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Spontaneous Closure of a Secondary Macular Hole After Rhegmatogenous Retinal Detachment Repair With Membrane Peeling: A Case Report

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Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
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Patient: Female, 71-year-old
Final Diagnosis: Secondary full-thickness macular hole after rhegmatogenous retinal detachment repair
Symptoms: Decreased visual acuity
Clinical Procedure: Pars plana vitrectomy • ERM/ILM peeling • endolaser photocoagulation • silicone oil tamponade and removal
Specialty: Ophthalmology

Objective: Unusual clinical course
Background: Secondary full-thickness macular hole (FTMH) following rhegmatogenous retinal detachment (RRD) repair is an uncommon but recognized complication. Although epiretinal membrane (ERM)-related tangential traction has been implicated, postoperative macular hole formation can occur in a more complex postoperative setting.
Case Report: A 71-year-old woman with blindness in the left eye due to untreated total retinal detachment presented with macula-off RRD in her only functional right eye. Best-corrected visual acuity (BCVA) was 20/50, and preoperative optical coherence tomography (OCT) revealed an ERM. She underwent 25-gauge pars plana vitrectomy with concomitant ERM/internal limiting membrane peeling, endolaser photocoagulation, and silicone oil tamponade. BCVA increased to 20/22 at 5 weeks postoperatively. Silicone oil was removed 7 weeks after surgery. OCT immediately before oil removal demonstrated a small foveal defect without cystoid macular edema (CME). Given the small size of the lesion, no additional intervention for macular hole closure was performed. One week later, OCT showed progression to an FTMH with concurrent CME and localized retinal detachment surrounding the hole. The hole was managed conservatively without reoperation. Serial OCT exhibited signs of closure at 3 weeks, with complete closure achieved by 5 weeks after oil removal followed by partial restoration of the outer retinal layers and a final BCVA of 20/30 at 13 weeks.

Conclusions: This report describes a case of a serial OCT-documented course from a small foveal defect before silicone oil removal to a transient postoperative FTMH with CME and localized retinal detachment, followed by spontaneous closure. In carefully selected patients with small postoperative macular holes without clear persistent traction and with anatomical stability, short-term OCT-based observation may be considered.

Keywords: Epiretinal Membrane • Macular Edema • Optical Imaging • Retinal Detachment • Silicone Oils • Vitrectomy

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Introduction

Secondary full-thickness macular hole (FTMH) after rhegmatogenous retinal detachment (RRD) repair is a rare but increasingly recognized postoperative complication, with reported prevalence rates ranging from 0.28% to less than 1% [1-3]. Tangential epimacular traction has been implicated in the pathogenesis of postoperative macular hole formation [4].

However, the mechanism of secondary macular hole after RRD repair is unlikely to be attributable to traction alone [5]. Macular involvement by the initial retinal detachment can induce structural foveal alterations [6], while postoperative cystoid or edematous macular changes can further contribute to hole formation in certain cases [7-10]. Silicone oil tamponade has also been associated with macular structural changes, including potential foveal injury [11,12].

We report a case of a secondary macular hole that developed after vitrectomy for RRD with concomitant epiretinal membrane/internal limiting membrane (ERM/ILM) peeling performed during the primary surgery. A small foveal defect identified before silicone oil removal subsequently progressed to an FTMH with concomitant cystoid macular edema (CME) and localized retinal detachment after oil removal before undergoing spontaneous closure without further macular surgery. This report describes the chronological OCT findings and discusses possible factors associated with this postoperative course, including the absence of clear persistent tangential traction, postoperative macular changes, and the small size of the macular hole. Compared with previous reports emphasizing postoperative

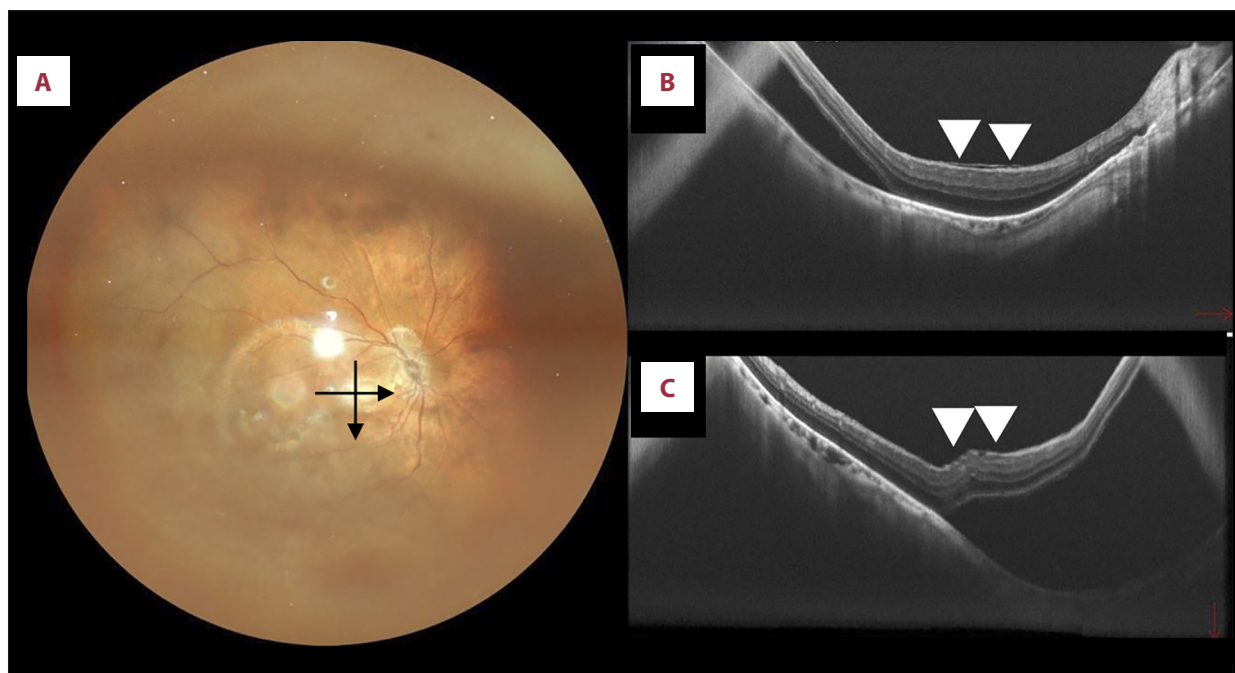
epimacular traction, the present case is notable for the occurrence of FTMH after ERM/ILM peeling and the chronological OCT documentation of spontaneous closure.

Case Report

A 71-year-old woman with monocular vision because of blindness in the left eye from untreated total retinal detachment developed RRD in her only functional (right) eye. The affected eye was pseudophakic and myopic, with an axial length of 25.86 mm. She had previously undergone cataract surgery at another hospital. A history of postoperative cystoid macular edema could not be confirmed from the available medical records. At presentation, the best-corrected visual acuity (BCVA) was 20/50.

Fundus examination demonstrated macula-off RRD extending from the temporal to the inferior retina, although visualization was partially obscured by posterior capsular opacification (Figure 1A). A superior pinhole tear was identified as the causative lesion. Preoperative optical coherence tomography (OCT) revealed the presence of an associated ERM (Figure 1B, 1C).

On the day of presentation, she underwent 25-gauge pars plana vitrectomy with ERM and ILM peeling over an area of approximately 2 disc diameters under visualization with triamcinolone acetate (MaQaid®), in addition to endolaser photocoagulation and silicone oil tamponade. Given the patient's monocular status, silicone oil tamponade was selected to enhance postoperative stability. An intentional drainage retinotomy



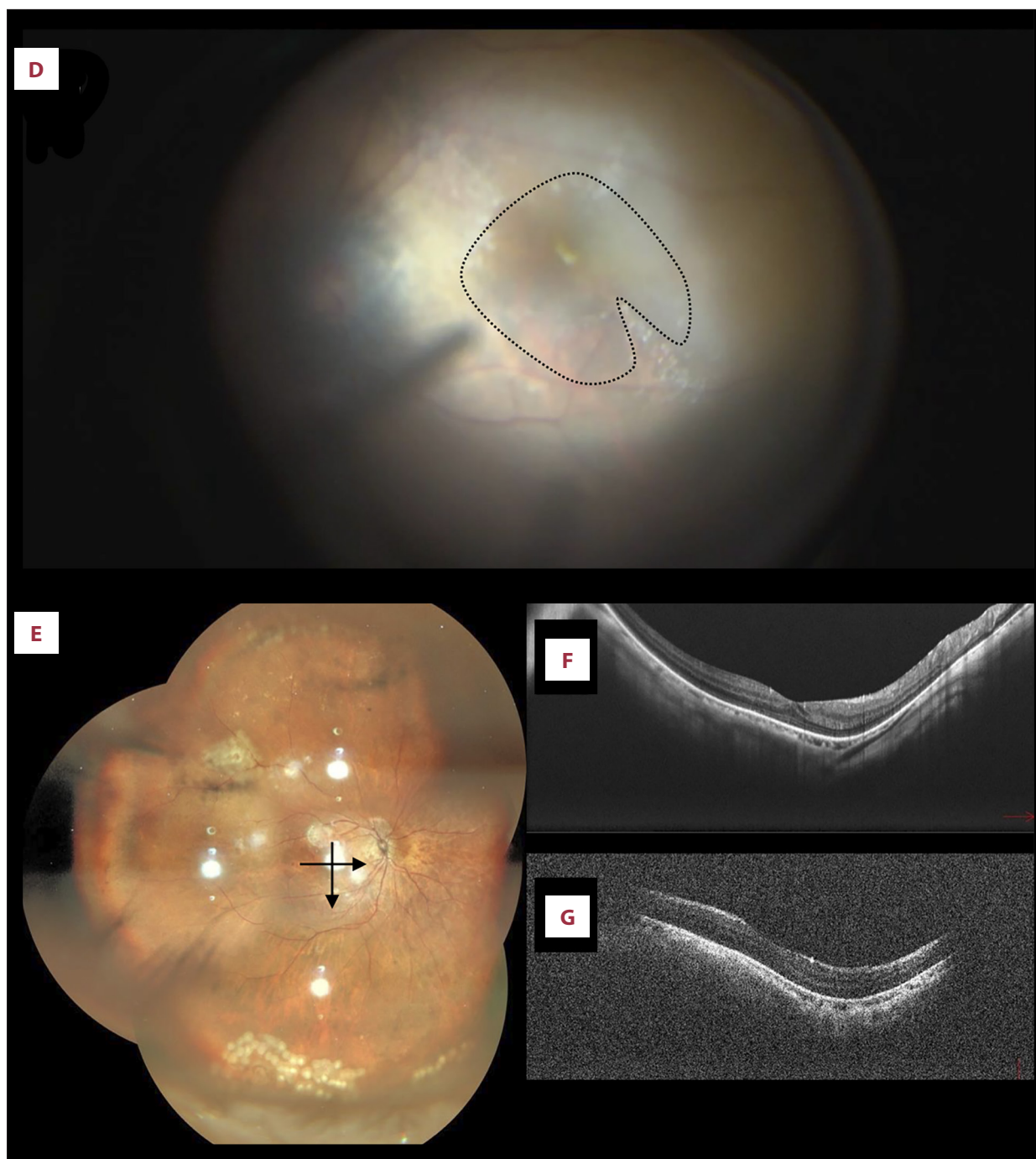


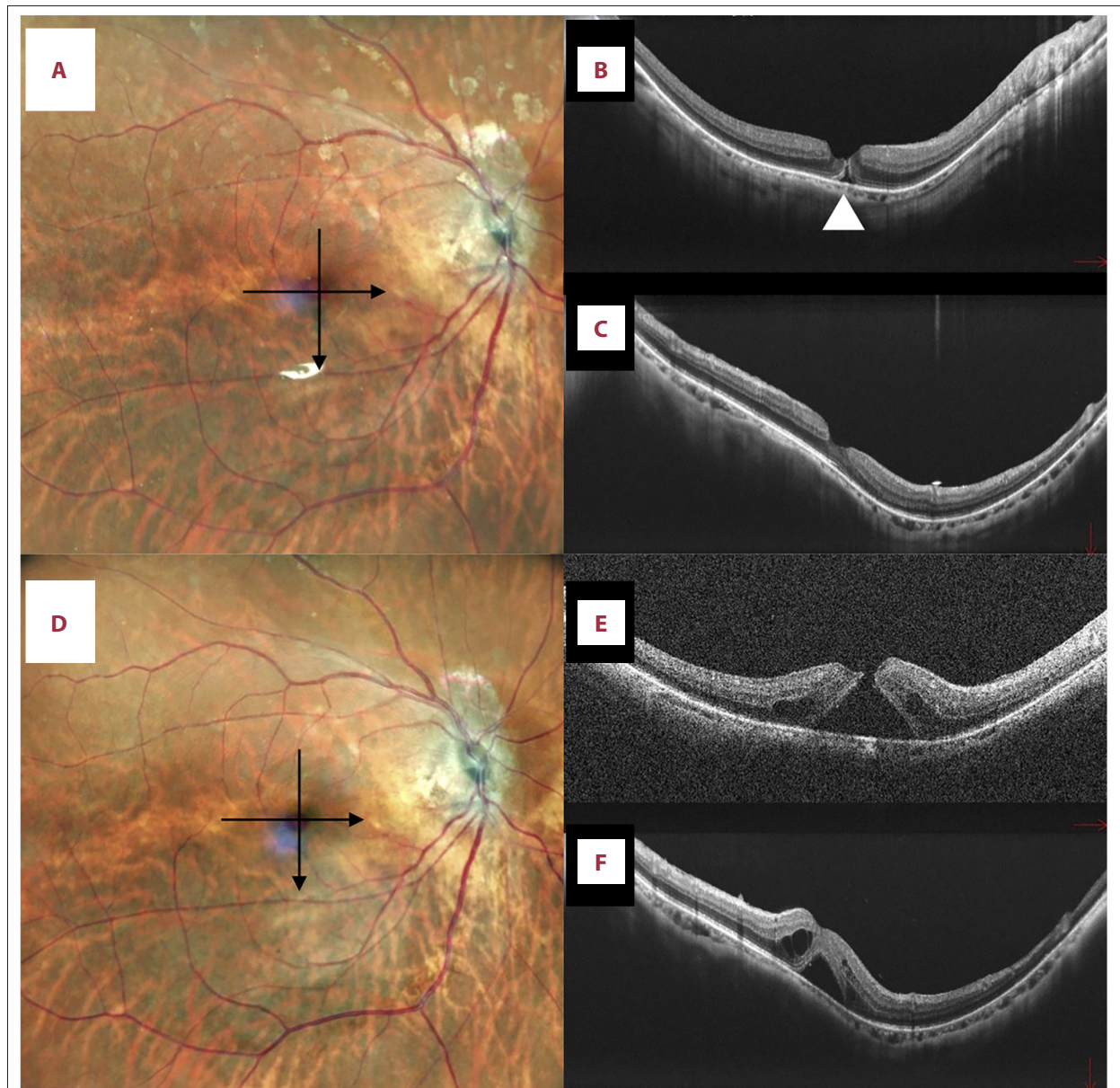
Figure 1. Preoperative, intraoperative, and early postoperative findings of the right eye. (A) Preoperative fundus photograph demonstrating macula-off rhegmatogenous retinal detachment extending from the temporal to inferior retina; visualization of the peripheral fundus was partially obscured by posterior capsular opacification. Arrows indicate the locations and orientations of the corresponding OCT B-scans shown in B and C (B, horizontal; C, vertical). Preoperative optical coherence tomography (OCT) B-scans depicting an epiretinal membrane (ERM) in the setting of macula-off retinal detachment; arrowheads indicate the ERM. (D) Intraoperative video-capture image illustrating epiretinal membrane/internal limiting membrane peeling during pars plana vitrectomy. A dashed line delineates the approximate area of membrane peeling. (E) Fundus photograph obtained on postoperative day 1 confirming retinal reattachment. Arrows indicate the locations and orientations of the corresponding OCT B-scans shown in F and G. (F, horizontal; G, vertical) OCT B-scans obtained on postoperative day 1 demonstrating retinal reattachment and early postoperative macular configuration.

was created in the superotemporal retina. Furthermore, intraoperative ERM/ILM peeling was performed (**Figure 1D**). Postoperatively, the retina remained attached (**Figure 1E**), and early postoperative OCT demonstrated macular configuration without evident macular hole formation (**Figure 1F, 1G**). BCVA improved to 20/22 at 5 weeks postoperatively.

Silicone oil removal was performed 7 weeks after surgery. A fundus photograph obtained immediately before silicone oil removal demonstrated no obvious macular edema or hemorrhage (**Figure 2A**). However, OCT identified a small foveal defect suggesting an early-stage macular hole, with a minimum diameter of 93 μm and a base diameter of 363 μm , without accompanying CME (**Figure 2B, 2C**). Because the lesion was

small, no additional macular hole closure procedure was performed during silicone oil removal.

One week after silicone oil removal, fundus photography demonstrated a subtle central foveal lesion with mild macular edema (**Figure 2D**). Subsequent OCT confirmed progression to a small FTMH accompanied by CME and localized retinal detachment surrounding the FTMH with enlargement of the base diameter from 363 μm to 1574 μm (**Figure 2E, 2F**). BCVA decreased to 20/50, and topical nepafenac was administered to reduce the associated CME, which was considered a possible factor contributing to the macular hole. Retinal thickness analyses also demonstrated changes consistent with CME and localized retinal detachment (**Figure 2G, 2H**).



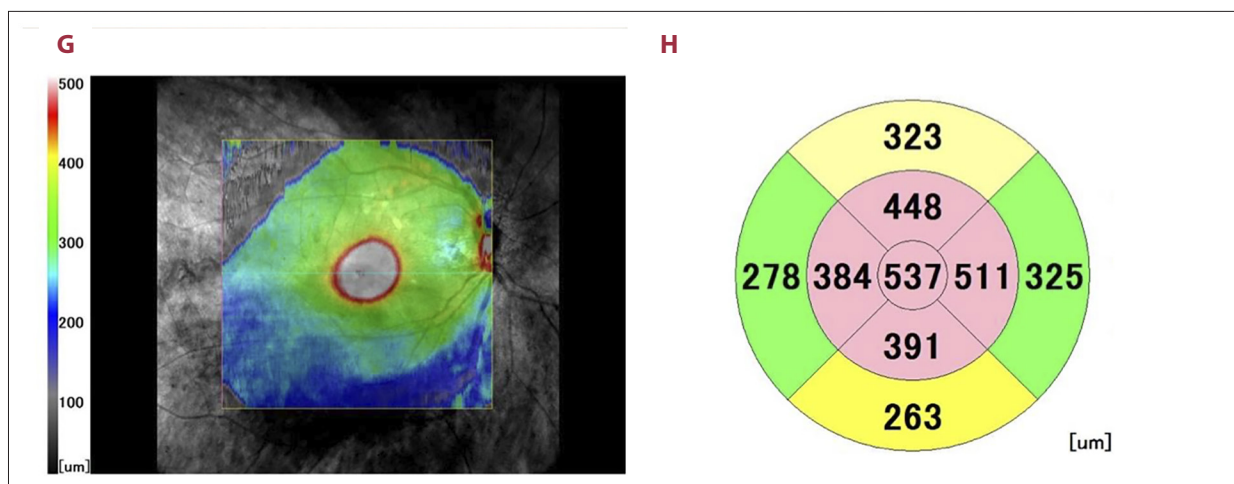


Figure 2. Findings immediately before and 1 week after silicone oil removal. (A) Fundus photograph obtained immediately prior to silicone oil removal, exhibiting the macula without evident macular edema or hemorrhage. Arrows indicate the locations and orientations of the corresponding OCT B-scans shown in B and C (B, horizontal; C, vertical). Horizontal and vertical OCT B-scans obtained immediately before silicone oil removal revealing a small foveal defect indicative of an early-stage macular hole. In panel B, the defect is indicated by an arrowhead. The minimum and base diameters were 93 μm and 363 μm, respectively, and no associated cystoid macular edema (CME) was observed. (D) Fundus photograph obtained 1 week after silicone oil removal, showing a small central macular hole with mild macular edema and localized retinal detachment surrounding the lesion. Arrows indicate the locations and orientations of the corresponding OCT B-scans shown in E and F (E, horizontal; F, vertical). OCT B-scans obtained 1 week after silicone oil removal revealing progression to a small full-thickness macular hole (FTMH) with associated CME and localized retinal detachment around the FTMH. The macular hole and its base diameter were best delineated on the horizontal scan, with a minimum diameter of 167 μm and a base diameter of 1574 μm. (G) Macular thickness map obtained 1 week after silicone oil removal depicting increased macular thickness consistent with CME and localized retinal detachment. (H) Early Treatment Diabetic Retinopathy Study (ETDRS) 9-sector map obtained 1 week after silicone oil removal demonstrating corresponding regional retinal thickening and localized retinal detachment.

At 3 weeks after silicone oil removal, OCT suggested macular hole closure with no clearly discernible central foveal defect, although residual postoperative edema persisted, predominantly in the parafoveal nasal region (Figure 3A-3D). At 5 weeks after silicone oil removal, complete hole closure was confirmed, with near-complete resolution of the edema, although the outer retinal layers remained indistinct (Figure 3E-3H). By 13 weeks, hole closure was maintained and partial recovery of the outer retinal layers was observed (Figure 3I-3L). Hyperreflective material was observed on the retinal surface during this closure process (Figure 3A, 3E, 3I, 3J). BCVA was 20/50 at 1, 3, and 5 weeks; 20/25 at 9 weeks; and 20/30 at 13 weeks after silicone oil removal. No additional surgical intervention was performed for the macular hole, and anatomical closure was maintained throughout follow-up.

Discussion

In this case, serial OCT showed a postoperative course from a small foveal defect before silicone oil removal to a transient FTMH with CME and localized retinal detachment after oil removal, followed by spontaneous closure without reoperation. No clear persistent tangential traction was evident during OCT

follow-up. This sequence provides a detailed example of secondary macular hole evolution and spontaneous closure in a postoperative setting without clear visible tangential traction.

Previous reports have implicated tangential epimacular traction in secondary macular hole formation after RRD repair [4]. However, no clear persistent traction was evident during OCT follow-up in the present case, suggesting that additional postoperative factors may have contributed to the observed course. Postoperative CME was observed during this course and has been described in the sequential development of secondary macular hole after RRD repair [9]. Localized subretinal fluid adjacent to the hole was also present, and previous reports of secondary macular hole after RRD repair have documented dynamic OCT changes during hole formation and spontaneous closure [9,10]. Preexisting foveal vulnerability after macula-off RRD has been proposed as a factor in secondary macular hole pathophysiology [6], and silicone oil-related macular alterations may also influence the postoperative macular environment [8,11,12]. In the present case, topical nepafenac was administered to reduce the associated CME. A previous study reported that topical anti-inflammatory therapy, including NSAIDs and corticosteroids, may be considered in selected cases of secondary FTMH, particularly when the holes are small and associated with CME [13].

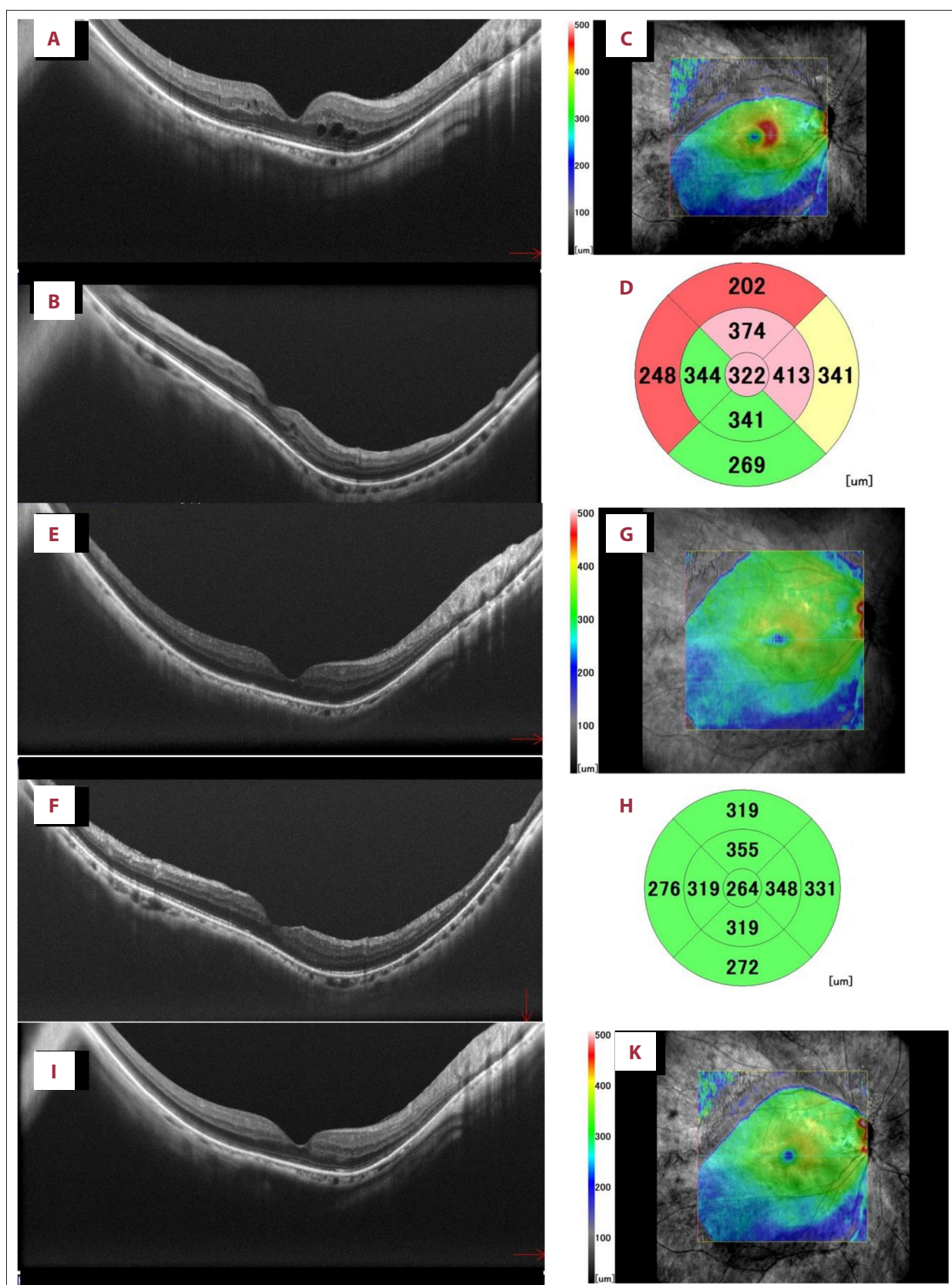




Figure 3. Serial optical coherence tomography (OCT) findings following silicone oil removal (A, horizontal; B, vertical). OCT B-scans obtained 3 weeks after silicone oil removal indicating progressive closure of the macular hole, without a clearly visible central foveal defect. Residual edema is present in the parafoveal nasal region. (C) Macular thickness map obtained 3 weeks after silicone oil removal demonstrating elevated retinal thickness predominantly on the nasal side of the macula, consistent with residual postoperative edema. (D) ETDRS 9-sector map obtained 3 weeks after silicone oil removal showing corresponding regional retinal thickening (E, horizontal; F, vertical). OCT B-scans obtained 5 weeks after silicone oil removal confirming complete hole closure, although the outer retinal layers remained indistinct. (G) Macular thickness map obtained 5 weeks after silicone oil removal revealing near-complete resolution of edema. (H) ETDRS 9-sector map obtained 5 weeks after silicone oil removal illustrating interval normalization of retinal thickness. (I, horizontal; J, vertical) OCT B-scans obtained 13 weeks after silicone oil removal demonstrating sustained hole closure and partial recovery of the outer retinal layers. (K) Macular thickness map obtained 13 weeks after silicone oil removal exhibiting sustained normalization of macular thickness. (L) ETDRS 9-sector map obtained 13 weeks after silicone oil removal confirming sustained anatomical recovery. Note: Surface hyperreflective material in panels A, E, I, and J could not be definitively characterized by OCT alone, but may represent residual membrane tissue, postoperative inflammatory material, or epiretinal proliferation.

The occurrence of FTMH after prior ERM/ILM peeling is an important distinguishing feature of this case. Membrane peeling during the initial surgery was performed for a preexisting ERM and therefore differed from purely prophylactic ILM peeling during primary RRD repair. Previous studies have suggested that membrane peeling can mitigate postoperative ERM formation, although its overall clinical benefit remains variable [14,15]. In the present case, prior ERM/ILM peeling is relevant as an important surgical background when interpreting the postoperative course, but this case report cannot determine whether membrane peeling influenced foveal susceptibility, spontaneous closure, or the overall postoperative course. Thus, ERM/ILM peeling should be discussed as an important contextual condition rather than as a proven causal factor. In eyes with RRD and preexisting ERM, the indication for and extent of membrane peeling may need to be considered individually.

Silicone oil was selected to prioritize postoperative stability in the patient's only functional eye, and previous studies have reported associations between silicone oil tamponade and macular edema or structural and microvascular changes [8,11,12]. Silicone oil was removed 7 weeks after the initial surgery because the retina had remained attached without evidence of recurrent retinal detachment or proliferative vitreoretinopathy. Although the patient had monocular vision, removal was considered appropriate after anatomical stability had been confirmed. Recent evidence suggests that silicone oil removal at approximately 2 months can achieve anatomical outcomes comparable

to later removal in selected eyes with primary RRD and limited PVR [16]. Secondary FTMH has also been described in eyes undergoing silicone oil tamponade or around the period of silicone oil removal, including reports of rapid macular hole formation and closure under a silicone oil meniscus and post-vitreectomy cases in which FTMH was identified after or during silicone oil removal [10,17]. In the present case, the timing of silicone oil removal coincided with subsequent macular changes and transient FTMH progression. This temporal relationship is clinically informative, but it does not establish that silicone oil or silicone oil removal directly caused the macular hole.

The macular hole also closed spontaneously without reoperation. In this case, the hole remained small, and serial OCT suggested progressive closure by 3 weeks, with complete anatomical closure achieved by 5 weeks after silicone oil removal. During the closure process, surface hyperreflective material was observed on OCT. Although this material could not be definitively characterized, it may have been residual membrane tissue, postoperative inflammatory material, or epiretinal proliferation. Such tissue may have been associated with the closure process, but its contribution to spontaneous closure remains uncertain in this single case. Short-term observation rather than immediate reoperation was selected because the postoperative hole was small, no clear persistent tangential traction was evident on OCT, close OCT-based follow-up was feasible, and the retina remained anatomically stable without progressive retinal detachment. This course is consistent with previous reports showing

that some FTMHs after RRD repair can close spontaneously, particularly when the holes are small [2,10]. Based on this course, short-term OCT-based monitoring may be considered in carefully selected eyes under similar conditions; however, this should not be generalized to larger holes, eyes with persistent or recurrent traction, or cases with progressive retinal detachment.

The main limitation of this report is its single-case design, which precludes causal conclusions regarding the mechanisms of macular hole formation and spontaneous closure. Nevertheless, the serial OCT-documented sequence may provide additional clinical information on secondary macular hole evolution and spontaneous closure after RRD repair. Further studies are needed to clarify the factors associated with spontaneous closure and to better define the clinical conditions under which short-term observation may be considered.

Conclusions

This case report describes a serial OCT-documented course in which a small foveal defect progressed to a transient postoperative FTMH with CME and localized retinal detachment after silicone oil removal and subsequently closed spontaneously without reoperation. No clear persistent traction was evident during follow-up. In selected small postoperative macular holes with no clear persistent traction and sufficient anatomical stability, short-term OCT-based observation may be considered, provided that close OCT follow-up is feasible.

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Institution Where Work Was Done

Tokushima Red Cross Hospital, Komatsushima, Tokushima, Japan.

Patient Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

Portions of the manuscript text were edited with the assistance of ChatGPT (OpenAI), a large language model. The authors reviewed and approved all content. No AI tools were used for data analysis or image generation.

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Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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