Journal of
Ophthalmology: Open Access

JScholar
Fostering Scholarly Communication

Review Article Open Access

Retinal Displacement Following Repair of Rhegmatogenous Retinal Detachment

Hui Ren[1*], Shengnan Li[1,2], Li Wang[3], Xiaojing Yi[2] and Hua Wang[3]

[1]Chendu Aier Eye Hospital, 610000, China
[2]Sichuan Eye Hospital, Aier Eye Hospital Group, 610000, China
[3]Ankang Gaoxin Hospital, Ankang, Shanxi, 725000, China

[*]**Corresponding Author:** Ren Hui, Chendu Aier Eye Hospital, 610000, China, E-mail: rh0037@163.com

Received Date: February 10, 2025 **Accepted Date:** March 10, 2025 **Published Date:** March 13, 2025

Citation: Hui Ren, Shengnan Li, Li Wang, Xiaojing Yi, Hua Wang (2025) Retinal Displacement Following Repair of Rhegmatogenous Retinal Detachment. J Ophthalmol Open Access 9: 1-8

Abstract

Retinal displacement refers to the strong fluorescent lines parallel to the retinal vessels that are detected through autofluorescence examination after rhegmatogenous retinal detachment (RRD) surgery. In the clinical setting, even if patients with rhegmatogenous retinal detachment achieve macroscopic structural reattachment after the operation, the visual function of some patients remains suboptimal. This is associated with the incomplete recovery of retinal function, and retinal displacement is one of the significant influencing factors. This paper aims to summarize the studies related to retinal displacement after rhegmatogenous retinal detachment surgery in the recent five years and review the latest research on its possible occurrence mechanisms, incidence rates, and influencing factors. It is conducive to enabling surgeons to conduct better design and planning for retinal reattachment surgeries, so that patients can obtain superior visual functions after the operation.

Keywords: Rhegmatogenous Retinal Detachment; Retinal Displacement; Influencing Factor; Mechanism; Incidence

The Concept of Retinal Displacement

Rhegmatogenous retinal detachment (RRD) is one of the most common eye diseases causing vision loss and blindness. In the past few decades, the treatment methods of RRD have developed rapidly. Currently, there are various surgical methods that can achieve retinal reattachment; however, with the significant progress of retinal imaging technology, researchers have found that after the macroscopic reattachment of the retina, the micro-anatomical structure of some retinas does not achieve a complete reattachment, thus giving rise to the latest concept related to retinal reattachment - the integrity of the retina [1]. In order for patients to obtain better postoperative visual function, surgeons should not only pursue macroscopic reattachment but also continuously approach the ideal retinal reattachment, that is: no retinal displacement, outer retinal folds or discontinuity of photoreceptor structure, while maintaining the integrity of the fovea centralis structure. In 2010, Shiragami et al. [2] discovered retinal displacement after RRD surgery through fundus autofluorescence (FAF), manifested as high autofluorescent lines approximately parallel to the retinal vessels, with similar shape and caliber but separated from the vessels, at the original retinal vessel positions. Subsequently, several scholars have made relevant reports and found that retinal displacement after RRD surgery is common, and these high fluorescent lines are called retinal pigment epithelial ghost vessels or retinal vascular imprints.

The Mechanism of Retinal Displacement

The discovery of retinal displacement depends on the high fluorescence images parallel to the vascular course shown in fluorescein angiography. Some studies suggest that the appearance of the high fluorescence line may be caused by the downward movement of the retina along with the residual subretinal fluid under the effect of gravity due to the intraocular filler after RRD surgery, exposing the retinal pigment epithelium under the blood vessels. The metabolic activity of the retinal pigment epithelial cells at this location increases under light, resulting in high fluorescence. Some also believe that the displacement is not only the movement of the retinal position but may also be accompanied by the stretching or distortion of the retina. Others think that the high fluorescence may be due to the difference in fluorescent substances at this location. In conclusion, there are various opinions on the mechanism of retinal displacement. However, in recent years, with the support of computer technology, some researchers have used computer simulation models for calculation and proposed the physical mechanism of its occurrence. Farahvash [3] et al. established a computer simulation model, using interfacial tension and the densities of gas and vitreous body to calculate the contact angle and pressure between the gas filler and the retina, in order to simulate the dynamics of fluid flow in the subretinal space and calculate the deformation of the retina. The results showed that in the simulation model, the overall flow of the gas filler away from the retina along the direction of gravity stretched the retina and caused its displacement; the degree of displacement depended on the thickness of the subretinal fluid, the contact area between the filler and the retina, and the contact pressure. Larger gas fillers exerted greater contact pressure on the retina. They found that compared with pneumatic retinopexy (PnR), the probability of retinal displacement increased by more than three times during pars plana vitrectomy (PPV) because the injected bubbles were larger. They believed that the gas filler stretched the retina by removing the subretinal fluid after retinal detachment repair, and this stretching was proportional to the size of the filler. Lee [4] et al. included 3 patients with RRD who received PnR treatment and conducted a prospective follow-up. Ultra-widefield fundus photography was performed at baseline and 1 to 2 minutes after intravitreal gas injection. The results showed that subretinal fluid immediately displaced in all patients after gas injection, indicating that the buoyancy exerted by the bubble on the retina was the cause of the displacement of subretinal fluid. Based on this, the authors inferred that the buoyancy exerted by small and large bubbles was the cause of retinal displacement after surgery, and that the use of large bubbles in vitrectomy combined with gas tamponade would more likely lead to retinal displacement. That is to say, the mechanism of retinal displacement is that retinal displacement after RRD surgery is related to the pressure of the filler on the retina, which causes the flow of subretinal fluid, and the relative position of retinal vessels changes after displacement, exposing the pigment epithelium that was originally shielded by the vessels, thereby showing hyperfluorescence in autofluorescence.

The Incidence and Functional Impact of Retinal Displacement

The research reports on retinal displacement after RRD surgery are relatively few nowadays. Moreover, in various studies on retinal displacement after RRD surgery, the incidence of retinal displacement varies greatly, ranging from 6.4% to 62.8% [5, 6]. Some scholars believe that abnormal visual function after RRD surgery is related to postoperative retinal displacement, which is of great significance. A multicenter retrospective study published in 2024 included 614 patients after RRD surgery and found that the significant imaging predictors affecting vision in the early postoperative period (3 months) were the discontinuity of the ellipsoid zone and the presence of retinal displacement, and retinal displacement was associated with unequal object size [7]. A prospective interventional cross-sectional controlled study by Azaizy et al. [8] evaluated the changes in the position and microstructure of the fovea centralis after retinal reattachment surgery. The results suggested that the incidence of macular displacement was 70%, and fovea centralis displacement and metamorphopsia had a significant impact on visual function. A prospective single-blind randomized clinical trial with a half-year duration included 239 patients after retinal detachment with macular detachment. Among them, 42% had retinal displacement, and the displacement amplitude was related to poor vision and metamorphopsia [9]. Another retrospective study included 50 RRD patients who received PPV combined with silicone oil tamponade. 54% of them had metamorphopsia after surgery, and macular folds and macular displacement were significantly related to the occurrence of postoperative metamorphopsia [10]. Melo et al. [11] analyzed 66 patients with RRD accompanied by macular detachment. 29% had retinal displacement, among which 84.2% of the displacements occurred in the macular area, and the circularity of the foveal avascular zone in patients with displacement in the macular area was lower than that in those without displacement. The above studies suggest that retinal displacement, especially macular displacement after RRD surgery, may be related to postoperative metamorphopsia, unequal size of vision, and abnormal macular structure, thereby resulting in poor recovery of visual function in patients after surgery.

Some scholars also believe that retinal displacement is not common after retinal repositioning surgery, does not affect postoperative visual function, and has little clinical significance. In 2022, Rohowetz [12] et al. included 12 patients with unilateral rhegmatogenous retinal detachment (RRD) who underwent scleral buckle (SB) surgery (without gas tamponade). Only one eye (8%) had a 0.1-mm retinal displacement in the superior vascular arcade and the superior temporal periphery, and the remaining eyes showed no identifiable signs of retinal displacement. Bazvand et al. [13] included 23 eyes after pars plana vitrectomy (PPV) with silicone oil tamponade, and only 2 eyes (8.7%) showed downward retinal displacement. The patients did not complain of metamorphopsia, and no abnormalities were found in the strabismus examination. Filippelli et al. [14] included 50 patients with RRD combined with proliferative vitreoretinopathy who underwent PPV combined with silicone oil tamponade, and only 2 cases (4.5%) had upward retinal displacement. A retrospective observational study in 2024 included a total of 123 eyes after RRD surgery, and only 14 eyes (11%) had macular retinal displacement. All displacements were downward, with an average angle of 3.8°, and were not related to the occurrence of metamorphopsia [15]. The above studies suggest that retinal displacement after PPV combined with silicone oil tamponade for RRD is not common, and even if macular displacement occurs, it has no significant clinical significance.

Actually, different surgical methods for RRD may affect the incidence of postoperative retinal displacement. A single-center case series published by Mahmoudzadeh [16] et al. in 2024 included a total of 194 eyes and reported the incidence of retinal displacement after the treatment of RRD with PPV, SB, or combined PPV/SB. Among them, the incidence in the combined group was 17.6%, in the PPV group was 15.5%, and in the SB group was only 2.2%. In 2023, Bansal [8] et al. included a total of 91 eyes, of which 42 eyes received SB treatment and 49 eyes received combined PPV and SB treatment. Three months after the surgery, 16.7% in the SB group and 38.8% in the combined group had retinal displacement. A multicenter retrospective consecutive case series study compared the retinal displacement after PnR and PPV, and a total of 238 eyes were included. 42.4% in the PPV group had retinal displacement, while 15.1% in the PnR group had it [17]. A retrospective comparative study by Özal et al. [18] included 53 patients with macular detach-

ment retinal detachment who received PPV. 64.2% in the gas filling group had macular displacement, and 36.0% in the silicone oil filling group had macular displacement. The above studies indicate that the incidence of retinal displacement varies with different surgical methods. Currently, it is considered that the incidence of retinal displacement is the lowest in the simple SB surgery and the highest in the PPV combined with gas filling.

Recent evidence suggests that different detection techniques may also lead to different incidences of displacement. There are many fundus autofluorescence detection instruments. Due to the differences in the excitation wavelength of the equipment, the nature of the barrier filter, and the image processing technology, the fundus autofluorescence images formed by the same lesion may also be different. Therefore, different detection instruments may also be an influencing factor for the detection rate of postoperative retinal displacement [19]. Cejudo et al. [20] analyzed the differences in 30° blue autofluorescence (BAF30), 55° blue autofluorescence (BAF55), and 200° green ultra-wide-angle autofluorescence (UWF200) imaging in detecting retinal displacement after vitrectomy for retinal detachment (RRD). A total of 42 eyes were included, all of which underwent three--incision vitrectomy. Different degrees of retinal displacement could be detected in 45.2% of the images, and the consistency of detection by these three methods was only about 80%.

In conclusion, for the incidence of postoperative retinal displacement in patients with RRD, there are significant differences in various clinical studies. The reasons may be related to the different numbers of included patients, different conditions, different surgical methods, and even different examination methods. Currently, it is believed that the incidence of retinal displacement from low to high is in the order of SB, PnR, and PPV, and the incidence of retinal displacement in PPV combined with silicone oil filling is lower than that with gas filling. Whether retinal displacement, especially in the macular area, has an impact on the postoperative visual function of patients still needs to be further clarified. Understanding the importance of the integrity of the anatomical structure by evaluating the displacement of the retina after reattachment may prompt improvements in vitreoretinal surgical techniques, and larger clinical sample studies with strict baseline control are still needed.

Influencing Factors of Retinal Displacement

It is believed that the occurrence of retinal displacement after RRD may be related to a variety of factors, including the degree of retinal detachment, the surgical method of retinal reattachment, the means of subretinal fluid drainage during the operation, the type of filler, the postoperative position, the detection method, and many other factors. Among them, the most important ones include the choice of surgical method and filler and the difference in postoperative position.

The Influence of Different Surgical Methods on Retinal Displacement

In the recent 5 years, most of the clinical studies related to retinal displacement after RRD surgery have focused on exploring the influence of surgical methods and fillers on its incidence. Most studies suggest that the incidence and degree of retinal displacement after SB and PnR are lower than those after PPV. Among them, the incidence of retinal displacement after SB is 2.2% - 16.7%, the incidence of retinal displacement after PnR is about 15.1%, the incidence of retinal displacement after PPV is 15.5% - 42.4%, and that in the SB combined with PPV group is 17.6% - 38.8% [8, 16-18]. Bhambra et al. [21] used three-dimensional reconstruction of ultra-wide-angle fundus laser scanning to quantify retinal displacement. The results showed that the average displacement after PPV was 0.44 ± 0.42 mm; while after PnR, the average displacement was only 0.21 ± 0.27 mm, and the difference was statistically significant.

The Influence of Different Fillers on Retinal Displacement

The choice of intraoperative fillers may also affect the occurrence of retinal displacement. A prospective cohort study in 2024 included a total of 103 eyes after PPV. The study found that the only variable significantly related to retinal displacement was the use of gas filling or silicone oil filling [22]. Farahvash et al. [23] established a computer simulation model to evaluate the mechanism and theoreti-

cal degree of retinal displacement during PPV with silicone oil filling and air filling. They proposed that the contact area and contact pressure between the air filler and the retina were larger than those of the silicone oil filler, which would increase the flow of subretinal fluid and lead to an increase in the amplitude of retinal displacement. In addition, two case reports also suggested that compared with standard PPV or PPV combined with SB and full-volume gas filling, minimally invasive vitrectomy using small-volume expandable gas filling and local scleral buckling could reduce the occurrence of retinal displacement [24,25].

The Influence of the Treatment Methods of Subretinal Fluid on Retinal Displacement

The different ways of handling subretinal fluid during the operation may also affect the occurrence of retinal displacement. Abdi et al. [26] compared the incidence and characteristics of retinal displacement after direct perfluorocarbon liquid (PFCL) - silicone oil exchange and indirect PFCL gas exchange and gas-to-silicone oil exchange methods in patients with RRD undergoing pars plana vitrectomy (PPV). The results showed that there was no significant difference in the incidence and location of postoperative retinal displacement between the direct and indirect fluid exchange methods. However, the average retinal displacement in the direct exchange method was lower than that in the indirect exchange method. Therefore, they believed that the direct exchange method has potential advantages in reducing postoperative retinal displacement. Bansal et al. [27] investigated whether minimally invasive PPV without gas-liquid exchange but with internal or external drainage would lead to retinal displacement. The clinical results showed that both methods could cause retinal displacement. This might be because allowing the retinal pigment epithelium pump to naturally absorb the subretinal fluid might reduce the risk of retinal displacement. Another result of their study also suggested that in the SB group, 22.5% (6/27) of the patients had retinal displacement after external subretinal fluid drainage, while the proportion was 6.7% (1/15) in patients without external drainage. Therefore, they believed that in the external drainage of SB, the artificially caused movement of subretinal fluid might lead to retinal stretching and displacement [8].

The Influence of Postoperative Body Position on Retinal Displacement

RRD patients usually need to maintain a special position after undergoing PPV combined with gas tamponade or PnR surgery to increase the success rate of retinal reattachment. Some surgeons support the prone position, while others prefer the position supporting the retinal break. However, there is no consensus on the effect of different positions on postoperative retinal displacement. A Meta-analysis published in 2024 compared whether the prone position could reduce the risk of retinal displacement in RRD patients after PPV and gas tamponade. The results showed that very low certainty evidence indicated that immediately adopting the prone position after PPV combined with gas tamponade had a lower incidence of retinal displacement, outer retinal folds, and diplopia than adopting the position supporting the retinal break [28]. But Casswell et al. [29] included 239 RRD patients who received PPV or PnR surgery. The results showed that among 100 patients in the prone position group, 42 (42%) had retinal displacement, while among 103 patients in the position supporting the retinal break group, 58 (56%) had retinal displacement, and the degree of displacement in the prone position group was lower. Other studies have also shown that immediate prone position has a lower risk of retinal displacement than delayed prone position [30].

Summary and Outlook

This article summarizes the latest research progress related to retinal displacement after RRD surgery in the recent five years. We conducted an English literature search on PubMed for the time period of "the recent five years" using the search terms "rhegmatogenous retinal detachment and retinal replacement", and a total of 50 related articles were retrieved. We reviewed all the articles to summarize the contents in four aspects: the concept of retinal displacement, the mechanism of retinal displacement, the incidence and functional impact of retinal displacement, and the influencing factors of retinal displacement. Currently, clinical research on retinal displacement after RRD surgery is insufficient, and larger sample-sized studies are needed to clarify its occurrence and development mechanism and influencing factors, and to evaluate its impact on the integrity

of visual function recovery in postoperative patients. The author believes that more precise quantification of the presence or absence of retinal displacement, the degree, angle, and direction of displacement, etc. is the entry point for achieving breakthrough progress in research related to retinal displacement.

Fund Program

Medical Research Project of Chengdu (2022362); Science Research Foundation of Aier Eye Hospital Group (AF2201D01).

References

1. Muni RH, Lee WW, Bansal A, Ramachandran A, Hillier RJ (2022) A paradigm shift in retinal detachment repair: The concept of integrity. Prog Retin Eye Res. 91: 101079.

2. Shiragami C, Shiraga F, Yamaji H, Fukuda K, Takagishi M, Morita M, Kishikami T (2010) Unintentional displacement of the retina after standard vitrectomy for rhegmatogenous retinal detachment. Ophthalmology. 117: 86-92.e1..

3. Farahvash A, Marafon SB, Juncal VR, Figueiredo N, Ramachandran A, Muni RH (2022) Understanding the mechanism of retinal displacement following rhegmatogenousretinal detachment repair: A computer simulation model. Acta Ophthalmol. 100: e1163-71.

4. Lee WW, Ramachandran A, Hamli H, Escaf LC, Bansal A, Muni RH (2023) Immediate Subretinal Fluid Displacement From The Buoyant Force Of A Small Gas Bubble Inpneumatic Retinopexy: Insights Into The Potential Mechanism Of Retinal Displacement After Retinal Detachment Repair. Retin Cases Brief Rep. 17: 251-5.

5. Shaheen AR, Iyer PG, Flynn HW, Yannuzzi NA (2023) Retinal displacement following repair of rhegmatogenous retinal detachment. Oman J Ophthalmol. 16: 205-10.

6. Mason RH, Minaker SA, Marafon SB, Figueiredo N, Hillier RJ, Muni RH (2022) Retinal displacement following rhegmatogenous retinal detachment: A systematic review and meta-analysis. Surv Ophthalmol. 67: 950-64.

7. Lee WW, Francisconi CLM, Marafon SB, Juncal VR, Chaudhary V, Hillier RJ, Muni RH (2024) Imaging Predictors Of Functional Outcomes After Rhegmatogenous Retinal Detachment Repair. Retina. 44: 1758-65.

8. Bansal A, Naidu SC, Marafon SB, Kohler JM, In S, Mahendrakar PA, Garima, Kashyap H, Susavar P, Bhende M, Ryan EH, Muni RH (2023) Retinal Displacement after Scleral Buckle versus Combined Buckle and Vitrectomy for Rhegmatogenous Retinal Detachment: ALIGN Scleral Buckle versus Pars Plana Vitrectomy with Scleral Buckle. Ophthalmol Retina. 7: 788-93.

9. Casswell EJ, Yorston D, Lee E, Heeren TFC, Harris N, Zvobgo TM, Tarafdar S, Xing W, Bourmpaki E, Bunce C, Keane P, Charteris DG (2020) Effect of Face-Down Positioning vs Support-the-Break Positioning After Macula-Involving Retinal Detachment Repair: The PostRD Randomized Clinical Trial. JAMA Ophthalmol. 138: 634-42.

10. Zgolli H, Abdelhedi C, Choura R, Abdaoui M, Fekih O, Zghal I, Nacef L (2023) Prevalence and predictors of metamorphopsia after successful vitrectomy surgery for macula-off rhegmatogenous retinal detachment. Tunis Med. 101: 280-4.

11. Melo IM, Francisconi CLM, Marafon SB, Figueiredo NA, Juncal VR, Bhambra N, Ta Kim DT, Brosh K, Berger AR, Giavedoni LR, Wong DT, Altomare F, Chow DR, Hillier RJ, Muni RH (2023) Optical Coherence Tomography Angiography Morphology After Rhegmatogenous Retinal Detachment Repair: Align Post Hoc Analysis. Retina. 43: 775-83.

12. Rohowetz LJ, Shaheen AR, Russell JF, Ashkenazy N, Iyer PG, Sridhar J, Flynn HW Jr, Yannuzzi NA (2022) Evaluation Of Retinal Displacement Following Primary Scleral Buckling For Macula-Involving Rhegmatogenous Retinal Detachment. Retina. 42: 1498-502.

13. Bazvand F, Azarkish A, Riazi-Esfahani H, Nabavi A, Khodabandeh A, Akbari M (2021) Mirmohammadsadeghi A, Ebrahimiadib N, Khojaste H. Retinal displacement following pars plana vitrectomy with silicone oil tamponade for rhegmatogenous retinal detachment. Int Ophthalmol. 41: 3007-11.

14. Filippelli M, Napolitano P, Costagliola C, Rinaldi M, Chiosi F, dell'Omo R (2021) Unintentional Retinal Displace-

ment in Eyes Treated for Rhegmatogenous Retinal Detachment Complicated by Proliferative Vitreoretinopathy with Pars Plana Vitrectomy and Silicone Oil. J Ophthalmol. 2021: 5532787.

15. de Saint Sauveur G, Sayadi S, Lejoyeux R, Salviat F, Tadayoni R, Bruneau S, Bonnin S, Le Mer Y (2024) Incidence of macular displacement after rhegmatogenous retinal detachment surgery using ultra-widefield fundus autofluorescence. Int Ophthalmol. 44: 66.

16. Mahmoudzadeh R, Swaminathan S, Salabati M, Wakabayashi T, Patel D, Mehta S, Kuriyan AE, Khan MA, Klufas MA, Garg SJ, Gupta OP, Regillo CD, Yonekawa Y, Cohen MN (2024) Retinal Displacement Following Rhegmatogenous Retinal Detachment Repair.Ophthalmic Surg Lasers Imaging Retina. 55: 560-6.

17. Brosh K, Francisconi CLM, Qian J, Sabatino F, Juncal VR, Hillier RJ, Chaudhary V, Berger AR, Giavedoni LR, Wong DT, Altomare F, Kadhim MR, Newsom RB, Marafon SB, Muni RH (2020) Retinal Displacement Following Pneumatic Retinopexy vs Pars Plana Vitrectomy for Rhegmatogenous Retinal Detachment. JAMA Ophthalmol. 138: 652-9.

18. Özal E, Baybora H, Karapapak M, Ermiş S, Güler MS, Yılmaz YC, Hayat ŞÇ, Özal SA (2024) Unveiling macular displacement: endotamponade variations in retinal detachment repair outcomes. Int Ophthalmol. 44: 412.

19. Brosh K, Roditi E, Bansal A, Martins Melo I, Potter MJ, Muni RH (2024) Optical coherence tomography homography for detection of retinal displacement: a validation study. Graefes Arch Clin Exp Ophthalmol. 262: 3797-804.

20. Cejudo RM, Marchite CB, Morán TP, Piqueras SC (2022) Comparison between standard and wide-field autofluorescence in detection of retinal displacement after rhegmatogenous retinal detachment surgery. Adv Ophthalmol Pract Res. 2: 100076.

21. Bhambra N, Francisconi CLM, Marafon SB, Figueiredo NA, Juncal VR, Brosh K, Hillier RJ, Muni RH (2022) A Novel Method of Quantifying Retinal Displacement Using Ultra-Widefield Fundus Autofluorescence Imaging. Am J Ophthalmol. 244: 1-10.

22. dell'Omo R, Cucciniello P, Affatato M, Rapino G, D'Albenzio A, Venturi F, Campagna G (2024) Influence of Vitreous Cortex Remnants on Normal Retinal Anatomy in Eyes with Primary Rhegmatogenous Retinal Detachment. Ophthalmol Retina. 8: 1002-12.

23. Farahvash A, Marafon SB, Juncal VR, Figueiredo N, Ramachandran A, Muni RH (2022) Impact of tamponade agent on retinal displacement following pars plana vitrectomy for rhegmatogenous retinal detachment repair: a computer simulation model. Acta Ophthalmol. 100: e1470-8.

24. Muni RH, Felfeli T, Figueiredo N, Marafon SB, Escaf LC, Juncal VR (2022) Minimal Gas Vitrectomy Technique For Reducing Risk Of Retinal Displacement Following Rhegmatogenous Retinal Detachment Repair. Retin Cases Brief Rep. 16: 681-4.

25. Muni RH, Bansal A, Lee WW, Escaf LC (2023) Minimal Gas Vitrectomy With Scleral Buckle To Minimize Retinal Displacement In Rhegmatogenous Retinal Detachment With Inferior Breaks. Retin Cases Brief Rep. 17: 247-50.

26. Abdi F, Zand A, Mirzakhan M, Zarehosseinabadi V, Anvari P, Mirshahi R, Sedaghat A, Taherian MM, Gordiz A, Alemzadeh SA (2024) Retinal displacement following direct versus indirect fluid exchange in pars Plana vitrectomy for rhegmatogenous retinal detachment. Eur J Ophthalmol. 11206721241286123.

27. Bansal A, Escaf LC, Lee WW, Muni RH (2024) Fluid-Fluid Exchange And External Needle Drainage With Minimal Gas Vitrectomy Associated With Retinal Displacement. Retin Cases Brief Rep. 18: 428-32.

28. Fung TH, Yim TW, Lois N, Wright DM, Liu SH, Williamson T (2024) Face-down positioning or posturing after pars plana vitrectomy for macula-involving rhegmatogenous retinal detachments. Cochrane Database Syst Rev. 3: CD015514.

29. Casswell EJ, Yorston D, Lee E, Heeren TFC, Harris N, Zvobgo TM, Tarafdar S, Xing W, Bourmpaki E, Bunce C, Keane P, Charteris DG (2020) Effect of Face-Down Positioning vs Support-the-Break Positioning After Macula-Involving Retinal Detachment Repair: The PostRD Randomized Clinical Trial. JAMA Ophthalmol. 138: 634-42.

30. Sverdlichenko I, Lim M, Popovic MM, Pimentel MC, Kertes PJ, Muni RH (2023) Postoperative positioning regimens in adults who undergo retinal detachment repair: A systematic review. Surv Ophthalmol. 68: 113-25.