Anatomic and Functional Results of Macular Hole Surgery with Silicone Oil Tamponade

Silikon Yağı Tamponadı Kullanılan Maküla Deliği Cerrahisinin Anatomik ve Görsel Sonuçları

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ABSTRACT

Purpose: To review the anatomical and visual outcomes in patients who underwent macular hole surgery with silicone oil tamponade.

Materials and Methods: A retrospective review of 21 patients who had undergone macular holes surgery with silicone oil tamponade was conducted The primary outcome variables include best-corrected visual acuity (BCVA) in Early Treatment of Diabetic Retinopathy Study (ETDRS) letters and optical coherence tomography changes in eyes with a macular hole after the surgery.

Results: The median age of 21 patients was 58.32 years. Thirteen patients had Stage 3 macular holes and eight patients had Stage 4 macular holes. Anatomical closure rate was achieved in 90.4% (19/21) of all patients. The median preoperative BCVA was 31.2 ETDRS letters (range: 13-52 letters), which increased to 42.9 ETDRS letters (range: 27-74 letters), six weeks following the removal of the silicone oil.

Conclusion: Our study with 21 patients indicates that the use of silicone oil tamponade in macular hole surgery showed satisfactory anatomical and functional outcomes. As an alternative to gas tamponade, silicone oil can be used for primary macular hole surgery in patients that are unable to position themselves in a face-down posture after surgery.

Key Words: Macular hole, silicone oil, pars plana vitrectomy, internal limiting membrane.

ÖZ

Amaç: Silikon yağı eşliğinde maküler delik cerrahisi gerçekleştirilen hastalarda anatomik ve görsel sonuçları değerlendirmek.

Gereç ve Yöntem: Silikon yağı eşliğinde maküler delik cerrahisi geçiren 21 hasta geriye dönük olarak değerlendirildi. Maküler cerrahi sonrası, gözlerdeki diyabetik retinopati erken tedavi çalışması (ETDRS) harf değerleri ve optik koherens tomografideki değişiklikler kaydedildi.

Bulgular: Yirmi bir hastanın ortalama yaşı 58.32 yıl idi. On üç hastada Evre 3, sekiz hastada Evre 4 maküler delik bulunmaktaydı. Anatomik kapanma hastaların %90.4'ünde sağlandı (19/21). Silikon alımından altı hafta sonra yapılan ölçümler sonucunda, ortalama en iyi görme keskinliği ameliyat öncesi 31.2 ETDRS harf (aralık: 13-52 harf) iken ameliyat sonrası bu görme keskinliği 42.9 ETDRS harf (aralık: 27-74 harf) düzeyine yükselmiştir.

Sonuç: Yirmi bir hasta üzerinden alınan verilerimiz, maküler hole cerrahisinde silikon yağı tamponadı kullanımının tatminkar anatomik ve işlevsel sonuçlar verdiğini göstermektedir. Ameliyat sonrası dönemde yüzüstü pozisyon alamayacak maküler delikli hastalarda silikon yağı, gaz tamponadına alternatif olarak kullanılabilir.

Anahtar Kelimeler: Maküla deliği, silikon yağı, pars plana vitrektomi, iç limitan membrane.

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INTRODUCTION

The repair of macular holes has traditionally been accomplished by pars plana vitrectomy with gas tamponade.[1] However, after surgery, the patient is required to remain in a face-down position for at least one week in order to ensure contact between the gas bubble and the macular hole. Recently, studies have shown that efforts to shorten the time requirements for adhering to this face-down position may result in slightly worse surgical outcomes.[2] Thus, posturing after surgery is believed to be an important factor in hole closure. Since macular holes typically occur in the sixth or seventh decades of life, a number of patients are unable to adhere to the posture requirements due to physical or medical reasons. Therefore, for those types of patients undergoing macular hole surgery, alternative materials to gas, such as silicone oil tamponade, are preferred. However, different anatomical and functional outcomes have been reported in the literature.[3-6]

In this study, we aimed to review anatomical and visual outcomes in our patients who underwent macular hole surgery using a silicone oil tamponade.

MATERIALS AND METHODS

In this retrospective case series, 21 consecutive patients with idiopathic macular holes underwent surgery at the Department of Ophthalmology, Selcuk University Faculty of Medicine, between February 2012 and February 2013. Inclusion criteria were stage 3 macular hole or Stage 4 macular hole diagnosed using the Gass classification method and confirmed by peroperative assessment of posterior hyaloid status, indirect biomicroscopy and OCT (OCT-3, Carl Zeiss Meditec, San Leandro, CA). Exclusion criteria were age-related macular degeneration, diabetic retinopathy, retinal detachment, previous eye trauma, and previous ocular surgery.

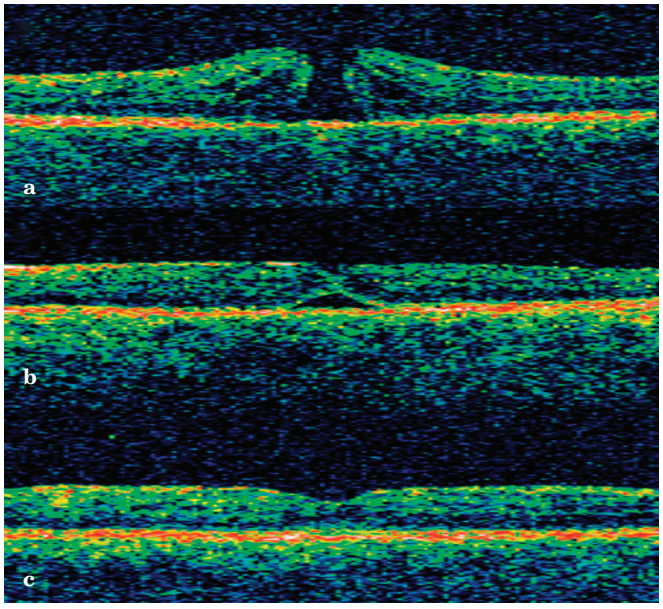


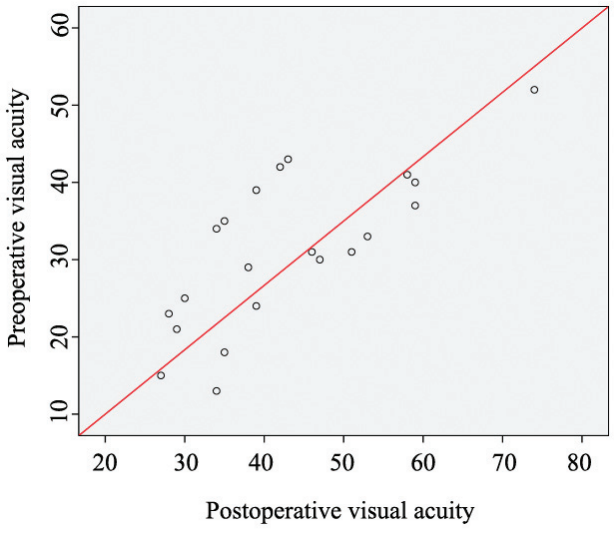
Figure: *Optical cohorence tomography scans of a case obtained (a) before surgery, (b) on the second day, (c) on the first month after surgery.*

Twelve surgeries (57.1%) were performed under general anesthesia, and the rest were performed under local anesthesia. All surgeries were done by the same surgeon (B.B). The surgery involved a standard 23-guage three port pars plana vitrectomy and the aspiration and removal of the posterior hyaloid face. Following injection of 0.025% 0.2 ml brilliant blue into the eye, internal limiting membrane peeling was performed.

Exchange of fluid-air and air-silicone oil (1000 centistokes) was carried out to complete the surgery. Postoperatively, patients had no restriction of posturing. The removal of silicone was performed after a minimum of six weeks following the initial surgery. If needed, phacoemulsification was also performed at the time of silicone removal.

Patient follow-up was at 1 day, 1 week, 1 month, and 3 months, postoperatively. The following preoperative data were recorded: age and gender, best-corrected visual acuity (BCVA) using the Early Treatment of Diabetic Retinopathy Study (ETDRS) chart at 4 m and 1 m, duration of macular hole, stage and size of the macular hole (measured at the level of the retinal pigment epithelium and at the apex of the hole), and the height of macular hole, using OCT.

The first visit was done to assess any complications and included intraocular pressure (IOP) measurements with an air-puff tonometer, a slit-lamp examination, and a dilated fundus examination (DFE). During the last three visits, the BCVA and OCT measurements were also performed.



Graphic: *Plot comparing preoperative (ordinate) and postoperative (axis) visual acuities in ETDRS letters.*

Primary outcome variables include BCVA and OCT changes of eyes with macular hole after surgery. The local ethics committee approved this study, which was conducted in accordance with the Declaration of Helsinki.

RESULTS

The median age of 21 patients (12 female, 9 male) was 58.32 years (range: 47 to 63 years). Six patients had coexisting vitreomacular traction and four patients had epiretinal membrane. Staging of the holes showed Stage 3 macular holes in 13 eyes and Stage 4 macular holes in eight eyes. The known median duration period of macular hole was 7.3 months (range: 4 to 15 months). The median preoperative basal and apical diameter of the macular holes were 688.5 µm (range: 412-803 µm) and 329.5 µm (range: 209-488 µm), respectively. Preoperative OCT showed elevated margins in all patients. The median height of macular holes was 386.1 µm (range: 302-479 µm), preoperatively. Before the hole surgery, 15 eyes were phakic and the rest were pseudophakic.

Intraoperative complications included iatrogenic retinal tears at the vitreous base in five eyes (23.8%). All phakic eyes needed cataract surgery due to lens opacifications at the time of silicone removal.

In 19 eyes (90.4%), postoperative anatomical success was achieved with a flat/closed configuration of the macular hole at 1 month. The elevated edges of an open macular hole were seen in two (9.6%) cases that had been treated for Stage 4 macular holes. One of the cases with an unclosed macular hole had epiretinal membrane symptoms before surgery. Following oil removal, the hole remained closed in 19 eyes (Figure).

The median preoperative BCVA was 31.2 ETDRS letters (range: 13 to 52 letters), and that increased to 42.9 ETDRS letters (range: 27 to 74 letters) at six weeks following the removal of the silicone oil (Graphic). There was no improvement in visual acuity in five of the cases (23.8%); three of those cases had Stage 4 macular holes before surgery. Three cases with closed macular holes showed no visual improvement after the surgery.

DISCUSSION

Current treatment of macular holes involves pars plana vitrectomy and intraocular tamponade.[1,5] C_3F_8 gas, SF_6 gas, silicone oil, and filtered room air have been used as intraocular tamponades.[7] The use of different concentrations of C_3F_8 gas and SF_6 gas has been shown to result in good anatomical and functional outcomes.[8]

However, the need for the patients to remain in a face-down posture postoperatively limits the use of these gases in macular hole surgery. Therefore, in those patients silicone oil should be considered as an intraocular tamponade. Using silicone oil also has the advantage of allowing fundus examination and OCT imaging during the early postoperative period.

The first reported series of vitrectomy and gas tamponade surgery for Stage 3 or Stage 4 macular holes achieved a 58% closure rate.[1] However, those success rates have improved with the peeling of epiretinal membranes and with the use of intraocular tamponades.

In their study of patients with macular holes that had not previously been treated, Tafoya et al. found that 81.3% (13/16) of the eye holes treated with silicone oil tamponade were sealed while 83.7% (36/43) of the gas-treated eyes were sealed.[9] Ovalı found no difference between silicone oil and C3F8 gas in anatomical closure of macular holes.[10]

Goldbaum et al. [11] reported an 80% success rate and Bopp et al.,[12] reported a 61% closure rate using with silicone oil. Pertile and Claes found a higher closure rate of 97% for Stage 3 to Stage 4 holes with silicone oil.[13] Recently, Voo et al. reviewed the anatomic outcomes of macular hole surgery with silicone oil tamponade versus gas, and they found a closure rate of 50% for silicone oil versus 75% for gas tamponade.[14] Our 90.4% closure rates are comparable with the findings of some previous studies These high success rates may have been due to the improvement in surgical techniques, including the peeling of ILM and the use of intraocular tamponades. Furthermore, coexisting situations, such as the presence of an epiretinal membrane and the presence of the macular hole condition for a long period of time, may affect the anatomical closure of the hole. One of our cases (1 of 2) with an unclosed macular hole had epiretinal membrane before surgery.

In our cases, the median of visual acuity improvement was 11.7 ETDRS letters (range: 0-22 letters) six weeks following the removal of the silicone oil. In some studies, the use of gas instead of silicone oil is reported to have resulted in a better outcome of visual acuity.[3,9] Kumar et al. reported that visual outcome in their patients was less rewarding, although good anatomical success was achieved.[3] A recent study using silicone oil tamponade reported a mean Snellen visual acuity improvement of 0.24 for Stage 3 and Stage 4 macular holes.[11]

In our cases, improvement in postoperative vision was similar to the results obtained in previous studies and we think that this outcome is likely to be related to the duration time of the hole.

In our series, the duration time of the holes ranged from 4 months to 15 months with an average of 7.3 months, and in Goldbaum's series, where the visual improvement is similar, the average was 5.6 months (range: 0.7 to 2.2 months).[11] Moreover, the stage of the macular hole before surgery may affect the patient's postoperative vision.[7] There was no improvement in visual acuity in our five cases; of those five, three had Stage 4 macular holes before surgery.

Silicone oil, like intraocular gas, likely works by isolating the macular hole from vitreous fluid currents.[11,15] The completeness of the oil's ability to fill the vitreous cavity has certainly been found to affect the seal rate of macular holes.[11]

Silicone oil bridges across macular holes or fills the underlying foveal depression, thereby preventing any fluid from reaching the macular hole.[16] In our study, the good tamponading property of silicone oil may be reflected in the finding that some of the holes were closed on the first postoperative day.

Possible photoreceptor toxicity resulting from silicone exposure was reported.[11,17] In an experimental study, Saitoh et al. showed that six-month silicone oil tamponade in a rabbit model may result in the accumulation of oil vacuoles within the optic nerve, as shown via electron microscopy.[18]

Cataract formation and glaucoma may also occur with the use of silicone oil. In a previous study, the need for cataract surgery after macular hole repair was 36% (four out of the 11 phakic patients) for the silicone oil group.[9] In the present study, all of the phakic eyes (15/21) had different stages of lens opacities at the time of silicone removal and combined cataract surgery and silicone oil removal were performed in these cases.

In conclusion, our study with a limited number of patients indicates that the use of silicone oil tamponade showed satisfactory anatomical and functional outcomes. We recommend silicone oil as an alternative to gas tamponade for primary macular hole surgery in patients that are unable to adhere to the face-down posture required of them, postoperatively. However, these findings should be confirmed with larger, planned, randomized, long-term studies.

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