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Ophthal Focus

Dear Doctor,

Greetings from Micro Labs Limited. We are happy to bring you 'Ophthal Focus' which contains latest and interesting news in the field of Ophthalmology.

This issue contains

- **Evaluation of the outcomes of dacryoendoscopic-assisted laser dacryoplasty with silicone intubation for the management of Nasolacrimal Duct Obstruction or Stenosis**
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- **Deep Learning-based Image Analysis for Evaluating Abduction Range in Abducens Nerve Palsy Patients Before and After Strabismus Surgery**
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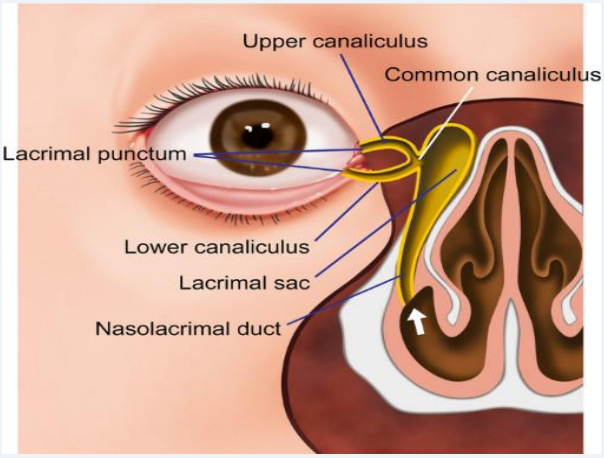
Best Regards,

Medical Team, Micro Labs Limited

Evaluation of the outcomes of dacryoendoscopic-assisted laser dacryoplasty with silicone intubation for the management of Nasolacrimal Duct Obstruction or Stenosis

INTRODUCTION

Obstruction of the lacrimal duct often presents with symptoms such as excessive tearing (epiphora) or repeated infections accompanied by mucopurulent discharge, which can sometimes lead to social discomfort. This blockage may arise at various points within the lacrimal drainage pathway, including the punctum, canaliculus, nasolacrimal duct, or nasal ostium.[1] Dacryocystorhinostomy (DCR) is the standard surgical procedure for treating nasolacrimal duct obstruction (NLDO), but it can be associated with complications such as nasal bleeding, skin scarring, and granuloma formation.[2] The advent of dacryoendoscopy has made silicone intubation a widely used approach for managing NLDO. Dacryoendoscopy has proven valuable not only for identifying variations in the causes of obstructions but also for their treatment. While it has improved the success rates of silicone intubation, these rates range between 51% and 90%. The variability in outcomes appears to be influenced by factors such as the location of the obstruction, differences in surgical techniques, criteria used to define success, follow-up duration, and the surgeon's level of expertise.[3] The purpose of this study was to assess the efficacy of dacryoendoscopic-assisted laser dacryoplasty combined with silicone intubation (DLDI) in treating NLDO or stenosis, as well as to determine the factors contributing to DLDI failure.



Nasolacrimal Duct Obstruction

DLDI appears to result in a higher success rate for patients with distal NLDO or nasolacrimal duct stenosis, while causing minimal tissue damage and fewer major complications

METHODS

This prospective, single-center cohort study was conducted among patients with NLDO or stenosis who underwent DLDI. Eligibility criteria included (1) a confirmed diagnosis of NLDO or stenosis based on dacryoendoscopic findings, with or without radiological confirmation using dacryocystography, and (2) recurrent or persistent symptomatic epiphora. Participants were

categorized into three groups: Group A (proximal NLDO), Group B (distal NLDO), and Group C (nasolacrimal duct stenosis). The Kaplan-Meier method was applied to evaluate anatomical and functional success rates of DLDI within a 2-year follow-up period after silicone stent removal. Cox proportional hazards regression analysis was performed to identify factors associated with treatment failure.

RESULTS

The study included 522 eyes from 522 patients with NLDO or stenosis who underwent DLDI. These were divided into Groups A (proximal NLDO, 170 eyes), B (distal NLDO, 174 eyes), and C (nasolacrimal duct stenosis, 178 eyes). The overall anatomical success rate for the cohort was 84.8% at the 2-year follow-up. Significant differences were observed in the cumulative anatomical and functional success rates among the three groups at the 2-year follow-up (Figure 1), with Groups B and C showing higher success rates compared to Group A. After adjusting for other factors, the Cox proportional hazards model identified a higher risk of DLDI failure in patients with a history of chronic dacryocystitis (HR=3.07; p<0.001) and in those with epiphora lasting more than 1 year (HR=2.67; p<0.001). Additionally, 37 patients (7.1%) experienced complications related to the procedure.

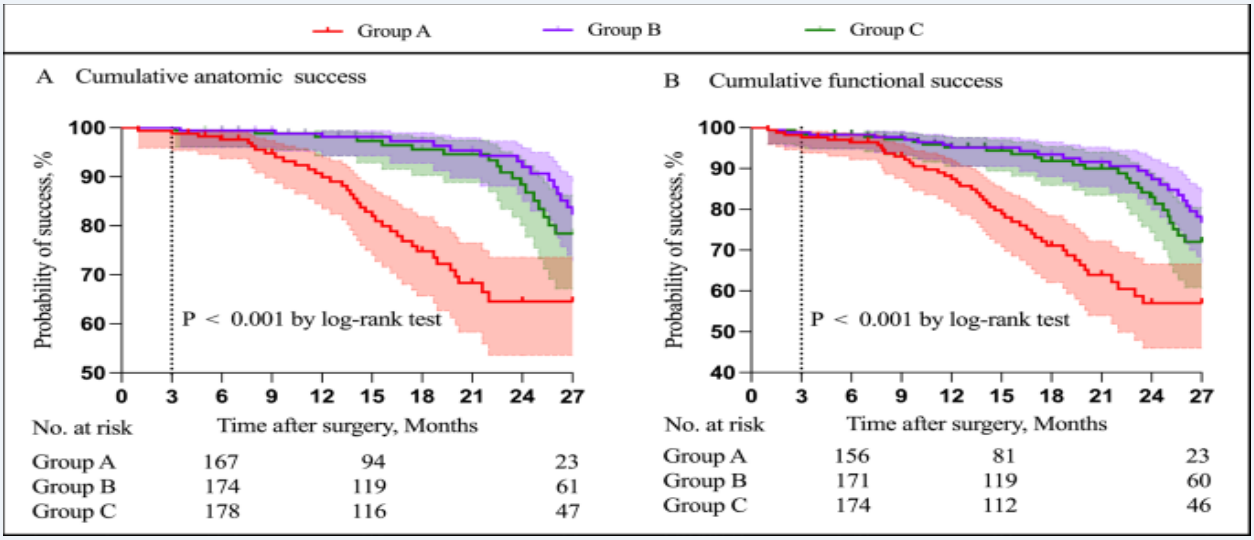


Figure 1. Kaplan-Meier curves comparing the three groups' cumulative DLDI success rates. The mean time between surgery and silicone tube removal was shown by the vertical dashed lines. DLDI stands for dacryoendoscopic-assisted laser dacryoplasty with silicone intubation.

DISCUSSION

Earlier research has documented success rates for silicone intubation combined with dacryoendoscopy for nasolacrimal duct stenosis, ranging from 73.9% to 82.9% at a 1-year postoperative follow-up.[4,5] This study reported cumulative anatomical and functional success rates

of 88.5% and 83.0%, at the 2-year follow-up after silicone stent removal, surpassing the outcomes of previous studies. The results indicated that patients with distal NLDO or stenosis were significantly less likely to experience symptomatic recurrence following DLDI compared to those with proximal NLDO. These findings suggest that the success of the procedure may be influenced by the location and severity of the obstruction or stenosis. In contrast, Kamao employed a sheath-guided bicanalicular intubation technique for managing NLDO.[6] Their study tracked patients for up to 6 months, reporting an 83% success rate for distal NLDO and a 91% success rate for proximal NLDO.[6]

CONCLUSION

DLDI appears to result in a higher success rate for patients with distal NLDO or nasolacrimal duct stenosis while causing minimal tissue damage and fewer major complications. A prolonged duration of epiphora and a history of chronic dacryocystitis were linked to an increased risk of requiring reoperation.

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Therapeutic effectiveness of various Intense Pulsed Light machines in Meibomian Gland Dysfunction Treatment

INTRODUCTION

Dry eye disease impacts around 350 million people worldwide, with the prevalence rates ranging from 5% to 50%, depending on the region.[1] Meibomian gland dysfunction (MGD) is the primary

cause of evaporative dry eye disease.[2] There are several treatment options available for Meibomian gland dysfunction (MGD), with IPL therapy being introduced as a method for managing the condition. Subsequent studies demonstrated that intense pulsed light (IPL) therapy can alleviate dry eye symptoms by enhancing meibomian gland function. Since IPL is a supportive, repeated treatment—typically requiring three or more sessions to achieve optimal results—safety becomes a crucial factor. Light with wavelengths below 420 nm falls within the UV spectrum, which can harm the skin and accelerate aging, particularly around the eyelids. Therefore, the presence of UV light must be completely avoided during IPL therapy. A filter that effectively blocks harmful light is essential to ensure safety. However, there are currently no standardized quality checks or warning systems for the filters used in IPL machines. Filters can only be inspected visually, with or without magnification, and operators often fail to check the filter before each session, missing minor defects visible only under magnification. This creates a significant safety risk, highlighting the need for a more secure filter system to guarantee the complete elimination of UV light during IPL treatments.[3] In response to the issues mentioned, this study was conducted to assess the therapeutic effectiveness of various IPL machines in treating MGD. The experimental machine featured a dual filter system to evaluate its feasibility and importance in IPL treatment.

The IPL machine's dual filter mechanism lowers light intensity by about 6.5% without compromising its therapeutic benefits. It is a workable way to guarantee double safety and has promise for increasing acceptance not just for MGD but also for other IPL therapy situations.

METHODS

This was a multicenter, two-arm parallel-group randomized active-controlled trial involving 213 participants diagnosed with MGD. These subjects received three sessions of IPL treatment either in a control group (M22) or an experimental group (OPL-I), with follow-up assessments conducted three to four weeks after each session. Various measures, including tear breakup time (TBUT), meibomian gland secretion scores (MGSS), meibomian gland meibum scores (MGMS), corneal fluorescein staining (CFS) scores, and the Standard Patient Evaluation of Eye Dryness (SPEED), were used to evaluate the signs and symptoms of eye dryness at baseline and follow-up visits.

RESULTS

Both machines operated on the same principles, with the experimental (OPL-I) group featuring a dual filter system. Changes in the primary signs and symptoms are presented in Figure 1. In both groups, the MGSS scores decreased, indicating improved meibomian gland patency, with the

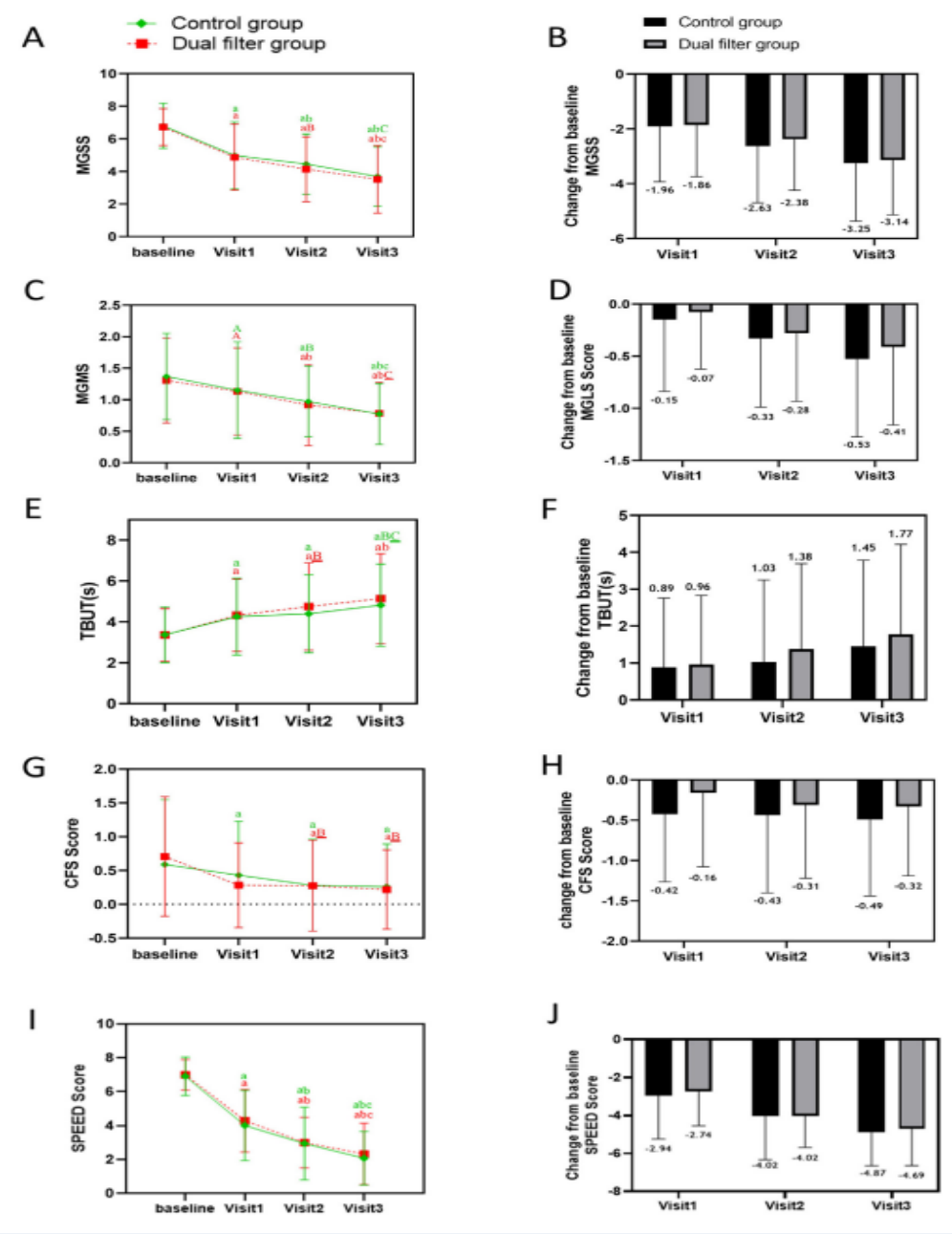

Figure 1. Improvement in symptoms and indicators following IPL

effect becoming more pronounced after multiple sessions (Figure 1A–B). The MGMS scores also showed a gradual decrease in both groups, reflecting enhanced meibum quality (Figure 1C–D). TBUT increased steadily in both groups as treatment sessions continued (Figure 1E–F). Additionally, CFS and SPEED scores decreased progressively in both groups (Figure 1G–J). These findings demonstrated a significant improvement in MGD signs and symptoms in both groups, confirming the efficacy of IPL treatment. Non-inferiority analysis revealed no statistically significant differences between the two groups. Over time, various defects appeared in the filter. Spectrophotometry indicated that the light intensity dropped to 93.5% ± 0.46% after passing through the first filter.

DISCUSSION

The current study indicated that the gradual accumulation of defects in IPL machine filters could pose a hidden risk to the eyelids. They confirmed that the high-output flash xenon lamp emitted light within the range of 300–1200 nm, which includes UV light, primarily UVA-1 (340–420 nm). UVA-1 is a well-known contributor to skin aging, as it induces matrix-degrading metalloproteases, and it also plays a role in skin cancer by causing photochemical DNA mutations, such as cyclopyrimidine dimers, which can accumulate with repeated exposure.[4,5] The eyelid, being one of the thinnest areas of skin, is especially susceptible to UV light, leading to pigment accumulation, wrinkles, and premature aging, which directly impact appearance.

CONCLUSION

IPL treatment using different machines produces similar results in improving the symptoms and signs of MGD. The dual filter system in the IPL machine reduces light intensity by around 6.5% but does not compromise its therapeutic effectiveness. This approach is a practical means of enhancing safety and holds potential for broader use, not only in MGD treatment but also in other IPL applications.

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Deep Learning-based Image Analysis for Evaluating Abduction Range in Abducens Nerve Palsy Patients Before and After Strabismus Surgery

INTRODUCTION

Excellent accuracy and consistency were achieved by a deep learning-based image processing technique for automatic measures of ocular abduction. This technique has promise for objectively evaluating surgical results in patients with abducens nerve paralysis.

The abducens nerve, which controls the lateral rectus muscle, is responsible for abducting the eye or moving it laterally.[1] Abducens nerve palsy leads to restricted abduction and horizontal double vision, which can worsen when gazing towards the affected side.[2] As noted, abducens nerve palsy is the most common ocular motor cranial nerve palsy, and surgical intervention should be considered when symptoms persist for more than six months. To assess surgical outcomes, the angle of deviation is typically measured using prisms or a synoptophore, and binocular single vision is evaluated through tests like the cover test, motor fusional vergences, and stereoacuity. While these methods are precise, they require experienced ophthalmologists. Thus, a more convenient approach is needed. The extent of abduction is a straightforward and valuable parameter for evaluation. Currently, deep learning techniques have demonstrated impressive results in processing ophthalmic images, with significant potential for quantifying ocular motor disorders. Lou et al. have introduced innovative deep learning-based methods for analyzing ocular movements, such as inferior oblique overaction.[3] To achieve accurate and efficient measurements and objectively assess surgical outcomes, the present study suggests using deep learning-based image analysis to automatically evaluate the extent of abduction in patients with abducens nerve palsy, both before and after strabismus surgery.

METHODS

This study involved 13 patients diagnosed with abducens nerve palsy who underwent strabismus surgery at a tertiary hospital. Photographs of the primary position, dextroversion, and levoversion were taken both before and after the surgery. An eye location and segmentation network was trained using recurrent residual convolutional neural networks with attention gate connections based on U-Net (R2AU-Net). Facial images from the abducens nerve palsy patients were used as the test set, and the parameters were automatically measured from the masked images. Absolute abduction was also measured manually, and relative abduction was calculated. The agreement between manual and automatic measurements, as well as repeated automatic measurements, was analyzed, and preoperative and postoperative results were compared.

RESULTS

The dice coefficients for eye segmentation tasks in the test set were 0.941 for the eyelid and 0.949 for the cornea. The intraclass correlation coefficients (ICCs) between manual and automatic measurements of absolute abduction ranged from 0.985 to 0.992 (all $P<0.001$), indicating excellent

agreement between the two methods. The ICCs between two repeated automatic measurements of absolute abduction ranged from 0.994 to 0.997 (all P<0.001), demonstrating exceptional repeatability of the automatic system. Furthermore, Bland-Altman plots confirmed the consistency between any two measurements of the affected eye and the contralateral eye. The average preoperative and postoperative automatic measurements of absolute abduction for the affected eye were 2.18 ± 1.40 mm and 3.36 ± 1.93 mm, respectively. For the contralateral eye, the average preoperative and postoperative measurements were 10.03 ± 2.37 mm and 9.94 ± 2.56 mm, respectively. Paired t-tests showed a significant increase in absolute abduction of the affected eye after strabismus surgery (P<0.05), with no significant change in the contralateral eye (P>0.05). Additionally, relative abduction improved in 76.9% of patients (10/13) following surgery (P<0.01) (Figure 1).

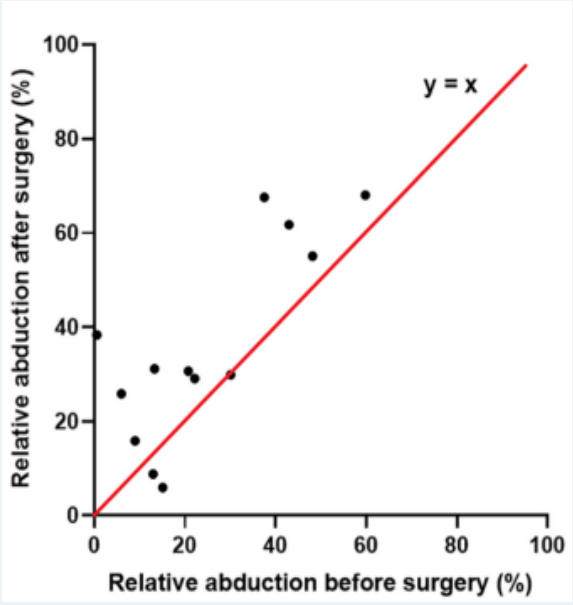

Figure 1. Relative abduction of 13 patients before and after surgery. The red line indicated the equation y = x.

DISCUSSION

In this study, a deep learning-based image analysis technique was introduced to automatically evaluate the extent of abduction in patients with abducens nerve palsy before and after strabismus surgery. The results showed excellent agreement between automatic and manual measurements, along with high repeatability in the automatic measurements, demonstrating the reliability of this evaluation method. Additionally, significant improvement in absolute abduction was observed after surgery, with relative abduction increasing in 76.9% of patients, suggesting that the surgery effectively addressed eye misalignment. Overall, strabismus surgery was found to be safe and successful in correcting ocular alignment.[4] Postoperative outcomes had a significant impact on the patient's visual quality of life and psychosocial well-being.[5]

CONCLUSION

This study introduced an automated method to quantitatively evaluate the degree of abduction in patients with abducens nerve palsy before and after strabismus surgery. The approach enabled rapid, accurate, and repeatable measurements using facial images, offering promising potential for application in abducens nerve palsy and other ocular motility disorders.

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Case report on a full-thickness macular hole associated with a retinal pigment epithelium tear after anti-VEGF therapy

INTRODUCTION

The FTMH was successfully closed by vitrectomy using the inverted ILM flap technique, even though the case was complicated.

Anti-vascular endothelial growth factor (anti-VEGF) therapy has significantly enhanced visual outcomes for patients with neovascular age-related macular degeneration (nvAMD). However, one significant complication of this treatment is pigment epithelial detachment (PED), which may cause a retinal pigment epithelium (RPE) tear. When the tear involves the macula, it can lead to permanent vision loss.[1] This study reports a case of a full-thickness macular hole (FTMH) and an RPE tear following anti-VEGF therapy in an eye with PED linked to nvAMD. In this case, the RPE tear had an unusual star-shaped appearance, possibly due to mechanical forces, and remained attached to the overlying photoreceptor cell layer, while also coexisting with an FTMH. Although previous reports have described cases of FTMH over a PED that could be closed with anti-VEGF therapy or vitrectomy, this case presented a unique combination of findings.[2,3] In this particular case, vitrectomy effectively closed the FTMH and resulted in an improvement in visual acuity.

CASE PRESENTATION

A 73-year-old man, who had been undergoing regular fundus examinations since the age of 60 due to diabetes and hypertension, had a history of smoking 20 cigarettes a day between the ages of 20 and 67. Although fundus exams showed no signs of diabetic retinopathy, optical coherence tomography (OCT) revealed irregularities in the retinal pigment epithelium (RPE) and multiple drusen in both eyes, leading to a diagnosis of early age-related macular degeneration (AMD). His best-corrected visual acuity (BCVA) was 20/13 in both eyes, with intraocular pressures of 12 mmHg in the right eye and 14 mmHg in the left. At the age of 72, a pigment epithelial detachment

(PED) measuring 1.24 mm vertically and 1.59 mm horizontally appeared under the macula of the right eye, although his vision remained stable. Over time, the PED expanded to 1.89 mm vertically and 2.28 mm horizontally, yet his vision was still unaffected. Fundus fluorescein angiography showed leakage and pooling beneath the PED, leading to a diagnosis of type 1 macular neovascularization (type 1 MNV). The patient received an intravitreal aflibercept (IVA) injection in the right eye, which caused a reduction in the PED height. After a second monthly IVA, the BCVA in the right eye improved to 20/17. However, two days after the third IVA, the patient experienced vision loss. Fundus examination and OCT revealed significant enlargement of the PED, along with the development of a full-thickness macular hole (FTMH) and an underlying RPE tear. The PED had increased by 10.3 mm vertically and 12.66 mm horizontally, with the RPE tear located below the macula, within the PED. Unusually, the RPE within the PED area remained attached to the photoreceptor layer, and the BCVA decreased to 20/133. Three days after the third IVA, the patient was referred to the clinic, where he underwent vitrectomy with cataract surgery on the same day. The inverted internal limiting membrane (ILM) flap technique was used during the vitrectomy to enhance both anatomical and visual outcomes, and 20% sulfur hexafluoride gas tamponade was applied. No anti-VEGF injections were administered during the surgery. By the first postoperative month, the FTMH had closed, though a flat PED remained outside the fovea. By the sixth month, the PED had disappeared, and BCVA improved to 20/29 (Figure 1). At 12 months post-surgery, the BCVA further improved to 20/25, with the RPE defect from the RPE tear remaining stable but not expanding. No additional anti-VEGF treatment was given after surgery.

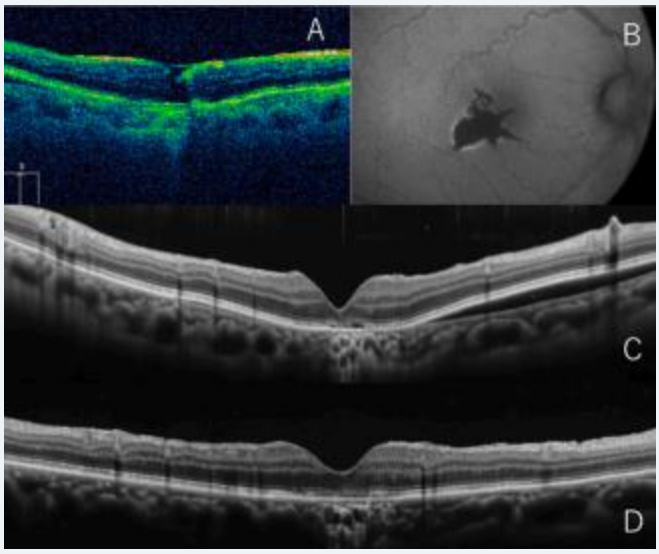

Figure 1. Postoperative results following vitrectomy

DISCUSSION

This case report discussed the occurrence of an FTMH and RPE tear following anti-VEGF treatment in an eye with expanding PED associated with neovascular age-related macular degeneration (nvAMD). Recent studies have highlighted an increased risk of RPE tears linked to anti-VEGF therapy. This elevated risk may stem from several factors, including the traction from macular neovascularization (MNV) contraction, the tangential stress on the RPE at the PED site, and the increased internal pressure within the PED due to intravitreal injections and/or changes in osmotic pressure. Known risk factors for RPE tears include a large PED, a small ratio of MNV to PED size, microrips, and a short period since PED formation.[4]

CONCLUSION

This case presented an uncommon complication, with both a FTMH and an underlying RPE tear occurring after anti-VEGF therapy in a patient with nvAMD and a pigment epithelial detachment (PED). Through vitrectomy with the inverted internal limiting membrane (ILM) flap technique, we successfully closed the macular hole. Fortunately, the RPE defect was located away from the fovea, which helped preserve good vision. Although the long-term prognosis is uncertain, this surgical method shows potential in maintaining vision in complex cases. Ongoing careful monitoring is essential to manage potential future complications and reduce the risk of vision loss.

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