ISSN 3006-2543 (Online)
ISSN 1990-3863 (Print)

AL-SHIFA JOURNAL OF OPHTHALMOLOGY

ASJO

An Open Access, Peer Reviewed, Quarterly Journal of
AL-SHIFA TRUST EYE HOSPITAL

Vol. 20, No. 4, October – December 2024

Indexed in
Index Medicus- EMR
Asian Digital Library
Pak Medinet

Recognized by
Higher Education Commission (HEC), Pakistan
College of Surgeon and Physician (CPSP), Pakistan

ISSN 3006-2543 (Online)
ISSN 1990-3863(Print)

A
S
J
O

Al-Shifa
Journal of Ophthalmology

Vol. 20, No. 4, October – December 2024 (Index Issue)

QUARTERLY PUBLISHED

Abstracts available at https://www.asjoalshifaeye.org and http://www.pakmedinet.com/ASJO
Manuscript submission through online platform ejmanager.com

Indexed in Index Medicus -EMR, Asian Digital Library (ADL)
Recognized by Higher Education Commission (HEC), Pakistan
Recognized by College of Surgeon and Physician (CPSP), Pakistan

Al-Shifa Journal of Ophthalmology

Editorial inquiries should be addressed to Prof. Dr. Tayyab Afghani, Department of Orbit and Oculoplastics, Al-Shifa Trust Eye Hospital, Jhelum Road Rawalpindi, Pakistan.
Tel: 0092 51 5487821-25, Fax: 0092 51 5487827: Email:aqrcpio@yahoo.com ;
Website: www.asjoalshifaeye.org

ORIGINAL ARTICLE

Analysis Of Corneal Endothelial Cells Post Pars Plana Vitrectomy And Silicon Oil Tamponade Treatment for Rhegmatogenous Retinal Detachment

Muhammad Hannan Jamil[1], Bilal Ashraf[2], Asmatullah Khan[3], Aneeb Ashraf[3], Nida Amin[4], Taha Sahar[4], Ferheen Shahbaz[5]

Abstract:

Objective: To examine the effects of pars plana vitrectomy (PPV) with silicone oil tamponade on corneal endothelial cell density in patients with rhegmatogenous retinal detachment (RRD).

Methods: The study was conducted at Ali Fatima Hospital in Lahore, Pakistan, 120 individuals with RRD diagnoses between the ages of 30 and 70 participated in a quasi-experimental design. Consecutive non-probability sampling was used. Pre- and post-PPV corneal endothelial cell density was assessed.

Results: There were notable differences in the quantity of corneal endothelial cells among the groups. Before surgery, no discernible changes were discovered. However, following surgery, there were significant differences in mean change between genders ($p = 0.001$) and age groups ($p < 0.0001$). The mean change between phakic and pseudophakic eyes varied significantly after surgery ($p < 0.0001$). The mean count was significantly different before and after surgery (-49.85 cells/mm2, $p = 0.005$).

Conclusion: This implies that PPV combined with silicone oil tamponade has a significant positive effect on the density of corneal endothelial cells. PPV combined with silicone oil tamponade has a good impact on RRD patients' corneal endothelial cell density. The mean change after surgery varied by gender and age, highlighting the significance of individualized treatment plans. *Al-Shifa Journal of Ophthalmology 2024; 20(4): 138-144. © Al-Shifa Trust Eye Hospital, Rawalpindi, Pakistan.*

1. *Ali Fatima Hospital, Lahore.*
2. *LRBT Eye Hospital, Lahore.*
3. *Ali Fatima Hospital Lahore.*
4. *Green international university.*
5. *University of the Punjab*

Originally Received: 10 Aug 2024
Revised: 27Aug 2024
Accepted: 10 Sep 2024

Correspondence to:
Ferheen Shahbaz
University of the Punjab.
ferheenshahbaz8@gmail.com

Introduction:

Retinal detachment is a serious disorder that threatens vision, with an annual frequency of 5 to 12 instances per 100,000 people.[1] The lifetime risk of getting this illness is approximately 0.6%, up to the age of 60. Although it is estimated that 6% of the general population have retinal fractures, the vast majority of these breaks are benign, atrophic, and cause no symptoms. These holes are not related to any pathology and do not result in retinal detachments.[2] The most common type of retinal detachment is rhegmatogenous retinal detachment (RRD), followed by tractional and exudative. This type of detachment occurs when fluid infiltrates beneath the retina through a hole in the neurosensory

retina.[3]The primary goal of retinal detachment treatment is to repair any retinal fractures and bring the sensory retina closer to the retinal pigment epithelium (RPE). The condition is often treated surgically in one of two ways. The first is exterior, sometimes known as standard. Scleral buckling is used in this method, which employs solid silicone material. It is recommended for cases with uncomplicated retinal detachment.[4] An alternate treatment for the problem is an internal operation that involves a vitrectomy and the use of silicone oil or long-acting gases. This technique is recommended for challenging cases of retinal detachment, such as grade C proliferative vitreoretinopathy (PVR),large retinal tears, choroidal coloboma, and ocular trauma. [5,6] Silicone oil is a common tamponade used during retinal detachment surgery. It is often left in the eye for at least three months before being removed, depending on the state of the posterior portion of the eye. However, the use of intraocular silicone oil has been associated with a number of problems.[7] Vitreoretinal surgery using silicone oil affects the corneal endothelium in both aphakic and pseudo-phakic individuals. Silicone oil is commercially available in compositions of 5000 and 1000 centistokes. Due to the decreased incidence of negative effects, 5000 centistoke silicone oil is now recommended. [8,9]

A recent study[10] recorded a loss in endothelial cells of the cornea of 30.48 ± 25.78 in phakic eyes and 77.52 ± 40.03 in pseudo-phakic eyes, indicating a substantial difference between the two groups. The findings of this study will provide vital information about the mean change in corneal endothelial cell density following PPV by analyzing a larger sample size and allowing comparisons between phakic and pseudo-phakic eyes. This information will be helpful to ophthalmologists as a primary reference when treating patients having rhegmatogenous retinal detachmen.[11]The purpose of the study is to determine the average change in endothelial cell density in the cornea after three months of pars plana vitrectomy with silicone oil tamponade in patients with rhegmatogenous type retinal detachment.

Methodology:

The study was carried outat the ophthalmology department of the Ali Fatima Hospital in Lahore, Pakistan from January 2022 to June 2023. The study employed a quasi-experimental design. A non-probability consecutive sampling technique was applied. A formula for determining sample size in a population when the predicted mean change is of interest was used to determine the sample size for the study. n=(E2Z2·σ2) formula was used for calculations with 95% of confidence interval. To accommodate any patient attrition or incomplete data, the sample size was rounded to 120. Thus, it was decided that 120 patients would be an adequate sample size for the study, yielding a 95% confidence level and a 5% margin of error. Patients between the ages of 30 and 70 who have been diagnosed with rhegmatogenous retinal detachment, are undergoing pars plana vitrectomy with silicone oil tamponade, and have either phakic or pseudo-phakic eyes are eligible for inclusion. Patients with tractional type retinal detachment, rhegmatogenous type retinal detachment, present corneal or retinal disease, and a history of ocular surgery other than cataract surgery were excluded. Before collecting data, informed consent was taken. A complete medical history and ophthalmic examinationwere done working under the guidance of a consultant ophthalmologist. Documented demographic information, such as age, gender, and status of the lens (phakic or pseudo-phakic). Finally, endothelial cell count using specular microscopy was obtained.

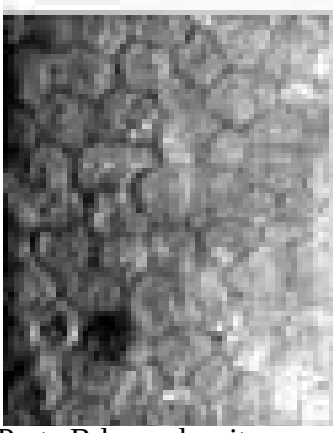
The surgeon and assistant starts with three sclerotomies to insert the vitrectomy

probe, followed by a core and peripheral vitrectomy to remove the vitreous gel and cure any retinal conditions. Following a fluid-air exchange, silicone oil is injected to tampon the retina, and sclerotomies are closed. Following surgery, topical antibiotics and corticosteroids are administered, and follow-up appointments are planned to monitor intraocular pressure, retinal health, and endothelial cell count. Potential complications, including cataract development, excessive IOP, and endothelial cell loss, necessitate close patient monitoring and management. Prior to and three months following pars plana vitrectomy, measure the density of corneal endothelial cells using a specular microscope. Recorded a small variation in the density of corneal endothelial cells. SPSS version 21.0 was utilized for data entry and analysis. Determined the mean and standard deviation for numerical data, including the age of the patient and the number of corneal endothelial cells. Calculated percentages and frequencies for qualitative factors like gender and eye status. After three months, compare the average changes in corneal endothelial cell density using an independent sample t-test. To account for potential effect modifiers, stratify data according to age, gender, and eye status. Use a post-stratification paired sample t-test with a $p < 0.05$ criterion to determine statistical significance. Participants informed permission and patient confidentiality are two ethical considerations.

Results:

Our research analyzed 120 cases, out of which 18 individuals (15%) were aged between 30-50 years while 85% (n=85) belonged to the age group of 51-70 years. We calculated the mean age as 59.2±23.92 years. Among the participants, 44 individuals (36.67%) were male, and 76 individuals (63.33%) were female. Mean corneal endothelial cell count before the surgery was 2555.19±71.71 which reduced to 2500.76±71.85 and the mean change was calculated as 54.4±23.11, p value was 0.

Part A: normal corneal endothelial cells in specular microscopy



Part B:low density corneal endothelial cells

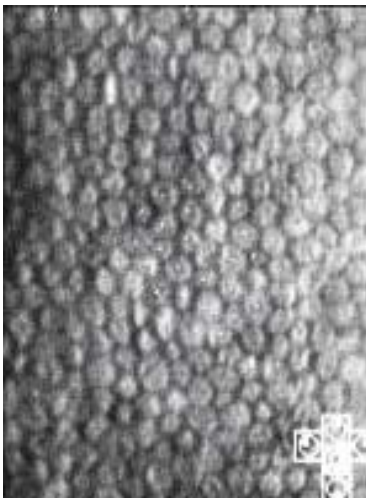


Table 1: demographic data by gender, and age group of people with retinal detachment.

Age	
30-50	24(20.08%)
51-70	96(80.12%)
Gender	
Male	44(36.67%)
Female	76(63.33%)

Table 2: Mean Corneal Endothelial Cell Density (cells/mm²) Before and After PPV + SO Surgery by Gender, Age Group, and Lens Status

Gender	Age Group	Lens Status	Mean Endothelial Density Before PPV + SO	Mean Endothelial Density After PPV + SO	Mean Change in Endothelial Density
Male	30-50	Phakic	2543.91	2508.64	35.27
		Pseudo-Phakic	2568.91	2491.13	77.78
	51-70	Phakic	2555.19	2500.76	54.43
		Pseudo-Phakic	2500.76	2450.00	50.76
Female	30-50	Phakic	2543.91	2508.64	35.27
		Pseudo-Phakic	2568.91	2491.13	77.78
	51-70	Phakic	2555.19	2500.76	54.43
		Pseudo-Phakic	2500.76	2450.00	50.76

Table 3: Inferential Statistics for Changes in Corneal Endothelial Cell Density

Lens Status	Mean Endothelial Density Before Surgery	Mean Endothelial Density After Surgery	Mean Change Standard Deviation (+/- SD)	p-value
Phakic Eyes	2554.55 (combined mean)	2504.70 (combined mean)	49.85 +/- 71.71	0.005
Pseudophakic Eyes	2567.84 (combined mean)	2470.06 (combined mean)	97.78 +/-52.56	<0.0001

Note: Single tailed t test was done

Discussion:

The quality of life associated with eyesight is significantly impacted by retinal disorders.[12] Although it is common knowledge that anterior segment surgery can lower the quantity of corneal endothelial cells, there hasn't been much research looking at how pars plana vitrectomy with internal tamponade affects the human cornea.[13] A common internal tamponade used during difficult retinal separation surgery is silicone oil (SO).[14] Removing SO after some time is the standard procedure to lessen its well-known complications.[15]

Although intraocular SO is generally well tolerated, a number of side effects, such as keratopathy, increased intraocular pressure, ocular hypotony, SO emulsification, cataract development, iritis, and endophthalmitis, have been observed. Several research have suggested that SO may harm the cornea in specific ways.[16] The detrimental effects of SO on the cornea were suggested to be due to SO forward migration to the anterior chamber and contacting the cornea.[17-20].Furthermore, endothelial cell toxicity has been linked to silicone oil (SO) in the eyes. Exposure of the cornea's endothelial cells to SO can cause physiological and morphological alterations. These alterations could result in SO-associated keratopathy, which may involve corneal thinning, the development of retro-corneal membranes, irreversible elimination of corneal endothelial cells and band keratopathy. The SO may

function as a barrier, depriving human corneal endothelial cells of the aqueous humor's usual source of sustenance.[21] However, because SO has been believed to be harmless in ocular tissues, Silicone oil's potential indirect cytotoxic effect on endothelial cells of cornea has not been adequately explored.

The current study was planned with the fact previous data include small sample size[7] less researches on in rhegmatogenous retinal detachment cases which was needed to be evaluated in pakistan, however, the results of the current study may be helpful to record mean change in corneal endothelial cell density following PPV on a larger sample size and compare phakic and pseudo-phakic eyes and set a primary data in this regard which will be helpful for ophthalmologists.

A recent study looked at corneal endothelial cell loss revealed that the loss was 30.482±5.78 in phakic eyes and 77.52±40.03 in pseudophakic eyes. There was a considerable difference between the two groups. [10]

A research on the effects of silicone oil on the cornea discovered that prolonged contact might result in significant endothelial cell loss and subsequent corneal decompensation.[18] The findings emphasize the importance of eliminating silicone oil in a timely way to avoid corneal issues Study by (Federman & Pang) Their findings, published in Ophthalmology, revealed that typical effects include increased intraocular pressure, cataract development, and keratopathy. These findings emphasize the importance of closely monitoring and treating patients with silicone oil tamponade.[19-20]

Farrahi et al. (2014) published a research in the Journal of Ophthalmic & Vision Research looking at corneal endothelial modifications in phakic and pseudophakic eyes after pars plana vitrectomy and silicone oil injection. Branisteanu, D.C in 2020discovered that phakic eyes experience more severe endothelial cell loss than pseudophakic eyes, demonstrating that lens status has a substantial influence on corneal health following surgery[21]. The findings corroborate our study.

The study investigated the effect of silicone oil (SO) on corneal endothelial cells in phakic and pseudo-phakic patients who had vitrectomy and were filled with SO. Although the presence of SO triggered a minor decrease in the amount of endothelial cells, it also caused a significant change in the shape.[22]

As a consequence, after the desired tamponade effect is achieved, the SO should be removed. Boscia et al. and Goezinne et al. discovered that after a 12-month vitrectomy with silicone oil tamponade in complex Gawaz et al. (2021) and Kunzman et al 2020 investigated rhegmatogenous retinal detachments in both phakic and pseudo-phakic eyes and found that the loss of endothelial cell density (ECD) was less than 5%. Furthermore, they discovered no obvious influence on the hexagonality or coefficient of variation of corneal endothelial cells.[22-23]

According to the findings of our research, we believe that silicone oil tamponade during vitreoretinal surgery has an positive impact on the corneal endothelium.

The results of the current study are helpful to with a larger sample size and also revealed that pseudo-phakic eyes had a significantly higher decline in endothelial cell count of cornea, however, some other trials are needed to validate our results.

Conclusion:

Our findings reveal a significant rise in the mean cell density of the cornea's endothelium three months following pars plana vitrectomy for individuals with rhegmatogenous retinal detachments.

References:

1. Cheng YH, Wang H, Li B, Ji M, Shi Q, Qi Y, Hu YG, Xie AM, Pei C. Vitrectomy with air tamponade for surgical repair of rhegmatogenous retinal detachment by eye position guided fluid-air exchange. International Journal of Ophthalmology. 2020;13(9):1417.
2. Ajlan R, Isenberg J, Cordahi G, Duval R, Olivier S, Rezende F. Primary rhegmatogenous retinal detachment with inferior retinal breaks postoperative prone positioning results: 1 day versus 7 days. International Journal of Retina and Vitreous. 2017 Dec;3:1-6..
3. Kianersi F, Barati Y, Kianersi H, Ghanbari H, Razmjoo H, Fazel F, Dehghani A, Akhlaghi M, Salehi A, Kianersi H, Pourazizi M. Rhegmatogenous retinal detachment: an analysis of 2315 eyes over a six-year period. Medical hypothesis, discovery & innovation in optometry. 2023 Dec 25;4(4):148-56..
4. Radice P, Carini E, Seidenari P, Govetto A. Standardized scleral buckling approach in the management of noncomplex primary rhegmatogenous retinal detachment. European Journal of Ophthalmology. 2021 Jul;31(4):1993-2002.
5. Shah MA, Khan B, Rehman M, Nawaz F. Frequency of complications of silicone oil in the surgical treatment of rhegmatogenous retinal detachment. Pakistan Journal of Ophthalmology. 2017 Jun 1;33(2).
6. Abrams GW, Azen SP, McCuen BW, Flynn HW, Lai MY, Ryan SJ. Vitrectomy with silicone oil or long-acting gas in eyes with severe proliferative vitreoretinopathy: results of additional and long-term follow-up: silicone study report 11. Archives of ophthalmology. 1997 Mar 1;115(3):335-44.
7. Abu-Yaghi NE, Abu Gharbieh YA, Al-Amer AM, AlRyalat SA, Nawaiseh MB, Darweesh MJ, Alkukhun LR, Abed AM, Saleh OA, Ababneh OH. Characteristics, fates and complications of long-term silicone oil tamponade after pars plana vitrectomy. BMC ophthalmology. 2020 Dec;20:1-7.
8. Zafar S, Shakir M, Mahmood SA, Amin S, Iqbal Z. Comparison of 1000-centistoke versus 5000-centistoke silicone oil in complex retinal detachment surgery. J Coll Physicians Surg Pak. 2016 Jan 1;26(1):36-40.
9. Hasan N, Asif MI, Raj N, Chawla R, Sharma N. Lens Status: A Protective Factor for Endothelium during Phacofragmentation Following Posterior Nucleus Drop during Phacoemulsification. Indian Journal of Cataract and Refractive Surgery. 2024 Jan 1;1(1):42-6.
10. Shaheer M, Khan AA, Ahmed N, Mahju TM, Rasheed U. Corneal endothelial cell loss after vitrectomy with silicone oil tamponade in phakic versus pseudophakic patients with rhegmatogenous retinal detachment. Pakistan Journal of Ophthalmology. 2017 Aug 1;33(3).
11. Senthil, M.P., Khadka, J. and Pesudovs, K., 2017. Assessment of patient-reported outcomes in retinal diseases: a systematic review. Survey of ophthalmology, 62(4), pp.546-582..
12. Prem Senthil M, Khadka J, Gilhotra JS, Simon S, Pesudovs K. Exploring the quality of life issues in people with retinal diseases: a qualitative study. Journal of Patient-Reported Outcomes. 2017 Dec;1:1-4.
13. Coman CC, Patoni SI, Malița D, Stanca S, Mușat O, Negru Ș, Feier H, Karancsi OL, Roșca C. Endothelial corneal cell damage after pars plana vitrectomy: analogy of different intraocular tamponade agents. Romanian Journal of Ophthalmology. 2021 Apr;65(2):141.

14. Coman CC, Munteanu M, Patoni SI, Mușat O. Silicone oil complications in vitreoretinal surgery. Romanian Journal of Ophthalmology. 2022 Oct;66(4):299.
15. Wan X, Li J, Liu Q. Effectiveness of different silicone oil remove methods after vitrectomy and light silicone oil tamponade in elderly patients. Annals of Palliative Medicine. 2020 May;9(3):1013019-1019.
16. Nicolai M, Lassandro N, Franceschi A, Rosati A, De Turris S, Pelliccioni P, Pirani V, Mariotti C. Intraocular pressure rise linked to silicone oil in retinal surgery: a review. Vision. 2020 Aug 13;4(3):36.
17. Valentín-Bravo FJ, García-Onrubia L, Andrés-Iglesias C, Valentín-Bravo E, Martín-Vallejo J, Pastor JC, Usategui-Martín R, Pastor-Idoate S. Complications associated with the use of silicone oil in vitreoretinal surgery: A systemic review and meta-analysis. Acta Ophthalmologica. 2022 Jun;100(4):e864-80.
18. The effect of silicone oil on the cornea. *jamanetwork.com*, https://jamanetwork.com/journals/jamaophthalmology/article-abstract/635368 (accessed 1 April 2023).
19. Federman JL, Schubert HD. Complications associated with the use of silicone oil in 150 eyes after retina-vitreous surgery. Ophthalmology. 1988 Jul 1;95(7):870-6.
20. Pang MP, Peyman GA, Kao GW. Early anterior segment complications after silicone oil injection. Canadian journal of ophthalmology. Journal canadiend'ophtalmologie. 1986 Dec 1;21(7):271-5.
21. Branisteanu DC, Moraru AD, Maranduca MA, Branisteanu DE, Stoleriu G, Branisteanu CI, Balta F. Intraocular pressure changes during and after silicone oil endotamponade. Experimental and Therapeutic Medicine. 2020 Dec 1;20(6):1-.
22. Kunzmann BC, Wenzel DA, Bartz-Schmidt KU, Spitzer MS, Schultheiss M. Effects of ultrasound energy on the porcine corneal endothelium–Establishment of a phacoemulsification damage model. Acta Ophthalmologica. 2020 Mar;98(2):e155-60.
23. Gawas L, Rao A. Changes in corneal thickness after vitrectomy—implications for glaucoma practice. PLoS One. 2021 Apr 21;16(4):e0249945.

Authors Contribution

Concept and Design: Muhammad Hannan Jamil
Data Collection / Assembly: Bilal Ashraf
Drafting: Asmatullah Khan, Aneeb Ashraf
Statistical expertise:Nida Amin, Taha Sahar
Critical Revision: Ferheen Shahbaz