



# Spontaneous Closure of Large Full-Thickness Macular Hole in a Patient with Degenerative Myopia: Case Report

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## Abstract

Macular hole is characterized by a full-thickness defect of the retinal layers in the center of the fovea and is an important cause of central vision loss. Spontaneous closure of a macular hole is rare, most often occurring in traumatic and idiopathic macular holes. In this case report, we present a 51-year-old woman with a myopic macular hole that closed spontaneously. The patient had degenerative myopia and a history of clear lens surgery and multiple laser retinopexy procedures due to retinal tear in both eyes. A macular hole was detected in her right eye, but she declined surgery and was followed up. At 66 months after presentation, bridge formation and spontaneous closure of the macular hole were observed. Spontaneous closure is extremely rare in cases of myopic macular hole, but may be seen in patients who are followed for a long time.

**Keywords:** Myopic macular hole, spontaneous closure, degenerative myopia

## Introduction

Macular hole is characterized by a full-thickness defect in the retinal layers at the foveal center and is an important cause of central vision loss. According to a series reported in 1982, 83% of cases are idiopathic and it frequently occurs in patients with vitreoretinal interface problems following posterior vitreous detachment.<sup>1</sup> The incidence of idiopathic macular hole in the general population is 0.33%.<sup>2</sup> The rate of macular hole closure has increased in recent years with pars plana vitrectomy (PPV), internal limiting membrane (ILM) peeling, gas tamponade, and supine positioning. Ch'ng et al.<sup>3</sup> reported anatomical success rates of 90% with this surgical procedure.

Although most macular holes are idiopathic, it is also a common complication in eyes with high myopia. In particular,

eyes with an axial length greater than 26.5 mm and/or refraction greater than -6.00 diopter (D) were found to be at higher risk.<sup>4,5</sup> The prevalence of macular hole was reported as 8.4% in patients with high myopia.<sup>6</sup> While the pathology of myopic macular hole has not been fully elucidated, it has been emphasized that vitreoretinal changes such as axial elongation, posterior staphyloma, chorioretinal atrophy, and posterior vitreous detachment in myopic eyes induce anteroposterior traction on the retina.<sup>7</sup>

Myopic macular holes are more difficult to repair with vitreoretinal surgery than idiopathic forms. Spontaneous closure is a rare phenomenon. It is more common in traumatic holes, whereas the incidence of spontaneous closure of idiopathic macular holes has been reported at rates of 4% to 11.5%.<sup>8</sup> There are numerous publications and case reports in the literature on

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the spontaneous closure of idiopathic and traumatic macular holes, but only a few case reports of spontaneous closure of myopic macular holes.<sup>9,10,11,12</sup>

In this case report, we describe the spontaneous closure of a macular hole in a patient with degenerative myopia who was diagnosed with macular hole and followed up due to refusal of surgery.

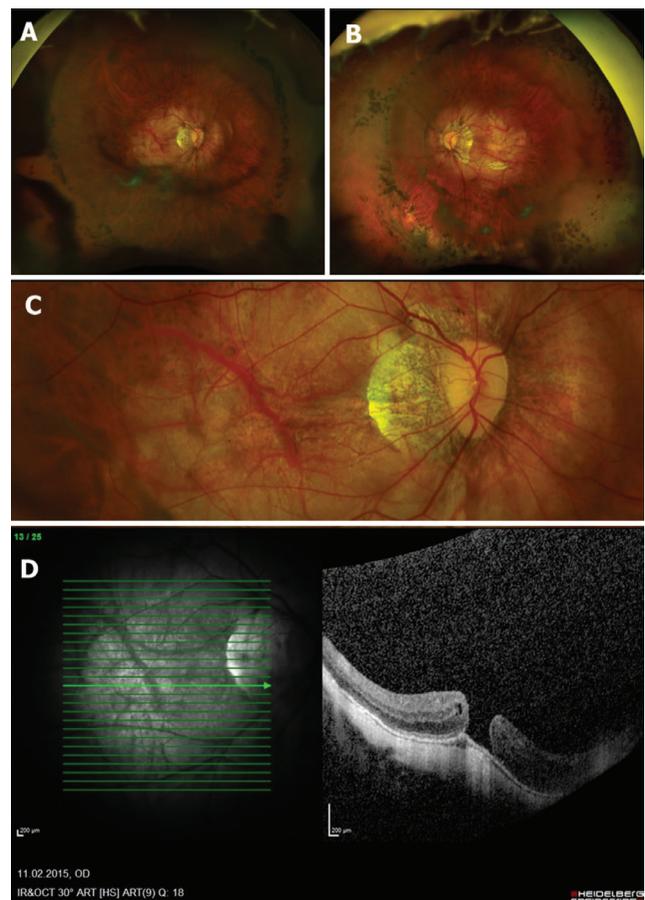
## Case Report

A 51-year-old woman with no known comorbid disease underwent transparent bilateral clear lens extraction and intraocular lens implantation 12 years earlier at the center where she was followed up for degenerative myopia. The patient had amblyopia in her left eye and a history of multiple argon laser retinopexy procedures in both eyes due to retinal tears. She presented to the center where she was followed up with complaints of decreased vision in her right eye for 1 month and was diagnosed with macular hole and referred to our center. On initial examination, her best corrected visual acuity on Snellen chart was 0.4 bilaterally. Anterior segment examination revealed posterior chamber lenses in both eyes. Fundus examination revealed bilateral findings of degenerative myopia and posterior staphyloma, as well as a macular hole in the right eye (Figure 1A, B, C). Axial length was measured as 34.97 mm in the right eye and 34.68 mm in the left eye by optical biometry (Lensstar LS 900, Haag-Streit, USA). On optical coherence tomography (OCT), a full-thickness macular hole with a base diameter of 425  $\mu\text{m}$  and minimum diameter of 403  $\mu\text{m}$  was observed in the right eye (Figure 1D). When the patient refused the recommended surgical intervention, follow-up was advised. The patient had regular long-term follow-up at intervals of 3 months on average, during which her visual acuity and macular hole morphology remained stable. On follow-up examination in June 2020, 66 months after her initial admission, her visual acuity was still 0.4 on Snellen chart but OCT revealed that the macular hole had spontaneously closed by bridge formation (Figure 2A). At the patient's next follow-up 5 months later, it was observed that the macular hole was still closed and the bridge formation had progressed, with the neurosensory retina coming into contact with the retinal pigment epithelium (Figure 2B). After a total of 71 months of follow-up, there was closure of the macular hole to the level of the external limiting membrane and the fovea was attached, but there was no increase in vision (Figure 3).

## Discussion

In this case report, a macular hole was detected in a patient with an axial length of 34.97 mm and posterior staphyloma. Vitreomacular traction (VMT) was not observed on OCT, and the hole spontaneously closed after approximately 5.5 years. There was no change in the patient's visual acuity during this period and no complications such as retinal detachment or retinoschisis were observed. According to our study, this is the fifth spontaneous closure of myopic macular hole reported in the literature.

Our case was also noteworthy for having the highest axial length (34.97 mm) among the spontaneous closures reported to date. In 2014, Brue et al.<sup>9</sup> reported a 55-year-old woman with an axial length of 33.1 mm whose macular hole spontaneously closed after 4 years, with increased visual acuity and regression of metamorphopsia. Also in 2014, Yu et al.<sup>10</sup> reported the case of a 64-year-old woman with an axial length of 31.37 mm and a macular hole 66  $\mu\text{m}$  in diameter accompanied by retinal detachment and VMT. At 54 months after her first admission, it was observed that the posterior hyaloid had detached, the hole had closed, and the retinal detachment had completely regressed. Li et al.<sup>11</sup> detected macular hole associated with retinoschisis, posterior retinal detachment, and VMT on OCT of a 76-year-old patient with refraction of -7.5 D and axial length of 27.8 mm. The patient was not able to undergo surgery due to poor general condition. On follow-up at 9 months, it was observed that although the VMT had not released, the macular hole was closed and retinal detachment had regressed slightly. In 2015, Golan and Barak<sup>12</sup> described a highly myopic 75-year-old woman

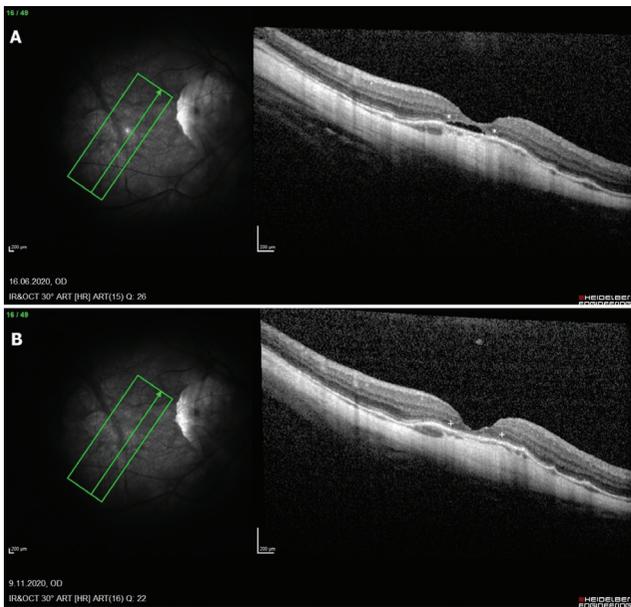


**Figure 1.** Fundus photograph and optical coherence tomography of the patient taken at initial admission in 2015. A, B) Wide-angle fundus photographs of the right and left eye show myopic fundus and peripheral laser scars. C) A magnified fundus photograph of the right eye posterior pole shows macular hole with tilted disc, peripapillary atrophy, and severe chorioretinal atrophy. D) The optical coherence tomography section shows a full-thickness macular hole associated with dome-shaped maculopathy. At this presentation, the macular hole had a base diameter of 425  $\mu\text{m}$ , minimum diameter of 403  $\mu\text{m}$ , and hole height of 338  $\mu\text{m}$

whose macular hole recurred and spontaneously closed 3 times at intervals of several months.

Many stages related to the closure of idiopathic macular holes have been identified. Factors such as retinal tissue bridging, glial cell proliferation towards the opposite side of the hole, and the release of anteroposterior forces due to complete separation of the posterior hyaloid facilitate contraction of the hole and cell proliferation in the hole base.<sup>13</sup> Liang and Liu<sup>8</sup> reported that the chance of closure was higher in idiopathic macular holes that are smaller than 400 µm (especially smaller than 250 µm) and those with OCT findings such as VMT release, bridge-like connections, epiretinal membrane, and cystic structures at the edge of the hole. Mitamura et al.<sup>14</sup> found that young patient age, small hole diameter, and posterior vitreous detachment were associated with spontaneous closure of traumatic macular holes.

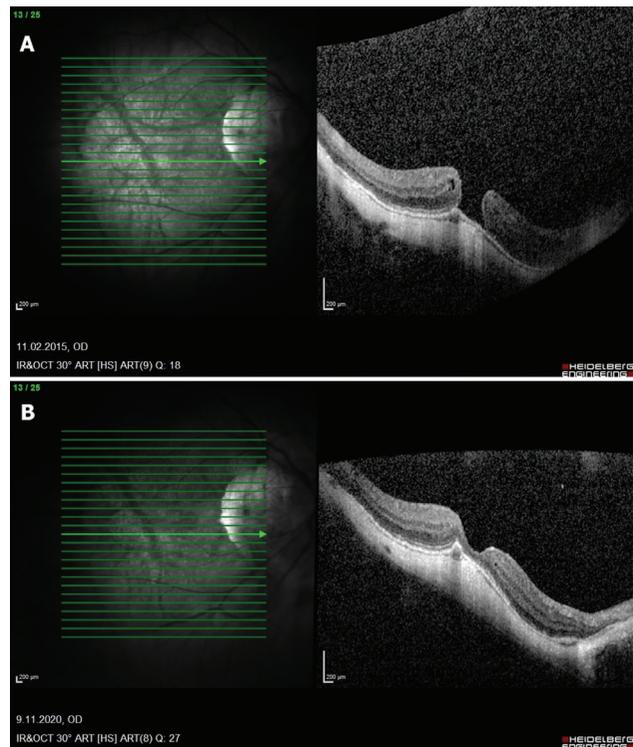
The mechanism of spontaneous macular hole closure has not been fully explained. Okubo et al.<sup>15</sup> described the OCT changes in a patient with a spontaneously closed idiopathic macular hole. They reported that Müller cells, which are found in all retinal layers, protruded at the external limiting membrane level, forming a bridge across the hole via centripetal extension. In our patient, we also observed that hole closure started with the external limiting membrane, upon which the outer nuclear and outer plexiform layers formed a bridge by centripetal extension (Figure 2A). Five months later, we saw that the bridge formation had settled on the retinal pigment epithelium and the fovea was flat (Figure 2B). The inner segment/outer segment junction layer of the photoreceptors was not fully restored, and the lack of visual improvement was attributed to this.



**Figure 2.** A) Optical coherence tomography images (OCT) of the patient showed that the macular hole had spontaneously closed due to formation of the external limiting membrane over the hole, over which the outer nuclear and outer plexiform layer formed a bridge (area indicated by white stars). B) Five months after initial closure, the neurosensory retina that formed in the closed hole had settled (area indicated by white pluses) and the hole remained closed

Macular hole is a well-known complication of high myopia. In highly myopic eyes, all anatomical structures such as the sclera, choroid, Bruch's membrane, RPE, neurosensory retina, and vitreous are affected, making the pathology of hole formation more complex.<sup>9</sup> Current theories regarding macular hole formation include the effects of anteroposterior and tangential forces at the vitreomacular interface. Perifoveal defects in these eyes are also thought to expand due to centrifugal forces around the axis of ocular rotation.<sup>12</sup> Therefore, the incidence of macular holes is higher in eyes with increased axial length.<sup>5</sup> The depth of posterior staphyloma, which is a scleral ectasia that causes axial elongation, also affects the strength of these potential traction forces. In patients with deep posterior staphyloma, limited flexibility due to the ILM and retinal vascular structures may lead to detachment of the neuroretinal tissues, causing foveoschisis. Foveoschisis can remain stable for years and later present with complications such as full-thickness macular hole and retinal detachment.<sup>16</sup> In shallower staphylomas, macular hole formation is similar to that in emmetropic eyes and the risk of retinal detachment is low.<sup>16</sup>

PPV is the preferred treatment for myopic macular holes. However, myopic macular holes have poorer anatomical and visual prognosis than nonmyopic eyes. PPV, ILM peeling, gas tamponade, and supine positioning provide anatomical closure rates higher than 90% in idiopathic macular holes, while closure



**Figure 3.** Optical coherence tomography (OCT) images at presentation to our center (A) and at final examination (B) demonstrate spontaneous closure of the macular hole in approximately 5.5 years of follow-up. Formation of the external limiting membrane and the overlying outer plexiform and outer nuclear layers was seen on OCT. The foveal contour appears to have formed on the dome-shaped macula

success in high myopic eyes ranges from 60% to 100% and may require multiple treatments.<sup>17</sup>

In conclusion, spontaneous closure is rare in patients with high myopia. Although vitreoretinal surgery is the most appropriate option for closure in these patients, spontaneous closure of small macular holes may be observed during follow-up, especially in patients who refuse or cannot tolerate surgery.

#### Ethics

**Informed Consent:** Obtained.

**Peer-review:** Externally peer reviewed.

#### Authorship Contributions

Surgical and Medical Practices: M.H., Concept: M.H., H.B.Ö., Design: M.H., H.B.Ö., Data Collection or Processing: M.H., H.B.Ö., Analysis or Interpretation: M.H., H.B.Ö., M.Y., Literature Search: H.B.Ö., M.Y., Writing: M.H., H.B.Ö., M.Y.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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