraocular lenses: an overview. *Surv Ophthalmol*. 2017;62(5):611–634.
50. Khoramnia R, Auffarth G, Łabuz G, Pettit G, Suryakumar R. Refractive outcomes after cataract surgery. *Diagnostics (Basel)*. 2022;12(2):243.
51. Saad E, Shammas MC, Shammas HJ. Scheimpflug corneal power measurements for intraocular lens power calculation in cataract surgery. *Am J Ophthalmol*. 2013;156(3):460–467 e462.
52. Akman A, Asena L, Güngör SG. Evaluation and comparison of the new swept source OCT-based IOLMaster 700 with the IOLMaster 500. *Br J Ophthalmol*. 2016;100(9): 1201–1205.
53. Lawless M, Jiang JY, Hodge C, Sutton G, Roberts TV, Barrett G. Total keratometry in intraocular lens power calculations in eyes with previous laser refractive surgery. *Clin Exp Ophthalmol*. 2020;48(6):749–756.
54. Gelender H. Orbscan II-assisted intraocular lens power calculation for cataract surgery following myopic laser in situ keratomileusis (an American Ophthalmological Society thesis). *Trans Am Ophthalmol Soc*. 2006;104:402–413.
55. Sónego-Krone S, López-Moreno G, Beaujon-Balbi OV, Arce CG, Schor P, Campos M. A direct method to measure the power of the central cornea after myopic laser in situ keratomileusis. *Arch Ophthalmol*. 2004;122(2):159–166.
56. Arce CG, Soriano ES, Weisenthal RW, et al. Calculation of intraocular lens power using Orbscan II quantitative area topography after corneal refractive surgery. *J Refract Surg*. 2009;25(12):1061–1074.
57. Savini G, Barboni P, Zanini M. Intraocular lens power calculation after myopic refractive surgery: theoretical comparison of different methods. *Ophthalmology*. 2006;113(8):1271–1282.
58. Hahn U, Krummenauer F, Kölbl B, et al. Determination of valid benchmarks for outcome indicators in cataract surgery: a multicenter, prospective cohort trial. *Ophthalmology*. 2011;118(11):2105–2112.
59. Lazaridis A, Schraml F, Preußner PR, Sekundo W. Predictability of intraocular lens power calculation after small-incision lenticule extraction for myopia. *J Cataract Refract Surg*. 2021;47(3):304–310.
60. Lischke R, Sekundo W, Wiltfang R, et al. IOL power calculations and cataract surgery in eyes with previous small incision lenticule extraction. *J Clin Med*. 2022;11(15):4418.
61. Olsen T, Hoffmann P. C constant: new concept for ray tracing-assisted intraocular lens power calculation. *J Cataract Refract Surg*. 2014;40(5):764–773 .
62. Potvin R, Hill W. New algorithm for intraocular lens power calculations after myopic laser in situ keratomileusis based on rotating Scheimpflug camera data. *J Cataract Refract Surg*. 2015;41(2):339–347.