Validity of the Watzke-Allen Test after a Surgery for Idiopathic Full Thickness Macular Hole

Saowanit Saetang MD*, Patama Bhurayanontachai MD*,
Mansing Ratanasukon MD*, Pichai Jirarattanasopa MD*

** Department of Ophthalmology, Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla, Thailand*

Objective: *To evaluate the role and validity of the Watzke-Allen test in following up patients after surgeries for an idiopathic full-thickness macular hole (FTMH).*
Design: *A prospective interventional analytical study.*
Material and Method: *Patients with idiopathic FTMH were consecutively recruited. A comparative analysis between pre-operative and post operative visual acuity, macular hole status and Watzke-Allen slit beam test results was performed using a Chi-square test and a random intercept mixed model.*
Results: *Twenty-one patients with an average age of 65.90 ± 6.05 years were included in the present study. Three months after surgery, macular holes were surgically closed in 13 eyes (61.9%) and still open in eight eyes (38.1%). An improvement in metamorphopsia, according to Watzke-Allen test results, was found in 61.53% of patients with closed holes and 87.5% of those with open holes. There was no statistically significant correlation between the Watzke-Allen test and the restorative status of a macular hole post surgery.*
Conclusion: *The Watzke-Allen test is a useful subjective assessment of visual function for diagnosis in patients with idiopathic FTMH. However, the test is not beneficial in the post operative follow-up of patients.*

Keywords: *Macular hole, Metamorphopsia, Optical coherence tomography (OCT), Watzke-Allen test*

J Med Assoc Thai 2012; 95 (Suppl. 4): S87-S91
Full text. e-Journal: *http://www.jmat.mat.or.th*

A macular hole is a full-thickness loss of retinal tissue involving the fovea of the eye. The formation of an idiopathic macular hole is believed to be the result of tangential traction on the fovea. Gass and Johnson[1-3] were the first to classify idiopathic macular holes into four stages using biomicroscopic observations.

Impending holes and full-thickness macular holes (FTMHs) may be confused with a number of other foveal and macular lesions, such as pseudo-hole of epiretinal membrane, lamellar hole, and early age-related macular degeneration[1-6]. Careful slit-lamp biomicroscopy, particularly fundus contact lens examination, is usually sufficient to establish a diagnosis in the majority of cases. The simplest method to detect this lesion is a Watzke-Allen slit beam test[7]. A report of a break in the central portion of the line means positive Watzke-Allen test, whereas report of thinning line means negative Watzke-Allen test.

There is no previous study that identifies a relationship between Watzke-Allen test results and postoperative clinical signs in patients who have macular hole surgeries. Therefore, the present study was conducted to evaluate the role and validity of Watzke-Allen test in diagnosis and follow-up of patients after macular hole surgery.

Material and Method

The protocol was approved by the Medical Ethics Committee of Songklanagarind Hospital. The present study is a prospective interventional analytical study including patients with idiopathic FTMH stages 2 to 4 who had visual acuity (VA) less than 20/40. Patients who had traumatic macular hole, macular edema, myopia more than -6.00 diopters, or who previously underwent a vitreoretinal surgery were excluded from the present study. A diagnosis of FTMH was made by a complete fundus examination, a Watzke-Allen test, and optical coherence tomography (OCT, Stratus OCT III, v.4, Zeiss, Germany). The Watzke-Allen test was performed by the projection of a vertical slit

Correspondence to:
Bhurayanontachai P, Department of Ophthalmology, Faculty of medicine, Prince of Songkla University, Hat Yai, Songkhla 90110, Thailand.
Phone: 074-451380-1, Fax: 074-429619
E-mail: tpatama@hotmail.com

beam, which was narrower than a diameter of the macular hole, with a 90- or 78-diopter lens onto the center of fovea. Then the patient is asked to describe the line contour of the beam. In order of best to worst, the perceived line contours were straight line, one-sided bending to the left or right, two-sided bending, then broken line (Fig. 1).

Each patient underwent a vitrectomy with internal limiting membrane peeling and intra-ocular gas injection, either with sulfur hexafluoride (SF_6) or perfluoropropane (C_3F_8), primarily for macular hole repair by one of three vitreoretinal surgeons (PB, MR, or PJ). A combination of cataract extraction was considered for patients who had a significant cataract at the time of surgery. All operations took place within an operating room under aseptic techniques. Patients were instructed to keep in a face-down position when they returned home until the gas disappeared, and, every month for three months, they were scheduled for regular post operative examinations. A successful closure of macular hole after the surgery was determined by a presence of 360-degree hole closure as well as a disappearance of sub-retinal fluid on fundus examination or a complete healing of the previous hole on OCT study.

Data, such as visual acuity, macular hole closure status, Watzke-Allen test result in pre-operative and post operative periods, were analyzed by mean, median, range, standard deviation, 95% confidence interval (95%CI), a random intercept mixed model and a Chi-square tests. A p-value of 0.05 or less was considered to be statistically significant.

Results

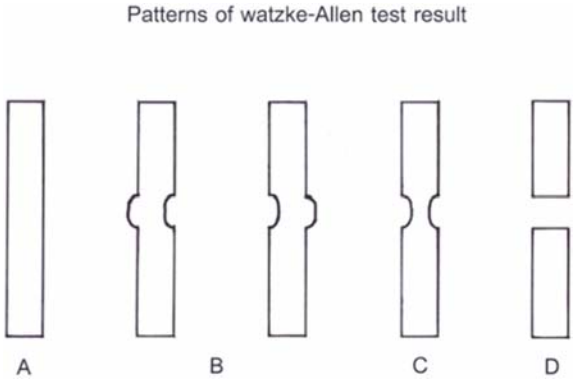

Fig. 1 Patterns of Watzke-Allen test, demonstrating perceived slit beam. A. Straight line, B. One-sided bending to the left or right, C. Two-sided bending, D. Broken line

From August 2008 to August 2009, there were 23 patients who were eligible for the present study, but two patients who did not complete a regular follow-up were excluded from the present study. The data of the remaining 21 patients (21 eyes) were used in the final analysis. The patients' age ranged from 58 to 77 years old, with a mean age of 65.90 $\pm$ 6.05 years. Two-thirds of them were female. The demographic data and descriptive statistics are shown in Table 1. Pre-operative visual acuity (VA) was classified as mild visual loss (VA $\geq$ 20/60) in 4.76% of the patients, moderate visual loss (VA = 20/80 - 20/160) in 61.90%, and severe visual loss (VA $\leq$ 20/200) in 33.33%.

The macular holes were found closed in 33.33% of the patients at one month post surgery and in 61.90% of the patients at three months. Regardless of the status of hole closure, most of the patients had an improvement in their Watzke-Allen test results (Table 2).

In the group with holes closed after surgery, eight of 13 patients (61.54%) improved on the Watzke-Allen test while three patients (23.07%) had unchanged results. Only two patients (15.38%) reported a

Table 1. Demographic data of patients with full-thickness macular holes (n = 21)

	number of eyes	%
Sex		
Female	14	66.67
Severity (stage)		
Stage 2	5	23.81
Stage 3	11	52.38
Stage 4	5	23.81
Visual acuity (VA)		
$\geq$ 20/60	1	4.76
20/80 - 20/160	13	61.90
$\leq$ 20/200	7	33.33
Types of surgery		
PPV+MP+C_3F_8	13	61.90
PPV+MP+SF_6	2	9.52
PE+IOL+PPV+MP+C_3F_8	6	28.57

PPV+MP+C_3F_8 = vitrectomy with internal limiting membrane peeling and intraocular perfluoropropane gas injection

PPV+MP+SF_6 = vitrectomy with internal limiting membrane peeling and intraocular sulfurhexafluo-ride gas injection

PE+IOL+PPV+MP+C_3F_8 = Combined phacoe-mulsification with intraocular lens implantation and vitrectomy with internal limiting membrane peeling and intraocular perfluoropropane gas injection

worsening of their Watzke-Allen test results, even though they had a complete healing of their macular holes confirmed by an OCT (Table 3).

In the group with still open holes at three months after surgery, seven of eight patients (87.5%) improved on the Watzke-Allen test, even two of them who previously had broken lines on the pre-operative test also reported results of two-sided bending post operatively (Table 4). Only one patient (12.5%) in the present group had an unchanged result. The relationship between changes in the Watzke-Allen test result and macular hole closure status at three months after surgery compared to the baseline was not statistically significant (p = 0.41).

Visual acuity at the first month post surgery was significantly reduced by 1.14 lines from the baseline (p = 0.046) because of the effect of ocular media obstruction by a gas bubble (Table 5). At the third month, visual acuity markedly increased from the first month by 1.52 lines; however, it remained only a 0.38 line improvement from the baseline and was not statistically significant (p = 0.495).

One patient had an acute post operative endophthalmitis and she was treated with a vitrectomy and intravitreal antibiotic injection on the first post operative day. This patient regained her best-corrected

Table 2. Macular hole closure status by fundus examination and Watzke-Allen test (n = 21)

	Baseline n (%)	One month after surgery, n (%)	Three months after surgery, n (%)
Fundus examination			
Open hole	21 (100)	14 (66.67)	8 (38.10)
Closed hole	-	7 (33.33)	13 (61.90)
Watzke-Allen test			
Straight line	0 (0)	0 (0)	1 (4.76)
One-sided bending	7 (33.33)	13 (61.90)	15 (71.43)
Two-sided bending	7 (33.33)	8 (38.10)	5 (23.81)
Broken line	7 (33.33)	0 (0)	0 (0)

Table 3. Changes in Watzke-Allen test results for cases of closed macular holes at three months postsurgery compared to the baseline (n = 13)

Baseline	Three months after surgery (eyes)			
	straight line	1-sided bending	2-sided bending	broken line
Straight line	0	0	0	0
1-sided bending	1	3	2	0
2-sided bending	0	4	0	0
broken line	0	2	1	0

Table 4. Changes in Watzke-Allen test results in cases of open macular holes at three months postsurgery compared to the baseline (n = 8)

Baseline	Three months after surgery (eyes)			
	straight line	1-sided bending	2-sided bending	broken line
Straight line	0	0	0	0
1-sided bending	0	1	0	0
2-sided bending	0	3	0	0
broken line	0	2	2	0

Table 5. Visual acuity change after macular hole surgery (n = 21)

	Visual acuity (VA)		Change from baseline		
	median	range	mean (lines)	95% CI	p-value
Baseline	20/125	20/50 - 5/200	-	-	-
First month	20/160	20/50 - HM	-1.14	-2.26, -0.02	0.046
Third month	20/100	20/40 - HM	+0.38	-0.74, +1.50	0.506

The change of visual acuity from the first to the third month after surgery = +1.52 lines
(P = 0.006, Random intercept mixed model)

VA of 20/100, had the macular hole closed, and the Watzke-Allen test result improved from a broken line to one-sided bending at the third month after surgery. Two patients in the present study had a significant progression of their cataracts and underwent subsequent cataract surgeries at four months after the macular hole repairs.

Discussion

Idiopathic macular holes generally afflict healthy women in their seventh and eight decades and, in the present study, two-thirds of the patients were female with an age range of 58 to 77 years old.

A proposed pathogenesis of idiopathic FTMH and cause of metamorphopsia is a migration of photoreceptors from the center of fovea. The pre-operative Watzke-Allen test result in this study showed a variety of patterns. Most of the patients had one-sided or two-sided bending of the vertical slit beam which corresponds to results in previous reports[8,9]. However, the frankly positive Watzke-Allen test (broken line) was found in a minority of cases with FTMH as in other studies[8,10].

In the post operative period, the results of Watzke-Allen test improved in cases where the macular hole was closed. This change correlates with the hypothesis of remigration of photoreceptors to the center of fovea after macular hole closure. However, some cases had unchanged or a worsening of the Watzke-Allen test results which may be explained by partial or compromised functioning of the re-migrated photoreceptors. On the other hand, an improvement in Watzke-Allen test results in cases where macular holes were still open at three months after the operation, may be explained by the functioning of partially remigrated photoreceptors, something a fundus examination could not detect.

However, there was no correlation between Watzke-Allen test results and the post operative status of macular hole closures. Therefore, the Watzke-Allen test is not useful in following-up the postsurgical patients for idiopathic FTMH for determining or predicting the closure status of the hole.

The reduction in visual acuity at one month after the macular hole surgery can be explained by the remaining intra-ocular gas which was not fully disappeared or a progression of the patient's cataract. At three months, after absorption of the intra-ocular gas bubble and a chance of macular hole closure over time, the vision finally improved.

The present study has some limitations, such as a small sample size and unavailable of post-operative OCT studies for some patients. A future study with long term follow-up and a larger sample size is required to re-evaluate whether Watzke-Allen test results can improve over a longer follow-up period.

Conclusion

The Watzke-Allen test is helpful for the diagnosis of idiopathic FTMH: the test is independent of a visual acuity test, a fundus examination, or an OCT. However, the validity of this test is not beneficial as a predictor of macular hole closure status after the surgery.

Acknowledgment

The present study was supported by the Faculty of Medicine, Prince of Songkla University, Hat Yai, Songkhla, Thailand.

Potential conflicts of interest

None.

References

1. Gass JD. Idiopathic senile macular hole. Its early stages and pathogenesis. Arch Ophthalmol 1988; 106: 629-39.
2. Johnson RN, Gass JD. Idiopathic macular holes.

Observations, stages of formation, and implications for surgical intervention. Ophthalmology 1988; 95: 917-24.
3. Gass JD. Reappraisal of biomicroscopic classification of stages of development of a macular hole. Am J Ophthalmol 1995; 119: 752-9.
4. Smiddy WE, Gass JD. Masquerades of macular holes. Ophthalmic Surg 1995; 26: 16-24.
5. Puliafito CA, Hee MR, Lin CP, Reichel E, Schuman JS, Duker JS, et al. Imaging of macular diseases with optical coherence tomography. Ophthalmology 1995; 102: 217-29.
6. Hee MR, Puliafito CA, Wong C, Duker JS, Reichel E, Schuman JS, et al. Optical coherence tomography of macular holes. Ophthalmology 1995; 102: 748-56.
7. Watzke RC, Allen L. Subjective slitbeam sign for macular disease. Am J Ophthalmol 1969; 68: 449-53.
8. Tanner V, Williamson TH. Watzke-Allen slit beam test in macular holes confirmed by optical coherence tomography. Arch Ophthalmol 2000; 118: 1059-63.
9. Martinez J, Smiddy WE, Kim J, Gass JD. Differentiating macular holes from macular pseudoholes. Am J Ophthalmol 1994; 117: 762-7.
10. Guez JE, Le Gargasson JF, Massin P, Rigaudiere F, Grall Y, Gaudric A. Functional assessment of macular hole surgery by scanning laser ophthalmoscopy. Ophthalmology 1998; 105: 694-9.

ความเที่ยงตรงของผลการตรวจด้วยวิธี Watzke-Allen ในผู้ป่วยหลังผ่าตัดภาวะจุดภาพชัดเป็นรูชนิดเกิดขึ้นเอง

เสาวณิต แซ่ตั้ง, ปฐมา ภูรยานนทชัย, แมนสิงห์ รัตนสุคนธ์, พิชัย จิรรัตนโสภา

วัตถุประสงค์*: เพื่อศึกษาความเที่ยงตรงของการตรวจด้วยวิธี Watzke-Allen ในการติดตามผลการรักษาด้วยการผ่าตัด ผู้ป่วยที่มีภาวะจุดภาพชัดเป็นรูชนิดเกิดขึ้นเอง ก่อนและหลังการผ่าตัด*

วิธีวิจัย*: การศึกษาไปข้างหน้าเชิงวิเคราะห์ (prospective analytical study)*

วัสดุและวิธีการ*: เก็บข้อมูลจากผู้ป่วยที่ได้รับวินิจฉัยว่ามีภาวะจุดภาพชัดเป็นรูชนิดเกิดขึ้นเองก่อนผ่าตัดจากการตรวจจอตา การตรวจด้วยวิธี Watzke-Allen และการใช้เครื่องมือวัดความหนาของจอตาบริเวณจุดภาพชัดและติดตามหลังการผ่าตัด ข้อมูลที่ได้นำมาวิเคราะห์หาความสัมพันธ์ระหว่างภาวะการปิดของรูบริเวณจุดภาพชัดและผลการตรวจด้วยวิธี Watzke-Allen โดยใช้ Random intercept mixed model และ Chi-square ในการวิเคราะห์ข้อมูล*

ผลการศึกษา*: ผู้ป่วยที่เข้าร่วมโครงการมีจำนวน 21 คน อายุเฉลี่ย 65.90 $\pm$ 6.05 ปี ที่ 3 เดือนหลังผ่าตัดพบว่า 13 คน (ร้อยละ 61.9 มีการหายสนิทของรูที่จุดภาพชัด และ 8 คน (ร้อยละ 38.1) รูที่จุดภาพชัดยังคงเปิดอยู่ ผู้ป่วยส่วนใหญ่มีแนวโน้มที่จะมีผลการทดสอบวิธี Watzke-Allen เห็นแสงคอดกิ่วน้อยลงหลังการผ่าตัด ในกลุ่มที่รูที่จุดภาพชัดหายสนิทร้อยละ 61.53 มีผลการทดสอบวิธี Watzke-Allen ดีขึ้นเมื่อเทียบกับก่อนผ่าตัด แม้ในกลุ่มที่รูที่จุดภาพชัดไม่ปิดหลังผ่าตัด ก็ยังพบว่าร้อยละ 87.5 มีการเปลี่ยนแปลงของผลการทดสอบวิธี Watzke-Allen ในทางที่ดีขึ้น โดยผลการทดสอบวิธี Watzke-Allen และภาวะการปิดของจุดภาพชัด ไม่พบมีความสัมพันธ์อย่างมีนัยสำคัญทางสถิติ*

สรุป*: การตรวจด้วยวิธี Watzke-Allen มีประโยชน์ในการช่วยยืนยันการวินิจฉัยผู้ป่วยที่มีภาวะจุดภาพชัดเป็นรูชนิดเกิดขึ้นเอง แต่ไม่ช่วยในการติดตามการรักษาผู้ป่วยหลังผ่าตัดในแง่ของการประเมินภาวะการปิดของรูที่จุดภาพชัด*