Systematic Review

The safety and Efficacy of Phacoemulsification in Diabetic Versus Non-Diabetic Patients: A Systematic Review and Meta-Analysis

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ABSTRACT

This review aims to compare the safety and efficacy of phacoemulsification cataract surgery between diabetic and non-diabetic patients, focusing on the differences in postoperative outcomes. Rev Man 5.4 was used for data analysis. Eighteen studies were included consisting of 2233 cases. We found better best corrected visual acuity (BCVA) at first post-operative day in non-diabetic patients and a lower endothelial cell density (ECD) in diabetic patients at 1st week and 3rd month. The central corneal thickness (CCT) was significantly thicker in diabetic group at 1st week and 1st month postoperatively. The coefficient of variations (CV) was significantly higher and hexagonal cell percentage (HCP) was significantly lower in the diabetic group at 1st week. HCP was significantly lower in at 1st and 3rd month postoperatively in diabetic group. No significant difference of central macular thickness (CMT) was found. Phacoemulsification has a greater impact on corneal endothelial damage and visual acuity in patients with diabetes mellitus (DM).

Keywords: Phacoemulsification, Diabetes, Endothelial cell count, Visual Acuity, Meta-analysis.

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INTRODUCTION

Cataract has been a huge problem around the world resulting in reversible blindness. The global prevalence of blindness and severe vision impairment caused by cataract reach 45.4% in adults more than 50 years. Among cataract patients, diabetes is considered as a major cause of ocular complication. Diabetes mellitus increases the incidence of cataract with 20.4 incidence risk per 1000 diabetic persons and 10.8 among 1000 person-years of population without diabetes.¹

Cataract surgery has been evolving through decades from couching, extracapsular cataract extraction, intracapsular cataract extraction, and now the modern phacoemulsification. Phaco or phacoemulsification was first performed in 1967 and now it is one of the safest and preferred surgeries for cataract and is considered a gold standard.² The process requires small incision, quicker procedure, quick mobilization and visual rehabilitation.²

Vision improvement in diabetic patients after phacoemulsification surgery depends on the patient's previous eye condition but may also be related to subclinical changes in the cornea and retina.³ Several studies have published the impact of cataract surgery including the result and complications in diabetic patients compared to non-diabetic patients. This study compares the effectiveness and safety of phacoemulsification in diabetic and non-diabetic patients.

METHODS

This systematic review's protocol has been registered with the **ID number: CRD42023451257** in PROSPERO and conducted based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines.

Authors collected the relevant studies through PubMed, Scopus, Web of Science, Cumulative Index to Nursing and Allied Health Literature via EBSCO, and Science Direct up to July 2023. The search terms used in this study were: (phacoemulsification) and (diabetes or non-diabetes or diabetic patient") and (endothelial cell or visual outcome or visual acuity) or complication). The authors did not restrict the publication date. The authors removed the duplicates, and reviewed the articles, screened abstracts for relevance, and evaluated the chosen articles for full text availability based on eligibility criteria. This study used the following PICO model to set the eligibility criteria. Population: diabetic patients with cataract; Intervention: phacoemulsification; Comparison: non diabetic patients; and Outcomes: the main outcomes were visual acuity, endothelial cell density (ECD), central corneal thickness (CCT), and retinal change. Secondary outcomes included the patient's diabetic condition. Exclusion criteria involved irrelevant title or abstract, unretrievable full text, reviews, case series, case reports, letter to the editors, conference abstracts or studies used other than English.

The next step was collecting relevant data for each included study including the first author, year when the studies were published, studies' location and design, sample size in each group, percentage of women, population age, values for each outcome (visual acuity, endothelial cell density, central corneal thickness, coefficient of variation, hexagonal cell percentage, and complications), diabetic condition, duration of diabetes mellitus, number of diabetic retinopathy, and grade of cataract. Methodological quality of each study was assessed with the original Newcastle-Ottawa Scale (NOS) for case control and cohort studies, while for cross sectional studies used the adapted NOS.⁴

Review Manager version 5.4 was used for performing all analyses. Standard mean difference (SMD) and 95% confidence interval (CI) were calculated based on the selected outcomes. A statistically significant difference was considered if P < 0.05. Heterogeneity was tested using I² test and Cochran's Q test which I² < 50% and P > 0.1 indicated no heterogeneity. To calculate the pooled effect, the fixed-effect model was used. A random effect model was used in the condition where a significant heterogeneity was found.

RESULTS

To select the eligible studies, 5 reviewers searched and selected studies independently. Initially, 1190 studies were extracted. The duplicates were removed, the articles were reviewed, the abstracts were screened for relevance, and the chosen articles were evaluated for full-text availability based on eligibility criteria. Three duplicates were removed by using Mendeley. The inappropriate title, topics, and abstracts (1106 records, followed by browsing 81 full text studies) were excluded. Eighteen eligible studies were chosen after excluding the wrong study method (n= 8), wrong component PICO (n= 49), and language other than English (n= 6). Finally, 18 studies were used in analysis as shown in figure 1.



Figure 1: Study Selection Flow Diagram.

Figures of A Systematic Review and Metaanalysis on Phacoemulsification: The Safety and Efficacy for Cataract in Diabetic Vs Non-Diabetic Patients were described in 9 studies where 5 of them showed more male patients.^{5,6,7,8,9} Two studies recorded that the mean age of patients was under 60, while the rest were above 60.^{4,8} The duration of diabetes was variable. In a study by Mehra et al, most of the patients werewith diabetes mellitus (DM) and 969 eyes without DM. The analysis consisted of 16

		DM		No	n DM		St	d. Mean Difference		Std. Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD 1	fotal N	Neight	IV, Random, 95% Cl	Year	IV, Random, 95% Cl
Degenring et al 2006	0.45	0.24	24	0.42	0.21	84	12.5%	0.14 [-0.32, 0.59]	2006	20
Misra et al 2015	0.62	0.56	28	0.53	0.42	28	12.1%	0.18 [-0.35, 0.70]	2015	
Hwang et al 2015	0.48	0.03	26	0.48	0.04	25	12.0%	0.00 [-0.55, 0.55]	2015	1994 - 19 <u>1</u> 2
Snaikniet al 2017 Mokhar et al 2019	0.61	0.18	48 54	0.00	0.31	44	12.7%	[10.1,81.0] 8C.0 [33.0,30.0] 8C.0	2017 2010	
Sekeli et al 2013	0.301	0.522	58	0.42 (0.425	208	13.2%	-0.16[-0.45_0.13]	2013	
Mehra et al 2022	0.062	0.00	37	0.71	0.18	37	11.0%	-3.28 [-3.99, -2.57]	2022	
Chaurasia et al 2022	0.69	0.21	100	0.67	0.2	100	13.3%	0.10 [-0.18, 0.37]	2022	+
								la là lài Trainnean anns anns an t		
Total (95% CI)			375			720 '	100.0%	-0.21 [-0.73, 0.31]		· · · · · · · · · · · · · · · · · · ·
Heterogeneity: Tau ² = 0	.51; Chi ^z	^e = 97.59	3, df = 7	(P < 0.0	0001); F	² = 93%	5		500	-4 -2 0 2 4
Test for overall effect: Z	= 0.78 (F	P = 0.44)							Favours [experimental] Favours [control]
		DM			Non DM			Std. Mean Difference	e	Std. Mean Difference
Study or Subaroup	Mean	SD	Total	Mean	SD	Tota	Weight	IV. Random, 95%	CI Year	IV. Random, 95% Cl
1.1.2 BCVA 1 day								,		
Chailth at al 2017	0.27	0.10	10	0.17	0.12	4.4	8.0%	0 60 10 10 1 0	21 2017	
Markinet al 2017	0.27	0.18	90 40 2 2 A	0.17	0.13	49	7.00	0.00 [0.19, 1.0	2] 2017	
Subtotal (05% CI)	0.57	0.447	102	0.220	0.290	239	1/1.0%	0.42 [0.12, 0.7	oj 2018 31	
Subtotal (55% Ci)	0.00.04	7 - 0 4	7 46 - 4	(D = 0.)	0.17-	2.30	14.7/0	0.45 [0.24, 0.7	51	•
Heterogeneity: I auf =	0.00; Ch	1* = 0.4. (D. 0.0	/, af = 1	(P = 0.4	49); 1*=	0%				
l est for overall effect: 2	2 = 3.87	(P = 0.0	1001)							
4.4.2 DC) (A.2 montho										
1.1.3 BCVA Z MONUNS	2.00			0.000		100		10 000 EX EX		
Hwang et al 2015	0.1	0) 26	0.08	0.01	25	e e e e e e e e e e e e e e e e e e e	Not estimab	le 2015	
Sekelj et al 2021	0	0.7	46	0	0.8	159	7.6%	0.00 [-0.33, 0.3	3] 2021	T
Subtotal (95% CI)			72			184	7.6%	0.00 [-0.33, 0.3	3]	•
Heterogeneity: Not app	olicable									
Test for overall effect: 2	Z = 0.00	(P = 1.0	10)							
1.1.4 BCVA 1 week										
Degenring et al 2006	0.2	0.24	24	0.13	0.12	84	6.6%	0.45 [-0.01, 0.9	1] 2008	
Sekelj et al 2021	0.05	0.64	57	0.05	0.68	208	7.8%	0.00 [-0.29, 0.2	9] 2021	-+-
Chaurasia et al 2022	0.18	0.09	100	0.15	0.1	100	7.9%	0.31 [0.04, 0.5	9] 2022	2
Mehra et al 2022	0.62	0.21	37	0.71	0.18	37	6.6%	-0.46 [-0.92, 0.0	11 2022	
Subtotal (95% CI)			218			429	29.0%	0.09 [-0.25, 0.4]	3j	*
Heterogeneity: Tau ² =	0.08; Ch	i ² = 10.4	47, df =	3 (P = 0	.01); I ² :	= 71%				
Test for overall effect: 2	Z = 0.53	(P = 0.6	;0)	837	1993					
1.1.5 BCVA 1 month										
Degenring et al 2006	0.2	0.22	24	0.42	0.21	84	6.5%	-1.03 [-1.50, -0.5	5] 2008	
Misra et al 2015	0.22	0.31	28	0.12	0.14	28	6.1%	0.41 (-0.12, 0.9	41 2015	
Shaikh et al 2017	0.23	0.15	48	0.14	0.13	44	6.9%	0.63/0.21 1.0	51 2017	· · · · ·
Khokhar et al 2019	0.085	0.086	54	0.086	0.085	194	7.8%	-0.01 [-0.31 0.2	91 2019	
Chaurasia et al 2022	0.000	0.000	100	0.005	0.02	100	7 9%	0.75/0.46/1.0	31 2023	· · · · · · · · · · · · · · · · · · ·
Subtotal (95% CI)	0.02	0.02	254	0.000	0.02	450	35.2%	0.16 [-0.42, 0.7	4]	•
Heterogeneity Tau ² =	0 39 [.] Ch	$i^2 = 45.9$	= 1h 09	4 (P < 0	00001)· IZ = Q	1%	[-
Test for overall effect: 3	7 = 0.54	(P = 0.6	50, ar – (9)	10 - 0		<u> 9</u>				
restion overall clicct. 2	- 0.54	(i = 0.5	,0,							
1.1.6 BCVA 6 weeks										
Shaikh et al 2017	0.17	0.13	48	0.08	0.09	4.4	6 9%	0 79 10 37 1 2	21 2017	-
Mehra et al 2022	0.17	0.10	, 4 0 27	0.00	0.03 0.00	27	67%	0.0010.07,1.2	61 2022	
Subtotal (95% CI)	0.04	0.1	85	0.04	0.08	81	13.5%	0.40 [-0.38, 1 1	oj izuzz 81	
Heteroneneity Tau ² -	0.28° Ch	j² = 6 20	1 - 1h 1	(P = 0.0)	11) [,] IZ –	84%			-1	
Test for overall effect: 3	7 = 1 01	(P = 0.2)	5, ar - 1 813	y = 0.0		5470				
n cottor overan enect. 2	1.01	v. ⊐ 0.0								
Total (95% CI)			731			1382	100.0%	0.21 [-0.02, 0.4	5]	•
Heterogeneity: Tau ² -	0.16 [.] Ch	i ² = 72 ·	- 19 df -	13 (P ≪	0 0000	1): P=	82%		•	
Test for overall effect:	7 = 1 90	(P = 0.0)	. 0, ur – 17)	50 (F 12) S	5.5500	21 -	02.00			-2 -1 0 1 2
Taet for eubaroun diffe	rences	γ	77 6 97 df	- 1 /D -	0.14	Z - 41	996			DM Non DM
mean or annaionh dille	ACHUES.	$\sim 01 = 1$	o.or, ul	- + (F =	0.14).	- 41.	0.00			

Figure 2: Forest Plot showing pre-operative and post-operative BCVA.

The safety and Efficacy of Phacoemulsification in Diabetic Versus Non-Diabetic Patients: A Systematic Review and Meta-Analysis

		Diabetes		Non-I	iabetes			Std. Mean Differe	nce		Std. Mean Difference
Study or Subgroup	Me	an S) Total	Mean	SD	Total	Weight	IV, Random, 9	5% CI	Year	IV, Random, 95% Cl
Hugod et al. 2011 preop	2,6	51 41	1 30	2,623	335	30	10.5%	0.07 [-0.43,	0.58]	2011	-
Misra et al. 2015 preop	2,38	4.9 43	8 28	2,254.3	426	23	10.1%	0.30 [-0.26,	0.85]	2015	-+
Chen Z et al. 2016 preop	2,743	56 109.2	3 50	2,742.14	107.54	50	11.4%	0.01 [-0.38,	0.40]	2016	+
Sahu et al. 2017 preop	2,628	52 281.0	9 60	2,672.7	259.84	60	11.7%	-0.16 [-0.52,	0.20]	2017	
Beato JN et al. 2021 preop	2,4	08 36	2 45	2,421	304	43	11.2%	-0.04 [-0.46,	0.38]	2019	-+
Fernandez-Munos et al. 2019 pr	eop 2,2	49 408	7 21	2,173	435.9	21	9.7%	0.18 [-0.43,	0.78]	2019	
Budiman B et al. 2020 preop	2,52	5.7 338.	2 67	2,481.7	341.7	86	11.9%	0.13 [-0.19,	0.45]	2020	+-
Chaurasia et al. 2022 preop	2,430	93 186.5	6 100	2,475.15	181.61	100	12.2%	-0.24 [-0.52,	0.04]	2022	
Ciorba et al. 2023 preop	1,7	65 403.	1 48	2,537	469	72	11.2%	-1.73 [-2.16, -	1.30]	2023	
Total (95% CI)			449			485	100.0%	-0.17 [-0.54,	0.201		•
Heterogeneity Tau ² = 0.27 [•] Chi ²	= 60 61 df=	8 (P < 0 0)	001) [,] P=	87%					•		
Test for overall effect: Z = 0.92 (F	P = 0.36	10	001/11	01.00							-4 -2 0 2 4
Favours [Non Diabetes] Favours [C											Favours [Non Diabetes] Favours [Diabetes]
	Diabe	tes		Von-Diabet	es		Std. M	Mean Difference			Std. Mean Difference
Study or Subgroup	Mean	SD Tot	al M	ean S	D Total	Weigh	nt IV,	, Random, 95% Cl	Year		IV, Random, 95% Cl
1.2.1 ECD 3M											
Hugod et al. 3M 2011	2,496	488 3	10 2,	580 35	3 30	6.19	Ж -	-0.19 [-0.70, 0.31]	2011		
Chen Z et al. 3M 2016	2,505.17	146.9	i0 2,736	6.85 108.8	9 50	6.29	- %	1.78 [-2.24, -1.31]	2016	i	
Sahu et al. 3M 2017	2,472.02 2	77.88	0 2,551	1.82 265.5	3 60	6.59	%	-0.29 [-0.65, 0.07]	2017		-
Fernandez et al. 3M 2019	1,595	403.2 :	1 1,	875 443	2 21	5.79	- %	0.65 [-1.27, -0.03]	2019	l	
Chaurasia et al. 2022 3M Subtotal (95% CI)	2,139.88	190.7 11 21	10 2,32: 1 1	3.95 19	5 100 261	6.69 31.0 '	× - % -(0.95 [-1.24, -0.66] 0.78 [-1.31, -0.24]	2022		→
Heterogeneity: Tau ² = 0.31° Chi	² = 31 31 df=	4 (P < 0 0	1001) [,] P:	= 87%							•
Test for overall effect: Z = 2.86 (P = 0.004)	10.0	,001/,1	- 01 /0							
1.2.5 ECD 1W											
Chen Z et al. 1W 2016	2,575.81 1	29.97 9	0 2,73	8.36 108.2	3 50	6.39	λ -	1.35 [-1.78, -0.91]	2016		+
Chaurasia et al. 2022 1W (1)	2,267.5 1	38.24 1	0 2,304	4.22 190.7	2 100	6.79	Ж.	-0.20 [-0.48, 0.07]	2022		+
Ciorba et al. 1W 2023	1,765	403.1	8 2,	372 476	7 72	6.49	- %	1.34 [-1.75, -0.94]	2023		+
Subtotal (95% CI)		19	8		222	19.3	% -(0.95 [-1.78, -0.12]			•
Heterogeneity: Tau ² = 0.50; Chi ²	²= 30.39, df=	2 (P < 0.0)001); P	= 93%							
Test for overall effect: Z = 2.25 (P = 0.02)										
1.2.7 ECD 1M											
Misra et al. 2016 1M	2,363.5	499 :	8 2,20	04.5 54	5 23	5.99	%	0.30 [-0.25, 0.86]	2016		
Chen Z et al. 1M 2016	2,524.49 1	32.23	0 2,736	6.85 108.8	9 50	6.29	λ -	1.74 [-2.20, -1.28]	2016		+
Fernandez et al 1M 2019	1,760	414.6	1, 1,	895 468	1 21	5.79	%	-0.30 [-0.91, 0.31]	2019	I	-+
Budiman B et al 1M 2020	1,667.3	553.8 1	7 1,7	73.3 542	2 86	6.69	λ.	-0.19 [-0.51, 0.13]	2020		
Beato et al. 1M 2021	2,057	259 ·	5 1,	919 50	7 43	6.39	%	0.34 [-0.08, 0.76]	2021		
Chaurasia et al. 2022 1M	2,213.84	177 1	10 2,371	1.55 193.1	8 100	6.69	× -	0.85 [-1.14, -0.56]	2022		
Subtotal (95% CI)		3.	1		323	37.3	% -	-0.41 [-1.00, 0.17]			•
Heterogeneity: Tau ² = 0.48; Chi ² Test for overall effect: Z = 1.38 (I	²= 60.34, df= ° = 0.17)	5 (P < 0.0)001); F*:	= 92%							
4 3 9 ECD 6M											
Chop 7 at all GM 2049	2 502 64 4	14 64	0 2 7 2	272 400 0	0 60	6.44	v.	2441262 464	2040		
Chen Ziet al. 6M 2016 Dests stiel 6M 2021	2,503.64 1	J4.01 :	U Z,73.	5.73 108.8 004 - 47	8 50 0 40	0.15	λο - ν	2.14 [-2.03, -1.04]	2016		
Subtotal (95% CI)	2,030	527	5 I, 15	921 47	0 43 93	0.31 12.4	% -	-0.96 [-3.26, 1.35]	2021		
Heterogeneity: Tau ² = 2.72; Chi ² Test for overall effect: Z = 0.81 (I	²= 50.57, df= P = 0.42)	1 (P < 0.0)001); I ^z :	= 98%							
Total (95% CI)		8	5		899	100.0	ا ۔ %	0.69 [-1.040.35]			•
Heterogeneity: Tau ² = 0.46: Chi ²	4= 180 48 df	= 15 /P < 0	-	I ² = 92%	000						
Test for overall effect: 7 = 3 90 /	2 < 0 00011	10 (1 - 1	.555517,	, = 52.0						500 T.	-4 -2 0 2 4
Test for subgroup differences: (Chi ² = 1.39, df	= 3 (P = 0	71), I² = ()%							- avours (ivon Diabetes) - Favours (Diabetes)

Figure 3: Forest Plot of ECD Results Pre-op and post-operative.

	Diabetes Non-Diabetes					S		Std. Mean Differend	ce	Std. Mean Difference		
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95%	CI Year	IV, Random, 95% Cl		
Hugod et al. 2011 preop	549	43.8	30	530	31.8	30	6.3%	0.49 [-0.02, 1.	00] 2011	· · · ·		
Chen Z et al. 2016 preop	513.36	16.16	50	511.58	13.59	50	10.8%	0.12 [-0.27, 0.	51] 2016			
Sahu et al. 2017 preop	508.53	18.18	60	507.18	27.21	60	12.9%	0.06 [-0.30, 0.	42] 2017			
Beato JN et al. 2021 preop	559	38	45	559	29	43	9.5%	0.00 [-0.42, 0.	42] 2019			
Fernandez-Munos et al. 2019 preop	571.6	48.3	21	559.7	41.1	21	4.5%	0.26 [-0.35, 0.	87] 2019	a state of the sta		
Knoknar et al. 2019 preop	522.85	18.32	54	524.13	18.86	194	18.2%	-0.07 [-0.37, 0.	23] 2019 201 2020			
Chauraan B et al. 2020 preop	514	20.8	100	511.9	31.5	80 100	10.3%	0.07 [-0.25, 0.	39] 2020 401 0000			
Chaulasia et al. 2022 preup	320.40	10.09	100	310.29	10.02	100	21.3%	0.14 [-0.14, 0.	42j 2022	in in its in the second		
Total (95% CI)			427			584	100.0%	0.09 [-0.04, 0.2	22]	◆		
Heterogeneity: Tau ² = 0.00; Chi ² = 4	.04, df = 7 (F	P = 0.78); I² = 09	6								
Test for overall effect: Z = 1.39 (P =	0.16)									Favours [Non Diabetes] Favours [Diabetes]		
	Di-1-4		New	Diskat			C4-1	M		Old Many Difference		
Study or Subgroup Ma	Diabetes	Total	Non	-Diabet(es Total	Moir	sta. abt IV	Mean Difference	Voar	Std. Mean Difference		
1.11.8 CCT 1W	an 30	Total	Mean	30	Total	TTCI	jin iv	, Nandoni, 55% cr	ICal			
Chen Z et al. 1M 2016 540	.27 20.79	50	506.49	9.05	50	6.5	5%	2.09 [1.60, 2.58]	2016	-		
Chen Z et al. 1W 2016 547	.95 27.26	50	512.69	13.46	50	6.6	3%	1.63 [1.17, 2.08]	2016	-		
Khokhar et al. 2019 1M 533	.28 12.72	54	531.49	12.47	194	6.9	3%	0.14 [-0.16, 0.44]	2019	+		
Chaurasia et al. 2022 1W 563	.25 16.72	100	527.73	13.4	100	6.8	3%	2.34 [1.97, 2.70]	2022	+		
Subtotal (95% CI)		254			394	26.	8%	1.54 [0.41, 2.67]		•		
Heterogeneity: Tau ² = 1.28; Chi ² =	: 100.07, df	= 3 (P	< 0.0000	01); I ² = 9	37%							
Test for overall effect: Z = 2.68 (P	= 0.007)											
1.11.9 CCT 1M												
Fernandez et al 1M 2019 55	78 48	21	543.3	41	21	6 3	7%	0.321-0.29.0.931	2019			
Budiman B et al 1M 2020 52	1.4 31.1	67	517.2	34.6	86	6.9	3%	0.13 [-0.19, 0.45]	2020	+		
Beato et al. 1M 2021 5	62 35	45	560	29	43	6.7	7%	0.06 [-0.36, 0.48]	2021	+		
Chaurasia et al. 2022 1M 53	0.2 15.67	100	523.85	i 13.9	100	7.0)%	0.43 [0.15, 0.71]	2022	+		
Subtotal (95% CI)		233			250	26.	7%	0.25 [0.07, 0.43]		•		
Heterogeneity: Tau ² = 0.00; Chi ² =	= 2.94, df = 3	3 (P = 0	.40); I² =	: 0%								
Test for overall effect: Z = 2.78 (P	= 0.005)											
1.11.10 CCT 3M												
Hugod et al. 3M 2011 5	548 44.2	30	529	34.3	30	6.4	4%	0.47 [-0.04, 0.99]	2011			
Chen Z et al. 3M 2016 51	1.9 15.71	50	506.48	8.53	50	6.7	7%	0.43 [0.03, 0.82]	2016			
Sahu et al. 3M 2017 515	.57 17.84	60	514.52	27.56	60	6.8	3%	0.04 [-0.31, 0.40]	2017	+		
Fernandez et al. 3M 2019 56	5.2 47.2	21	556.1	40.3	21	6.2	2%	0.20 [-0.40, 0.81]	2019			
Chaurasia et al. 2022 3M 523	.71 17.7	100	522.42	12.79	100	7.0)%	0.08 [-0.19, 0.36]	2022	t		
Subtotal (95% CI)		261			261	33.	1%	0.19 [0.02, 0.37]		•		
Heterogeneity: Tau ² = 0.00; Chi ² =	: 3.75, df = /	4 (P = 0	.44); I*=	:0%								
Test for overall effect. $Z = 2.19$ (P	= 0.03)											
1.11.11 CCT 6M												
Chen Z et al. 6M 2016 513	.44 16.1	50	502.37	4.28	50	6.7	7%	0.93 [0.52, 1.35]	2016	-		
Beato et al. 6M 2021 6	54 32	45	566	31	43	6.7	7%	-0.38 [-0.80, 0.04]	2021			
Subtotal (95% CI)		95			93	13.	4%	0.28 [-1.01, 1.56]		+		
Heterogeneity: Tau ² = 0.81; Chi ² =	= 18.89, df =	1 (P <	0.0001)	; I² = 95'	%							
Test for overall effect: $Z = 0.42$ (P	= 0.67)											
Total (95% CI)		843			998	100.	0%	0.59 [0.20, 0.98]		•		
Heterogeneity: Tau ² = 0.55; Chi ² =	: 215.41, df	= 14 (F	< 0.000	001); I² =	94%				_			
Test for overall effect: Z = 2.97 (P	= 0.003)	, v								-4 -2 U 2 4 Favours [Non Diabetes] Favours [Diabetes]		
Test for subgroup differences: Ch	i² = 5.43. di	f = 3 (P	= 0.14).	$ ^{2} = 44.8$	3%					Lavorus livou manerest Lavorus (maneres)		

Figure 4: Forest Plot of CCT Results Pre-op and post-op

prospective studiesWe collected 18 observational studies published between 2006 and 2023, including a total of 1,264 eyes and 2 cross sectional studies. Female and male ratio diagnosed with diabetes within 5-10 years.⁹ Other studies provided mean duration of 20.08, 10, 5, 9.1, 4.4, 3.06, and 11.54 years.^{5,6,9-13}

There were 8 studies that reported patients with

	Diabetes Non-Diabetes							Std. Mean Difference		Std. Mean Difference		
Study or Subgroup	Mean	SD 1	fotal I	Mean	SD	Total	Weight	IV, Random, 95% Cl	Year	IV, Random, 95% Cl		
1.5.1 HCP 1W										· · · ·		
Chen Z et al. 1W 2016	51.11	1.49	50 :	56.55	1.63	50	9.0%	-3.46 [-4.08, -2.83]	2016	+		
Chaurasia et al. 2022 1W	63.87	4.05	100	68.92	3.64	100	9.3%	-1.31 [-1.61, -1.00]	2022	•		
Subtotal (95% CI)			150			150	18.3%	-2.36 [-4.47, -0.26]		◆		
Heterogeneity: Tau ² = 2.25;	Chi ^z = 36	54, df:	= 1 (P ¹	< 0.000	i01); l²	= 97%						
Test for overall effect: Z = 2.2	20 (P = 0.	03)										
1.5.2 HCP 1M												
Chen Z et al. 1M 2016	49.42	1	50 :	56.46	1.65	50	8.6%	-5.12 [-5.94, -4.30]	2016	-		
Budiman B et al 1M 2020	41.7	14.6	67	50.1	14.5	86	9.3%	-0.57 [-0.90, -0.25]	2020	*		
Beato et al. 1M 2021	52.1	10	45	50.3	9.8	43	9.2%	0.18 [-0.24, 0.60]	2021	Ť		
Chaurasia et al. 2022 1M	66.28	4.08	100	70.6	3.94	100	9.3%	-1.07 [-1.37, -0.78]	2022			
Subtotal (95% CI)			262			279	36.5%	-1.58 [-2.91, -0.26]		◆		
Heterogeneity: Tau ² = 1.77;	Chi ^z = 13	1.47, d	f=3(P	< 0.00	i001); I	r = 989	6					
Test for overall effect: $Z = 2.3$	34 (P = 0.	02)										
1 5 3 HCD 3M												
Chon Zotal 2M 2016	40.2	1 0 2	60	56 42	1.64	60	0604	5181500 A221	2016	+		
Cherry et al. 3W 2010 Robu et al. 2M 2017	43.3	1.03	60	17 06	6.70	00	0.0%	0.02102039,-4.33	2010	1		
Chauracia otal 2017	47.73 60.2	4.00	100	47.00 77.40	0.79 A NQ	100	9.3% 0.2%	-0.02 [-0.36, 0.34]	2017	-		
Subtotal (95% CI)	00.5	4.24	210	72.43	4.00	210	27.3%	-2.01 [-3.94, -0.08]	2022	•		
Heterogeneity: Tau ² = 2.82	Chi² = 12	5 25 d	f = 2 (P	< 0.00	0011	 ₽= 989	6	,		•		
Test for overall effect: 7 = 21	0111 = 12 04 (P = 0	0.20, 0 N4)	- 2 (0.00		- 007	•					
	04 (i = 0.	04)										
1.5.4 HCP 6M												
Chen Z et al. 6M 2016	49.26	1.05	50 :	56.37	1.66	50	8.6%	-5.08 [-5.90, -4.26]	2016	+		
Beato et al. 6M 2021	54.5	93	45	53.9	10	43	9.2%	0.01 [-0.41, 0.43]	2021	- +		
Subtotal (95% Cl)			95			93	17.9%	-2.52 [-7.51, 2.46]				
Heterogeneity: Tau ² = 12.84	; Chi² = 1	17.82,	df = 1 (P < 0.0	0001);	; I² = 99	%					
Test for overall effect: Z = 0.9	99 (P = 0.	32)										
			747			722	400.0%	4 00 1 3 04 4 471				
Total (95% CI)	0.02 10	0.05 4	(1) () ()		00041	132	100.0%	-1.99 [-2.81, -1.17]	_			
Heterogeneity: Taur = 1.85; Teet for everall effect: 7 = 4.1	Chi= 43	8.85, 0 00004)	T= 10 (P < U.U	0001);	; if = 98	70			-20 -10 0 10 20		
Test for eularoun difference	/0 (P≤U. >e:Chi≇—	00001)	1 1f - 070	2 – n a	2) IZ -	n%.				Favours [Non Diabetes] Favours [Diabetes]		
restion subgroup difference	<u>, s. on =</u> n	iahete	e	- 0.3.	n Diah	otos		Std. Mean Difference		Std. Mean Difference		
Study or Subaroup	Mear	1 SD	Total	Mea	n Si	D Tota	l Weigh	t IV. Random. 95% C	Year	IV. Random, 95% Cl		
Chen Zietal 2016 preop	57.03) 157	50	56.9	5 1 6	1 5	n 19.09	6 004 F0 35 0 44	1 2016	-+-		
Sahu et al. 2017 preop	52.3	7 5 5 5	10	53.0	0 1.0 8 7.0	7 61	0 10.07 N 10.09	0.04 [0.00] +0.0 10 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1 2010	-		
Beato IN et al. 2011 preop	581) "as		, 55.0 ; 58	4 10 ·	. 0 5 /	3 10.37	6 0.00 [0.42, 0.00 6 0.02 LO AA 0 AC	1 2017			
Budiman Blet al. 2021 preop	1 51 G	, 0.0 0	- +- 67	, 30. 56.0	5 1 B	1 0	6 70.37 6 70.80	6 -0.02 (-0.44, 0.40 6 -0.83 (-1.46 -0.40	a 2013	+		
Chauracia et al. 2020 preus	72.01.3	, 9 ,/10	100	50.9 1 72	0 1.0 0 2.7	, o 1 10	o ∠0.0% N ???a	6.03 [1.10, -0.48 6 0.16 LO 42 0 41	/ 2020 N 2020			
onaurasia et al. 2022 preup	13.34	4.10	100	, (3.	5 - J.Z	4 10	0 22.27	0 -0.10 P0.40, 0.12	.j 2022			
Total (95% CI)			322			33	9 100.0%	6 -0.21 [-0.53, 0.10	1 -	•		
Heterogeneity Tau ² = 0.10 ¹	Chi²=16	38. df=	: 4 (P =	0.003	: ² = 7	6%		• • • • •	-			
Test for overall effect: 7 = 1.3	R1 (P = 0.1)	19) 9)	· · ·	5.000,		- //				-4 -2 0 2 4		
		/								Favours (Non Diabetes) Favours (Diabetes)		

Figure 5: Forest Plot of HCP Results Pre-op and post-op.

mild to moderate non proliferative diabetic retinopathy.^{5,9-11,14-17} While the rest had either no retinopathy patients or did not present the data. Cataract grades were categorized using LOCS II and LOCS III as follows: grade II (LOCS II)⁷, less than grade IV (LOCS III),¹⁸ moderate cataracts,¹⁹ primarily grade II³ and nuclear sclerosis (ranging from grade II to III,¹³ with most cases in grade III¹² or grade II⁷).

The assessment of NOS is based on the selection

valued by 4 stars, comparability valued by 2 stars and outcome valued by 3 stars. A study is mentioned to have a considerable risk of bias if there is 0 star in any categories of questions. Moderate risk if scoring 1-star and low risk of bias if scoring 2 star or above in all categories. Only 1 study in this analysis scored moderate risk of bias.⁷ The rest of the studies had 2 stars or above in all categories and were marked as low risk of bias.^{5,6,8,9,10,12,13,14,21-22}

		Diabetes Non-Diabetes Std. Mean Difference						e	Std. Mean Difference			
Study or Subgroup	Mea	n S	D Tota	al Mea	an S	D Tot	tal Weigh	t IV, Random, 95%	CI Year	IV, Random, 95% Cl		
Chen Z et al. 2016 preop	49.1	1 3.8	35	0 43.3	29 1.8	5	50 19.19	6 1.92 [1.44, 2	40] 2016	+		
Sahu et al. 2017 preop	33.0	01 3.8	96	0 34.9	55 4.5	ig (60 20.19	-0.36 [-0.72, 0.00] 2017		*		
Beato JN et al. 2021 preop	35	.9	64	5	35	4 ·	43 19.69	6 0.17 [-0.24, 0.5	59] 2019	1		
Budiman B et al. 2020 preop	38	.3	66	7 37	15	.8 1	86 20.49	6 0.20 [-0.12, 0.9	52] 2020	t i		
Chaurasia et al. 2022 preop	33.6	58 3.1	1 10	0 33.0	05 2.7	'1 11	00 20.79	6 0.22 [-0.06, 0.4	49] 2022	T		
Total (95% CI)			32	2		33	39 100.09	% 0.41 [-0.20, 1.0)3]	•		
Heterogeneity: Tau ² = 0.45; (Chi r = 58	3.20, df	= 4 (P	< 0.000	001); I ^z	= 93%						
Test for overall effect: Z = 1.3	3 (P = 0	.18)								Favours [Non Diabetes] Favours [Diabetes]		
	Dia	betes		Non-	Diabete	s	S	td. Mean Difference		Std. Mean Difference		
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% Cl	Year	IV, Random, 95% Cl		
1.3.1 CV 1W												
Chen Z et al. 1W 2016	46.85	3.11	50	43.63	1.84	50	8.9%	1.25 [0.82, 1.68]	2016	+		
Chaurasia et al. 2022 1W	39.89	3.24	100	37.76	3.23	100	9.4%	0.66 [0.37, 0.94]	2022	÷		
Subtotal (95% CI)			150			150	18.3%	0.93 [0.35, 1.51]		◆		
Heterogeneity: Tau ² = 0.14; 0	Chi² = 5.	11, df=	: 1 (P =	0.02);	l ² = 809	6						
Test for overall effect: Z = 3.1	4 (P = 0	.002)										
1.3.2 CV 1M												
Chen Z et al. 1M 2016	48.6	3.84	50	43.8	1.88	50	8.8%	1.58 [1.12, 2.03]	2016	+		
Budiman B et al 1M 2020	40.1	9.3	67	38.1	7.5	86	9.3%	0.24 [-0.08, 0.56]	2020	+		
Beato et al. 1M 2021	52.1	10	45	50.3	9.8	43	8.9%	0.18 [-0.24, 0.60]	2021	+		
Chaurasia et al. 2022 1M Subtotal (95% CI)	40.25	3.26	100 262	38.14	3.58	100 279	9.4% 36.5 %	0.61 [0.33, 0.90] 0.64 [0.10, 1.17]	2022	•		
Heterogeneity: $Tau^2 = 0.26^{\circ}$ (Chi² = 2P	3 63 df	= 3 (P ·	< 0.000	101) [,] P	= 89%				·		
Test for overall effect: Z = 2.3	4 (P = 0	.02)	- (i									
133 CV 3M												
Chan Z at al. 2M 2046	40	2.0	50	12.05	4.00	50	0.00	4 66 14 04 0 4 01	204.6	1		
Crien Zietal, 3W 2016 Robu et al. 2M 2017	49 วดว	3.8 2.80	00	43.90 วก.กก	1.92	00	0.0% 0.100	1.00[1.21, 2.12]	2010	1 · · · ·		
Chauragia et al. 2022 2M	30.2 36.33	3.00	100	38.00 36.10	4.02	100	9.170	-0.09[-1.00,-0.32]	2017	· · ·		
Subtotal (95% CI)	30.23	3.01	210	30.13	4.7.3	210	9.0% 27.4%	0.20 [-0.02, 0.54]	2022	▲		
Heterogeneity: Tau ² = 1.01; C	Chi ^z = 61	.58, df	= 2 (P -	< 0.000	001); I ^z	= 97%						
Test for overall effect: Z = 0.6	8 (P = 0	.49)			i)							
1.3.4 CV 6M												
Chen Z et al. 6M 2016	49.11	3.83	50	43.97	1.89	50	8.8%	1.69 [1.23, 2.15]	2016	÷		
Beato et al. 6M 2021	54.5	9.3	45	53.9	10	43	9.0%	0.06 [-0.36, 0.48]	2021	+		
Subtotal (95% Cl)			95			93	17.7%	0.87 [-0.72, 2.47]		+		
Heterogeneity: Tau ² = 1.27; C	Chi r = 28	6.39, df	= 1 (P ·	< 0.000	001); I²	= 96%						
Test for overall effect: Z = 1.0	7 (P = 0	.28)										
Total (95% CI)			717			732	100.0%	0.67 [0.27, 1.07]		♦		
Heterogeneity: Tau ² = 0.43; (Chi ^z = 13	36.49, 0	f= 10 ((P < 0.0)00001);	2 = 93	3%					
Test for overall effect: Z = 3.2	6 (P = 0	.001)								-10 -0 U 5 10 Favours (Non Diabetes) Favours (Diabetes)		
Test for subgroup difference	s: Chi ^z =	0.90,	df = 3 (F	^o = 0.8	3), ² =	0%				i avoura (ivon Dianetes) i ravours (Dianetes)		

Figure 6: Forest Plot of CV Results Pre-op and post-op.

The safety and Efficacy of Pha	acoemulsification in Diabetic	Versus Non-Diabetic Patients	: A Systematic Review a	and Meta-Analysis
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	[M		Non	DM		St	d. Mean Difference			Std. Mean Difference			
Study or Subgroup	Mean	SD 1	Total	Mean	SD T	otal V	Veight	IV, Random, 95% Cl	Yea	ir	Ν	/, Random, 95% Cl		
Errickson 2010	216.7	25.8	35	211.6	19.6	33	23.5%	0.22 [-0.26, 0.70]	201	0				
Chen Z 2016	194.97	2.87	60 1	95.03	2.91	60	41.8%	-0.02 [-0.38, 0.34]	201	6		_ _		
Stunf 2017	238.6	29	18	247.5	25	10	8.8%	-0.31 [-1.09, 0.47]	201	7				
Mehra et al 2022	212.73	14	37	213 1	5.15	37	25.8%	-0.02 [-0.47, 0.44]	202	2				
Total (95% CI)			150			140 1	00.0%	0.01 [-0.22, 0.24]				•		
Heterogeneity: Tau ² =	0.00; Chi	² =1.44	, df = 3	(P = 0.70); I ² = 09	6				÷				
Test for overall effect:	Z=0.09 (P = 0.9	3)		all.					-2	-1.	U 1 DM Non DM	2	
		3	981									DM 14011 DM		
		DM		N	on DM			Std. Mean Differenc	e			Std. Mean Difference		
Study or Subgroup	Mean	SD	Total	Mean	SD	Tota	Weight	IV, Random, 95%	CI	Year		IV, Random, 95% Cl		
2.2.1 1 Week														
Chen Z 2016	217.25	7.45	60	195.53	2.75	60	19.7%	3.84 [3.23, 4.4	45]	2016				
Mehra et al 2022 Subtotal (95% CI)	214	16.11	37 97	214.95	16.11	37 97	20.1% 39.8%	-0.06 [-0.51, 0.4 1.89 [-1.94, 5.7	40] 7 1]	2022		-		
Heterogeneity: Tau ² =	= 7.54; Ch	i² = 100).78, df:	= 1 (P < (0.00001); ² = 9	9%							
Test for overall effect	Z=0.97	(P = 0.3	33)											
N. R. STONE CO. COMP. MINUS														
2.2.2 6 Months														
Errickson 2010	231.8	36.5	33	219	20.9	34	20.0%	0.43 [-0.06, 0.9	91]	2010		-		
Chen Z 2016	195	1.87	60	192.02	2.9	60	20.3%	1.21 [0.82, 1.6	60]	2016		*		
Stunf 2017	255.2	31.5	29	261.7	29	25	19.9%	-0.21 [-0.75, 0.3	33]	2017		t.		
Subtotal (95% CI)			122			119	60.2%	0.49 [-0.33, 1.3	82]			₽ .		
Heterogeneity: Tau ² =	= 0.47; Ch	i² = 18.	69, df =	2 (P < 0.	0001);1	r = 899	6							
Test for overall effect	:Z=1.17	(P = 0.2	24)											
Total (05% CI)			210			246	100.0%	103102022	71					
Hotorogonoity TouZ-	4 04 · Ob	i Z = 4.00	213 100 df.	- 4 /0 - 1	0 00004	1.12 - 0	100.07	1.05 [-0.20, 2.2	1		C			
Tact for overall offect	- 1.91, UN - 7 - 1.65	11 = 120 70 = 0.4	5.00, UI: 10\	- 4 (0.00001	715=8	70 70				-10	-5 0 5	10	
Test for cubarous dif	.∠= 1.00 foroncec:	(r = 0.1 Chi≇ –	10) 0.40 AF	- 1 /D -	0 40\ 12	- 0%						DM Non DM		
nest of subgroup all	ierences:	VIICE	0.49, UI) (F.=	0.46), l ⁻	- 0%								

Figure 7: Forest Plot Pre-op and Post-op CMT.

The BCVA values at one week, one month, two months, and six weeks of assessments did not differ statistically (Fig. 2; 1 week: WMD= 0.09, 95% CI: -0.25-0.43, P= 0.60; 1 month: WMD= 0.18, 95% CI: 0.33-0.70, P= 0.18; 2 months: WMD= 0.96, 95% CI: -0.97-2.89, P= 0.33; 6 weeks: WMD= 0.40, 95% CI: -0.38-1.18) However, the result is significant in 1 day postoperatively favoured the non-DM group (WMD= 0.49, 95% CI: 0.24-0.73, p= 0.0001).

There were 10 studies that calculated the parameters of endothelial change after phacoemulsification. These studies measured the ECD,

CCT, CV and HCP in pre-operative and the postoperative evaluation on the first week, first month, third months and six months post-operative. Significant difference of ECD was not found between the two groups pre-op, 1 month and 6 months post-op (pre-op: WMD= -0.17, 95% CI: -0.54-0.20, p= 0.36; 1 month: WMD= -0.41, 95% CI: -0.54-0.20, p= 0.36; 1 month: WMD= -0.41, 95% CI: -1.00-0.17, p= 0.17; 6

However, the significant result was seen in ECD measurement in 1 week and 3 months follow up which favoured to non-DM group as shown in figure 3. (1 week: WMD= -0.95, 95% CI, -1.78 to -0.12,

p=0.02; 3 months: WMD= -0.78, 95% CI: -1.31 to -0.24, p= 0.004).

Meanwhile for CCT (figure 4), the differences in preoperative, 3 months and 6 months of follow up showed no significant result. (pre-op: WMD= 0.09, 95% CI: -0.040.22, p= 0.16; 3 months: WMD= 0.19, 95% CI: 0.02-0.37, p= 0.03; 6 months: WMD= 0.28, 95% CI: -1.01-1.56, p= 0.67) However, DM group had significantly thicker CCT in 1 week and 1 month follow ups (1 week: WMD= 1.54, 95% CI: 0.41-2.67, p= 0.007; 1 month: WMD= 0.25, 95% CI: 0.07-0.43, p= 0.005).

Authors found a significantly lower result of HCP (figure 5) in 1st week, 1st month, and 3rd months after surgery in the DM group (1 week: WMD= -2.36, 95% CI: -4.47 to -0.26, p= 0.03, 1 month: WMD= -1.58, 95% CI: 2.91 - -0.26, p= 0.02, 3 months: WMD= -2.01, 95% CI: -3.94 - -0.08, p= 0.04) but also found that the result measured preoperatively and 6 months post op was not significant (pre-op: WMD= -0.21, 95% CI: -0.53-0.10, p= 0.19; 6 months: WMD= -2.52, 95% CI: -7.51-2.46, p= 0.32).

In figure 6, DM patients have significantly higher CV in 1 week and 1-monthfollowup (1 week: WMD= 0.93, 95% CI: 0.35-1.51, p= 0.002; 1 month: WMD= 0.64, 95% CI: 0.10-1.17, p= 0.02). However, the result showed no significant difference in preoperative, 3 months and 6 months postoperative, respectively (preop: WMD= 0.41, 95% CI: -0.20-1.03, p= 0.18, 3 months: WMD= 0.40, 95% CI: -0.75-1.56, p= 0.49; 6 months: WMD= 0.87, 95% CI: -0.72-2.47, p= 0.28).

Four studies that measured CMT and included in this review are shown in Figure 7(preoperative: WMD= 0.01, 95% CI: -0.22-0.24, p= 0.93; 1 week: WMD= 1.89, 95% CI: -1.94-5.71, p= 0.33; 6 months: WMD= 0.49, 95% -0.331.32, p= 0.24).

DISCUSSION

In patients with diabetes especially uncontrolled ones will bring complications whether its pre-intra-postsurgery. Nevertheless, there is no notable difference in the outcome. This study was conducted to discuss latest analysis regarding the outcomes seen after phacoemulsification in diabetes compared with nondiabetic patients.

The meta-analysis revealed that non-diabetic (non-DM) patients achieved significantly better bestcorrected visual acuity (BCVA) results one day postoperatively. This outcome may be attributed to severe postoperative inflammation in the diabetic group, which reduces retinal sensitivity. Cataract surgery contributes significantly to macular thickening and the development of macular edema, leading to vision deterioration through the release of prostaglandins and increased oxidative stress.

Patients with diabetes who already have high levels of oxidative stress because of their underlying disease, the impact of cataract surgery may result in more frequent and pronounced macular thickening.¹² The visual outcomes for diabetic individuals after phacoemulsification with intraocular lens implantation were nearly equivalent to those in non-diabetic patients, especially when diabetics maintained good glycaemic control and had no diabetic retinopathy or were in the early stages of diabetic retinopathy. Previous studies have also supported these findings, emphasizing the pre-operative diabetic retinopathy status as a crucial prognostic factor after cataract surgery in diabetics. Other factors linked to a good visual outcome included the highest level of education, clinical centre network, preoperative visual acuity, and undergoing bilateral cataract surgery.¹¹ Hence, our results suggest that enhanced visual outcomes can be expected post-surgery by phacoemulsification for both DM and non-DM patients.

High blood glucose influences the corneal ultrastructural biochemical and abnormalities. Therefore, the corneas of diabetics with cataract surgery are believed to be more susceptible to stress and trauma caused by the surgery.¹¹ This research shows higher ECD in 1 week and 3 months follow up in non-diabetic patients. Yang et al, reported that endothelial cell density (ECD) was significantly lower in the diabetic (DM) group, while endothelial cell loss increased significantly in non-diabetic patients from 1 month to 6 months postoperatively.²³ This suggests that endothelial cell loss continues to accelerate and does not stabilize within 6 months after surgery, indicating delayed postoperative corneal recovery in DM patients. This condition may be attributed to factors such as advanced patient age, increased vulnerability of endothelial cells in diabetic patients. higher cataract density, and greater cataract grade.

CCT measurements can be used to determine endothelial damage due to surgery. In this study, the results showed that surgery influences corneal condition of diabetic patients which was proved by higher CCT results of diabetic compared to the nondiabetic patients after surgery. Similarly, Chaurasia et al, found significant differences in CCT at 1-week and 1 month follow-up which was higher in DM group.⁷ In normal conditions, the corneal endothelial cell pump regulate hydration balance. If the corneal endothelial cell pump does not function, water will accumulate in the corneal stroma which can cause swelling and characterized by the increasing of corneal thickness.³

HCP and CV describe the repair process and morphology of endothelial cells of the cornea after injury. Increased CV indicates large variability in cell size, whereas decreased HCP indicates increased pleomorphism.²³ In this study, authors found that HCP in 1 week, 1 month, and 3 months post-op were significantly lower in the DM patients. In line with previous study, a significant decrease in HCP at 3 months after surgery was seen in the diabetic group.¹⁷ Contrary to these findings Beato et al, showed no differences in HCP between two groups six months after surgery.¹¹ It is thought that these variations are caused by endothelial cell rearrangements and cellular oedema that occur early after surgery but progressively recover to preoperative status. The higher CV in DM patient in 1 week and 1 month follow up was also explained by Chaurasia's study which showed higher CV in diabetic patients compared to non-diabetic patients at the follow-up stage.

This analysis recorded that patient with diabetes often had higher CMT levels than patients without the disease. Even though the difference of each group was not significant statistically. The same result was also recorded from a previous study by Ikegami et al.²⁴ Furthermore, the lack of significant variations in CMT between the two groups may be attributed by the diabetic conditions that revealed some mild and moderate diabetic retinopathy with variable mean duration of diabetes and glycaemic management. However, a wider range of time of follow up done by Katsimpris et al, shows significantly different CMT on 1, 3, 6, and 12 months postoperatively.²⁵

CONCLUSION

This study demonstrated significant effects of phacoemulsification surgery on diabetic patients, particularly in endothelial changes and visual outcomes. While the outcomes appeared worse in the diabetic group, gradual improvement was observed over time. These findings highlight the importance of adopting a comprehensive approach in managing diabetic patients, rather than focusing solely on cataract. Future research should consider stratifying patients based on the presence or absence of retinopathy and distinguishing between controlled and uncontrolled diabetes for more comprehensive insights.

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