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ORIGINAL RESEARCH

Macular Hole Surgery as a Historical Perspective

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Purpose: To evaluate the outcomes of macular hole (MH) surgery as a historical perspective after its inception in 1991.

Patients and Methods: Retrospective review of 1032 eyes of 949 patients with an idiopathic MH who were followed for at least one year after the initial surgery. All surgeries were performed from 1990 to 2016 by one surgeon (NO) and included phacovitrectomy for patients of ≥40-years-of-age, a removal of the posterior hyaloid and epiretinal membrane, and SF6 gas tamponade with a 1-week face-down. After 1998, internal limiting membrane (ILM) peeling became the conventional procedure. All surgeries were classified into four periods based on the year of the initial surgery. The first period was 1990~1995 (n = 222), the second period was 1996~1999 (n=327), the third period was 2000~2004 (n = 234), and the last period was 2005~2016 (n=249).

Results: The mean follow-up period was 81.3, 79.8, 88.4, and 77.3 months; hole size was 0.33, 0.28, 0.25, and 0.24 disk diameter; hole duration was 15.1, 10.6, 8.2, and 6.1 months; the decimal visual acuity (VA) was 0.13, 0.15, 0.17, and 0.19. The initial closure rate was 61.3, 78.0, 96.6, and 96.4%. The final decimal visual acuity was 0.33, 0.50, 0.66, and 0.79. The rate of a final decimal VA of 0.5 or better was 48.2, 66.4, 82.1, and 88.8%. The rate of a final decimal visual acuity of 1.0 or more was 17.6, 29.3, 43.6, and 58.2%. Multiple regression analyses showed that hole duration and ILM peeling were significantly associated with both the anatomic and functional outcomes.

Conclusion: The favorable outcomes of MH surgery was primarily achieved by earlier surgery and conventional ILM peeling. Favorable results might be obtained using only conventional ILM peeling.

Keywords: macular hole, evolution, internal limiting membrane, early surgery, vitrectomy

Introduction

Macular holes (MH) surgery has evolved[1] after Kelly and Wendel's preliminary report in 1991[2] and 1993.[3] Currently, MH surgery is one of the most successful operations performed on the retina with most studies reporting a single-operation success rate exceeding 90%.[4] Initially, MH surgery was advised for patients whose vision was ≦20/50, and the surgery was a 5-step operation: pars plana vitrectomy, removal of adherent cortical vitreous, stripping of epiretinal membranes (when present), a total gas-fluid exchange (typically with SF6 gas), and 1 week of strict face-down positioning.[2,3]

Peeling the internal limiting membrane (ILM) around the MH, ie, a conventional ILM peeling, was instituted in 1997[5] and is now widely performed as a routine surgical procedure. Its use has led to favorable functional and anatomical results.

Recently, several new adjuvant manipulation techniques have been reported, including inverted ILM flap,[6] macular detachment,[7] radial retinal incision,[8] autologous ILM transplantation,[9] lens capsule flap,[10] autologous retinal transplantation,[11] human amniotic membrane transplantation,[12] and retinal massage.[13] However, long-term effects of these techniques remain to be undetermined.

The purpose of this study was to evaluated the outcomes of MH surgery with and without conventional ILM peeling from our consecutive case series[14–20] performed by the same surgeon (NO) over a 20-year period after its inception in 1991 as a historical perspective on the eras of MH surgery.

Materials and Methods

This was a retrospective consecutive case series, and the procedures used were approved by the Institutional Review Board of each participating clinic. The participating clinics were Kami-iida Daiichi General Hospital, Shinjo Eye Clinic

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and Nishigaki Eye Clinic. The procedures used conformed to the tenets of the Declaration of Helsinki. All patients had signed an informed consent for the surgery, data collection, and the use of the data for research studies.

One thousand and sixty-six eyes of 949 patients with an idiopathic MH underwent vitreous surgery from 1990 to 2016 by the same surgeon (NO). Thirty-four eyes of 25 patients were excluded because the follow-up period was <1 year. Thus, this study included 1032 eyes of 924 patients. Eyes with previous retinal detachment, vitreous surgery, cystoid macular edema from any cause, and traumatically induced holes, and proliferative diabetic retinopathy were excluded. All participants underwent comprehensive ophthalmologic examinations including measurements of the refractive error, best-corrected visual acuity (BCVA) measured with a standard Japanese chart in decimal units, axial length measurements, slit-lamp examinations, measurement of the intraocular pressure with a Goldmann applanation tonometer, and dilated indirect slit-lamp biomicroscopy with or without contact lenses. After 1998, optical coherence tomography (OCT) was used to confirm the presence of a full-thickness MH.

Of the 1032 eyes, 672 eyes (65.1%) were of women, the mean age was 65.7 years (range, 23 to 87 years), the mean decimal visual acuity was 0.16 (range, 0.01 to 1.0), the mean axial length was 23.37 mm (range, 20.33 to 30.72 mm), the size of the MH was 0.28 disk diameter (DD) (range, 0.1 to 0.7 DD), the mean hole duration was 9.9 months (range,1 to 200), and the mean follow-up period after the surgery was 81.5 months (range,12 to 330).

The procedures included phacovitrectomy for patients whose age was ≥40 years, removal of the posterior hyaloid membrane and epiretinal membrane when present, and SF6 gas tamponade with 1 week face-down positioning. After 1998, ILM peeling was generally performed in a range of 2- to 3-DDs around the MH. We performed debridement of the retinal pigment epithelium for large or persistent MHs.[21] ILM peeling was initially unstained,[18] but later Indocyanine green (ICG) staining[19] or triamcinolone acetonide (TA)[20] were used to make the ILM more visible.

All surgeries were classified into four periods based on the year of initial surgery; the first period was 1990~1995 (n=222), the second period was 1996~1999 (n=327), the third period was 2000~2004 (n=234); and the last period was 2005~2016 (n=249).

The decimal BCVAs were converted to the logarithm of the minimal angle of resolution (logMAR) units for the statistical analyses. Geometric averages were used for the mean of the decimal BCVA. An increase or decrease in the visual acuity was defined as a change greater than 0.2 logMAR units.

Statistical Analyses

Numerical data between two periods were analyzed by paired *t* tests. Comparisons between numerical data between each period were analyzed using an analysis of variance with a post hoc test by the Scheffe procedure. Categorical variables were analyzed using the Chi-square test. Multiple regression analyses were performed to examine the effects of hole duration and ILM peeling on the rate of the initial closure and final visual acuity. Statistical analyses of the data were performed using Stat View software version 5.0 (SAS Institute, Inc, Cary, North Carolina, USA). A $P < 0.05$ was accepted as statistically significant.

Results

The preoperative characteristics of the studied eyes are shown in Table 1. With time, hole duration became shorter, the holes were smaller, and the BCVAs were better. The frequency of phakic eyes, posterior vitreous detachments (PVDs), and epiretinal membrane (ERM) decreased over the 20 years period. Significant differences were observed between the periods.

The distribution of preoperative visual acuity is shown in Table 2. The frequency of a preoperative decimal BCVA <0.1 was 24.8% in the first period and 17.7% in the last period. The frequency of preoperative BCVA better than 0.3 was 21.2% in the first period and 41.8% in the last period. The frequency of eyes with good visual acuity increased with time. Significant differences were observed between the periods.

The surgical procedures performed are shown in Table 3. After 1998, ILM peeling became routine. The surgical outcomes are shown in Table 4. The initial closure rate improved from 61.3% to 96.4%, and the reopening rate decreased. The incidence of postoperative retinal detachments remained unchanged at around 3%. Significant differences were observed between the periods.

Table 1 Preoperative Characteristics of the Study Eyes

	First 1990–1995 (n=222)	Second 1996–1999 (n=327)	Third 2000–2004 (n=234)	Last 2005–2016 (n=249)
Age (y)	65.3 ± 8.2	65.7 ± 8.6	65.4 ± 7.3	66.3 ± 7.3
Female	151 (68.0)	221 (67.4)	156 (66.7)	144 (57.6)
Visual acuity				
Decimal[a]	0.13	0.15	0.17	0.19
LogMAR	0.90 ± 0.35[b]	0.82 ± 0.33[c]	0.77 ± 0.36	0.73 ± 0.37
Hole size (DD)	0.33 ± 0.12[d]	0.28 ± 0.12[d]	0.25 ± 0.12	0.24 ± 0.13
By hole size				
0.2DD≧	56 (25.2)[d]	131 (40.1)[d]	121 (51.7)	142 (57.0)
0.3–0.4DD	129 (58.1)[b]	175 (53.5)	103 (44.0)	87 (34.9)
0.5DD≦	37 (16.7)[d]	21 (6.4)	10 (4.3)	20 (8.0)
Hole duration (m)	15.1 ± 22.7[b]	10.6 ± 23.9	8.2 ± 21.5	6.1 ± 15.7
Phakia	211 (95.0)[b]	310 (94.8)[b]	210 (89.7)	190 (76.3)
PVD	84 (37.8)[d]	84 (25.7)	62 (26.5)	66 (26.5)
ERM	110 (49.6) [d]	111 (33.9)	82 (35.0)	83 (33.3)
Follow-up (m)	81.3 ± 63.1	79.8 ± 59.8	88.4 ± 61.4	77.3 ± 47.6

Notes: [a]geometric average; Data are expressed as numbers (%) or means ± standard deviations; [b]P<0.01 compared with third period and last period; [c]P<0.01 compared with last period; [d]P<0.01 compared with the other periods.
Abbreviations: DD, disk diameter; PVD=posterior vitreous detachment; ERM, epiretinal membrane.

Table 2 Distribution of Preoperative Visual Acuity

	First 1990–1995 (n=222)	Second 1996–1999 (n=327)	Third 2000–2004 (n=234)	Last 2005–2016 (n=249)
VA in decimal				
1.0≦	0	0	0	1 (0.4)
0.7–0.9	0[a]	4 (1.2)[b]	8 (3.4)	13 (5.2)
0.5–0.6	9 (4.1)	21 (6.4)	22 (9.4)	22 (8.8)
0.3–0.4	38 (17.1)[b]	65 (19.9)[b]	56 (23.9)	68 (27.3)
0.1–0.2	120 (54.1)	170 (52.0)	106 (45.3)	101 (40.6)
<0.1	55 (24.8)[b]	67 (20.5)[b]	42 (17.9)	44 (17.7)

Notes: Data are expressed as numbers (%). [a]P<0.01 compared with third period and last period; [b]P<0.01 compared with last period.
Abbreviation: VA, visual acuity.

The visual outcomes are shown in Table 5. There was a significant difference between the preoperative and one-year postoperative BCVA in all periods (all, P <0.0001). There was also a significant difference between the preoperative BCVA and the final BCVA in all periods (all, P <0.0001). The final BCVA was significantly better than the one-year BCVA for the last period (P = 0.015). There was no significant difference for the other periods between 1-year BCVA and the final BCVA. The frequency of improvements of the final BCVA increased from 72.5% to 88.4% and worsening decreased from 3.6% to 1.6%.

The distribution of the final BCVA is shown in Table 5. The frequency of eyes with a postoperative BCVA ≥0.5 increased from 48.2% to 88.8%. The frequency of a decimal BCVA of ≥1.0 increased from 17.6% to 58.2%. When the preoperative MH size was ≤0.2 DD, the rate of BCVA of ≥0.5 increased from 78.6% to 97.2%. The rate of a BCVA of ≥1.0 increased from 37.5% to 73.2%. Significant differences were observed between the periods.

Table 3 Initial Surgical Procedures

	First 1990–1995 (n=222)	Second 1996–1999 (n=327)	Third 2000–2004 (n=234)	Last 2005–2016 (n=249)
Vitrectomy system				
20 gauge	222 (100)	327 (100)	234 (100)	190 (76.3) [a]
25 gauge	0	0	0	58 (23.3) [a]
27 gauge	0	0	0	1 (0.4)
Additional procedures				
ILM peeling	0[a]	69 (21.1) [a]	232 (99.1)	248 (99.6)
No staining	0	69 (100)	41 (17.7)	0
ICG	0	0	113 (48.7)	7 (2.8)
TA	0	0	78 (33.6)	240 (96.8)
BBG	0	0	0	1 (0.4)
RPE debridment	37 (16.7) [a]	30 (9.2) [a]	0	0
RPE debridment				
With ILM peeling	0	11 (3.4) [a]	1 (0.4)	0

Notes: Data are expressed as numbers (%). [a]P<0.01 compared with the other periods.
Abbreviations: ILM, internal limiting membrane; ICG, indocyanine green; TA, triamcinolone; BBG, briant blue green; RPE, retinal pigment epithelium.

Table 4 Surgical Outcomes

	First 1990–1995 (n=222)	Second 1996–1999 (n=327)	Third 2000–2004 (n=234)	Last 2005–2016 (n=249)
Initial closure	136 (61.3)[a]	255 (78.0)[a]	226 (96.6)	240 (96.4)
By hole size				
0.2DD≧	53/56 (94.6)[b]	122/131 (93.1)[b]	121/121 (100.0)	139/142 (97.9)
0.3–0.4DD	79/129 (61.2)[c]	121/175 (69.1)[b]	97/103 (94.2)	84/87 (96.6)
0.5DD≦	4/37 (10.8)[a]	12/21 (57.1)[a]	8/10 (80.0)	17/20 (85.0)
Complications				
Retinal break	28 (12.6)[b]	48 (14.6)	59 (25.2)[a]	23 (9.2)
Reopen	5(3.7)[d]	20 (7.8)[c]	2 (0.9)	0
RD	6 (2.7)	12 (3.7)	10 (4.3)	8 (3.3)

Notes: Data are expressed as numbers (%); [a]P<0.01 compared with the other periods; [b]P<0.01 compared with the Third period; [c]P<0.01 compared with the Third and last period; [d]P<0.01 compared with the last period.
Abbreviations: DD, disc diameter; RD, retinal detachment.

The Results of multiple regression analyses on the effects of hole duration and ILM peeling on the initial closure rate and final visual acuity are shown in Tables 6 and 7. The results showed that hole duration and the ILM peeling were significantly associated with both the anatomic and visual outcomes.

The same analysis was performed for the last period. The results showed that hole duration was significantly associated with both the anatomic and visual outcomes (Tables 8 and 9).

Discussion

We evaluated the evolution of MH surgery over a 20-year period after its inception in 1991. We examined 1032 eyes operated consecutively by the same surgeon. The surgical procedures were based on Kelly's 5 steps procedure combined with cataract surgery.[14,15] Since 1998, ILM peeling has been also performed. All of the results of the surgeries were placed into four periods based on the year of the initial surgery. We studied the baseline characteristics, and the

Table 5 Visual Outcomes

	First 1990–1995 (n=222)	Second 1996–1999 (n=327)	Third 200–2004 (n=234)	Last 2005–2016 (n=249)
Preoperative				
Decimal[a]	0.17	0.2	0.23	0.26
LogMAR	0.90 ± 0.35[b]	0.82 ± 0.33[c]	0.77 ± 0.36	0.73 ± 0.37
Postoperative 1 year				
Decimal[a]	0.29	0.49	0.65	0.74
LogMAR	0.54 ± 0.47[b]	0.31 ± 0.36[b]	0.19 ± 0.33	0.13 ± 0.28
Improved	161 (72.5)[b]	257 (78.6)[b]	202 (86.3)	215 (86.3)
Unchanged	53 (23.9)[b]	67 (20.5)[b]	30 (12.8)	33 (13.3)
Worsened	8 (3.6)[d]	3 (0.9)	2 (0.9)	1 (0.4)
Final				
Decimal[a]	0.33	0.50	0.66	0.79
LogMAR	0.49 ± 0.45[c]	0.30 ± 0.41[c]	0.18 ± 0.34	0.11 ± 0.29
Improved	161 (72.5)[b]	261 (79.8)[e]	201 (85.9)	220 (88.4)
Unchanged	53 (23.9)[c]	55 (16.8)[e]	30 (12.8)	25 (10)
Worsened	8 (3.6)	11 (3.4)	3 (1.3)	4 (1.6)
Distribution of Final VA in decimal				
0.5≦	107 (48.2)[c]	217 (66.4)[c]	192 (82.1)[e]	221 (88.8)
1.0≦	39 (17.6)[c]	96 (29.3)[c]	102 (43.6)[c]	145 (58.2)[c]
Distribution of Final VA in decimal by hole size				
0.2DD≧				
0.5≦	44 (78.6)[b]	106 (80.9)[b]	113 (93.4)	138 (97.2)
1.0≦	21 (37.5)[b]	56 (42.7)[b]	68 (56.2)[c]	104 (73.2)
0.3–0.4DD				
0.5≦	59 (45.7)[c]	104 (59.4)[c]	76 (73.8)	74 (85.1)
1.0≦	18 (14.0)[d]	39 (22.3)[e]	33 (32.0)	40 (46.0)
0.5DD≦				
0.5≦	4 (10.8)[d]	7 (33.3)	3 (30.0)	9 (45.0)
1.0≦	0	1 (4.8)	1 (10.0)	1 (5.0)

Notes: Data are expressed as numbers (%) or means ± standard deviations. [a]geometric average. [b]P<0.01 compared with the third and last period. [c]P<0.01 compared with the other periods. [d]P<0.01 compared with the second and last period. [e]P<0.01 compared with the last period.
Abbreviation: VA, visual acuity.

Table 6 Multiple Regression Analysis for Initial Closure (All Periods)

Independent Variable	β value	P value
Age	−0.12	<0.0001
Gender	−0.047	0.095
Hole duration	−0.24	<0.0001
PVD	0.023	0.42
Hole size	−0.24	<0.0001
Lens status	−0.045	0.096
Preoperative VA	0.021	0.47
Axial length	−1.02	0.0006
ILM peeling	0.26	<0.0001

Notes: Adjusted R^2=0.33 for initial closure in multiple regression (P<0.0001).
Abbreviations: PVD, posterior vitreous detachment; VA, visual acuity; ILM, internal limiting membrane.

Table 7 Multiple Regression Analysis for Final Visual Acuity (All Periods)

Independent Variable	β value	P value
Age	0.18	<0.0001
Gender	0.078	0.0015
Hole duration	0.22	<0.0001
PVD	−0.065	0.0092
Hole size	0.15	<0.0001
Lens status	−0.019	0.42
Preoperative VA	0.33	<0.0001
Axial length	0.076	0.0036
ILM peeling	−0.22	<0.0001

Notes: Adjusted R^2=0.48 for final VA in multiple regression (P<0.0001).
Abbreviations: PVD, posterior vitreous detachment; VA, visual acuity; ILM, internal limiting membrane.

Table 8 Multiple Regression Analysis for Initial Closure (Last Period)

Independent Variable	β value	P value
Age	−0.048	0.46
Gender	0.11	0.08
Hole duration	−0.51	<0.0001
PVD	−0.056	0.36
Hole size	0.062	0.40
Lens status	0.028	0.62
Preoperative VA	0.13	0.053
Axial length	−0.076	0.24

Notes: Adjusted R^2=0.29 for initial closure in multiple regression (P<0.0001).
Abbreviations: PVD, posterior vitreous detachment; VA, visual acuity.

Table 9 Multiple Regression Analysis for Final Visual Acuity (Last Period)

Independent Variable	β value	P value
Age	0.19	0.0013
Gender	0.009	0.87
Hole duration	0.17	0.0037
PVD	−0.06	0.29
Hole size	0.25	0.0003
Lens status	−0.59	0.27
Preoperative VA	0.25	<0.0001
Axial length	0.12	0.05

Note: Adjusted R^2=0.40 for final VA in multiple regression (P<0.0001).
Abbreviations: PVD, posterior vitreous detachment; VA, visual acuity.

anatomical and functional outcomes during these four periods. The results suggested that the main reasons for the improvement of the MH surgery were earlier surgery and the addition of conventional ILM peeling to the Kelly's 5 steps surgical regimen.

In 1993, Wendel et al[3] published a second series of 170 eyes including the 52 preliminary eyes. In their study, 73% of the MHs were closed, the vision in 56% improved by ≥2 visual acuity chart lines, and 29% attained 20/40 or better vision. In our patients, the initial closure rate was 61.3% in the first period and 96.0% in the last period. The rate of the final BCVA being 0.5 (20/40) or better was 48.2% in the first period and 88.8% in the last period. The rate of the final BCVA being 1.0 (20/20) or better was 17.6% in the first period and 58.2% in the last period. These results indicated a significant anatomical and functional improvement of the MH surgery.

Tornambe state in 2009 that the primary reason for the better results was because the surgery was performed earlier and on smaller holes with better preoperative vision.[1] Since the genesis of MH surgery, the surgeries performed earlier had better outcomes.[2,3,14,22,23] In 2022, the Macular Hole Duration Study Group[24] defined the effect of the hole duration on the outcomes in patients undergoing MH surgery from an individual participant data study of randomized controlled trials. They concluded that the hole duration was independently associated with both the anatomic and visual outcomes. This is consistent with our results and our earlier studies.[14–20]

The preoperative characteristics of the eyes by the periods showed a shortening of the hole duration, and a reduction of the hole size. These preoperative findings were associated with a greater improvement of the postoperative BCVA. These findings suggested an increase in the number of early surgeries would be better.

Tornambe[1] believe that the outcomes are better today for 3 reasons: better diagnostic instruments such as OCT which allowed clinicians a better detection of a MH leading to a correct diagnosis, a better understanding of the cause of the MH, and a more accurate depictions of the anatomic surgical results. In addition, better surgical instruments have been developed which allowed a release of vitreoretinal traction safely and predictably (posterior hyaloid dissection and ILM peeling), and they also reduced the incidence of complications. These advances gave clinicians greater confidence to operate earlier on smaller holes which resulted in better vision. Our results indicated that performing surgeries earlier was one of the reasons for the improved outcomes of MH surgery.

The "typically friable and hard to remove" membrane that Kelly and Wendel[2,3] described perhaps included the ILM and prompted others to consider removing the unstained ILM.[5,18,25] After that, improved views of the ILM made ILM peeling a safer and easier procedure.[19,20] ILM peeling is not essential for all cases,[26–28] but ILM peeling has been generally performed since 1998 in this study. Both the conventional and flap methods have been recently used, but only eyes that had undergone the conventional method were examined in this study.

It is well accepted that ILM peeling is an effective additional procedure during MH surgery. The initial closure rate was ≥96% after the third period when ILM peeling was performed. This success rate is significantly higher than the first and second periods. In addition, multiple regression analyses showed that ILM peeling was a significant factor for the initial closure rate and visual outcomes. These findings suggested that ILM peeling is another reason for the improvement of MH surgery.

In the last period, the closure rate after the first surgery was 96.0% in all cases, 97.9% in eyes with a MH size of ≤0.2 DD, and 85.0% in eyes with a MH size of ≥0.5 DD. The frequency of the final decimal BCVA of 0.5 or better was 88.8% in all cases, and 97.2% in cases with a MH size of ≤0.2 DD. The frequency of the final VA of 1.0 or better was 58.2% in all cases, and 73.2% in cases with a MH size of ≤0.2 DD. In the last period the mean follow-up period after the initial surgery was 77.3 months (range, 12 to 185 months). These results may reflect the long-term outcomes of conventional ILM peeling and would be useful for evaluating the effectiveness of modified ILM peeling such as the flap method.

The type of tamponade agents and the necessity of face-down positioning are still controversial.[29–34] In 1997, Tornambe et al[29] reported that the face-down positioning was not needed as long as the gas bubble was large enough to isolate the hole from liquid vitreous with the patient upright. They also performed lensectomy on all eyes prior to or at the time of the vitrectomy and used 15% C3F8 gas tamponade. Over the last decade, the time of face-down positioning has been gradually reduced, and recently more than a dozen reports have stated that the face-down positioning is not necessary and phacovitrectomy is safe.[30] Our surgical procedures generally consisted of phacovitrectomy and SF6 tamponade with 1 week face-down positioning.

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Our good surgical outcomes may be due to several reasons. Although vitrectomy with ILM peeling performed by non-experienced surgeons is a safe procedure that leads to good anatomical and functional results, very experienced surgeons may achieve even better functional outcomes.[35] In our study, all surgeries were performed by the same experienced surgeon. There was a visual benefit in the facedown positioning compared to facing forward positioning.[32] In our patients, the facedown positioning was maintained for 1 week.

Phacovitrectomy nullifies the effects of cataract progression. As a result, the postoperative BCVA reflects the postoperative foveal function. Although the reason is unclear, eyes receiving SF6 gas tended to have better visual outcomes than those receiving longer-acting gases.[36] Revision surgery for full-thickness macular holes that have failed to close after the primary surgery is associated with high closure rates and significant visual gains.[37] We tried to close the refractory MH as much as possible.

The new classification put forth by the CLOSE study group[38] indicated that large (400–550 µm) and X-Large (550–800 µm) holes can be treated highly successfully with the ILM peel and ILM flap insertion techniques, respectively. The X-Large holes corresponded to MH of 0.3–0.4 DD in our patients. In the last period of our study, the initial closure rate was 96.6%, the frequency of the final BCVA of 0.5 or better was 85.1%, and the frequency of a final BCVA of 1.0 or better was 46.0%. Our data suggest that favorable results can be obtained without using new adjuvant manipulation techniques.[6–13]

This study has several limitations. The same examiner (NO) evaluated the status of the hole before and after the surgery, and OCT scanning was not widely available. A single surgeon performed the surgery with phacovitrectomy that coincided with the Kelly and Wendel's 5-step technique, however, the study was not able to evaluate the improvements of the surgical instruments. The time periods were set in consideration of the balance of the number of cases per surgery year. However, it risks being viewed as a manipulation to fit the intended narrative. We do not address our experience or the implied value of the several new adjuvant manipulation techniques[6–13] that are generally applied to the lower prognosis cases.

Conclusion

In Conclusion, our findings showed that the surgery was performed earlier and on smaller holes with better preoperative vision from a historical perspective. Hole duration is an important factor even in the era of conventional ILM peeling. We believe that only conventional ILM peeling will achieve favorable results. Further studies are needed to determine the long-term benefit of new adjuvant manipulation techniques.[6–13]

Disclosure

The authors report no conflicts of interest in this work.

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