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Effect of preoperative tear function on early functional visual acuity after laser in situ keratomileusis

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Purpose: To assess the effect of preoperative tear function on early changes in functional visual acuity (FVA) after laser in situ keratomileusis (LASIK).

Setting: Minamiaoyama Eye Clinic, Tokyo, Japan.

Methods: This prospective single-center study assessed the effect of preoperative and postoperative tear functions on FVA in 30 eyes of 15 patients who had LASIK. Functional visual acuity was defined as the binocular recognition acuity measured by the FVA tester (Wellsystem) during a 10-second, blink-free period. All patients had a Schirmer test with anesthesia and tear-film breakup time (BUT) measurements preoperatively and 1 day and 1 week after LASIK. Corneal topography and Landolt visual acuity and FVA measurements were performed before surgery and 1 day and 1 week after LASIK. Eyes with a Schirmer test reading less than 5.0 mm and a BUT less than 5 seconds were grouped as definite dry eye (DDE). Eyes with a normal Schirmer test score but a shortened BUT were grouped as probable dry eye (PDE).

Results: In all patients, the best uncorrected Landolt visual acuity was 20/20 or better at the postoperative examination times. In the DDE group, the mean preoperative FVA declined from 1.2 to 0.75 ± 0.16 (SD) at 1 day and increased to 1.2 at 1 week. No change in FVA was observed postoperatively in the PDE group.

Conclusion: Laser in situ keratomileusis patients with low basal tearing and full uncorrected distance Landolt acuity may experience a transient decrease in FVA that returns to baseline within 1 week.

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Dry-eye patients often complain of decreased visual acuity during daily activities such as reading, driving, and video display terminal (VDT) work.[1,2] Many myopic dry-eye patients intolerant to contact lenses resort to visual rehabilitation by refractive surgery. It is reported that 50% of LASIK patients have preoperative dry eye and that the LASIK procedure itself induces aqueous deficiency.[3,4] Laser in situ keratomileusis has also been shown to significantly alter the early postoperative tear stability.[3–5] A stable tear-film layer over the surface of the cornea is essential for clear visual imaging. An irregular corneal surface resulting from aqueous deficiency is reportedly associated with poor quality of vision.[6]

Many LASIK patients complain of the quality of their vision despite optimal uncorrected binocular visual acuity in the early postoperative period. We think this may be related to disturbances in the tear film.

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An assessment of functional visual acuity (FVA) is reportedly useful in the detection of subtle changes in visual quality in dry-eye patients.[1,2,6] In this study, we performed conventional and FVA measurements before and after LASIK and studied the effect of tear functions on early postoperative FVA.

Patients and Methods

Thirty eyes of 15 consecutive patients who had bilateral LASIK for myopia (range −1.25 to −9.0 diopters [D]) were enrolled in this study. All had slitlamp biomicroscopy, corneal topography, and best corrected Landolt visual acuity and FVA measurements before and 1 day and 1 week after LASIK. Tear-function examinations including Schirmer test with anesthesia and tear-film breakup time (BUT) were performed preoperatively and 1 day and 1 week after LASIK. In each patient, the degree of preoperative myopia, amount of myopic correction, and ablation depth were recorded.

Tear Examinations

The standard Schirmer test with topical anesthesia (oxybuprocaine chloride 0.4%) was performed. The standardized strips of filter paper (Alcon Inc.) were placed in the lateral canthus, away from the cornea, and left in place for 5 minutes with the eyes closed. Readings were reported in millimeters of wetting for 5 minutes. A reading of less than 5.0 mm was referred to as dry eye.

For BUT measurements, 2.0 µL of fluorescein 1% was applied to the conjunctival sac by a micropipette. The patients were then instructed to blink several times. The interval between the last blink and the appearance of the first black spot in the central corneal tear film was measured. A BUT value less than or equal to 5 seconds was considered abnormal. The dry-eye patients were divided into 2 groups of "definite" and "probable" dry eyes according to the preoperative tear functions. Eyes with a Schirmer test reading less than 5.0 mm and a BUT less than 5 seconds were grouped as definite dry eye (DDE), and those with a normal Schirmer test score but a shortened BUT were grouped as probable dry eye (PDE).

Functional Visual Acuity Measurements

The FVA tester (Wellsystem) was used to measure the recognition visual acuity continuously. Functional visual acuity was defined as the binocular recognition acuity measured by the FVA tester during a 10-second, blink-free period. The details of the testing procedure have been reported.[1,2] First, visual acuity was measured with no restraints to blinking using this instrument (baseline FVA). Topical anesthesia (oxybuprocaine chloride 0.4%) was administered before the FVA examination to minimize discomfort and prevent reflex tearing and blinking. Five minutes after the topical anesthesia was instilled, patients were instructed not to blink for 10 seconds during the measurement of FVA. The examiner confirmed the absence of blinking during the 10-second period. Patients indicated the orientation of the automatically presented Landolt rings using the joystick. Initially, the 24/20 Landolt ring was shown on the terminal display at 5 m from the patients. The Landolt ring increased in size when the answer was incorrect and decreased in size when it was correct. If the Landolt ring was recognized correctly, the same-size ring was displayed at random again. The result was displayed as a plot graph when the measurement was complete.

Corneal Topography

Corneal topography of each patient was measured using TMS-2 videokeratoscope software (Tomey Corp.). Topography was measured immediately after the eyes were opened and after the 10-second, blink-free period. The surface regularity index (SRI) was measured at 0 and 10 seconds (SRI 0 and SRI 10, respectively).

Statistical Analysis

Data were processed using Graph Pad Software. The paired *t* test was used for analysis of the nonparametric values. The change in SRI from baseline over time was assessed in each group by the 2-way repeated-measures analysis of variation test. A probability level less than 5% was considered statistically significant.

Results

The mean age of the 3 women and 12 men was 37.1 years ± 7.3 (SD) (range 23 to 55 years). Of the 30 eyes, 12 (6 patients) were in the DDE group and 18 (9 patients) in the PDE group based on the preoperative tear functions. The best uncorrected Landolt visual acuity was 20/20 or above in all cases at each post-LASIK examination.

Refractive and Ablation Data

The mean degree of preoperative myopia was −6.5 ± 2.4 D in the DDE group and −5.6 ± 2.3 D in the PDE group. The difference was not significant ($P>.05$). The mean amount of myopic correction was −4.9 ± 2.2 D in the DDE group and −5.8 ± 2.1 D in the PDE group ($P>.05$). The mean depth of ablation was 80.5 ± 30.4 µm and 87.8 ± 33.0 µm, respectively ($P>.05$).

Tear-Function Examinations

The overall mean BUT was 4.42 ± 0.82 seconds in the DDE group and 3.06 ± 0.85 seconds in the PDE group. In the 12 DDE eyes that presented with

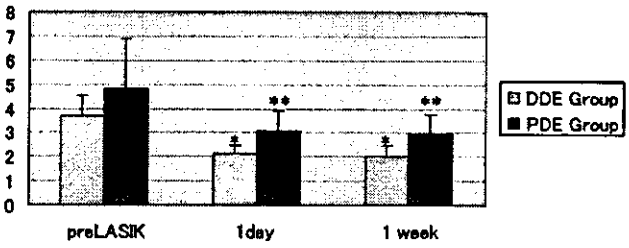

Figure 1. (Tanaka) The change in BUT after LASIK in dry-eye patients.

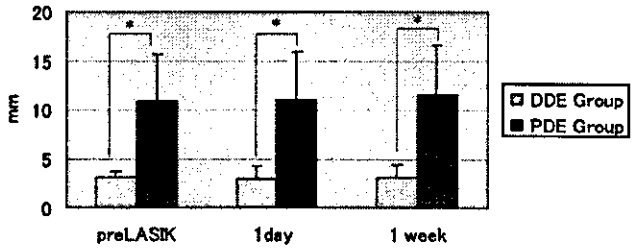

Figure 2. (Tanaka) The change in Schirmer test values after LASIK.

a decrease in 1-day FVA, the preoperative BUT was 3.70 ± 0.82 seconds; it declined to 2.13 ± 0.35 seconds at 1 day ($P<.05$). The BUT remained at 2.00 ± 0.45 seconds at 1 week. In the 18 PDE eyes with stable 1-day FVA, the BUT was 4.80 ± 2.09 seconds preoperatively and 3.06 ± 0.85 seconds at 1 week; the BUT remained at 2.98 ± 0.75 seconds at 1 week, as shown in Figure 1 ($P<.05$). Although the mean pre-LASIK BUT in the DDE group was lower than that in the PDE group, the difference was not statistically significant ($P>.05$). A statistically significant between-group difference in the 1-day BUT values was noted ($P<.05$).

In the 12 DDE eyes that presented with decreased 1-day FVA, the mean preoperative Schirmer test value was 3.05 ± 0.67 mm; this declined to 2.97 ± 1.32 mm at 1 day and 3.07 ± 1.30 mm at 1 week. The differences were not significant ($P>.05$). In the 18 PDE eyes with stable 1-day FVA, the mean Schirmer test value was 10.80 ± 4.80 mm preoperatively and 11.00 ± 4.90 mm at 1 day, as shown in Figure 2 ($P>.05$). The between-group difference in Schirmer test values at each examination time was statistically significant ($P<.05$).

Functional Visual Acuity

The baseline FVA was 24/20 in all patients before LASIK surgery. It decreased to a mean 15/20 in 6 DDE patients at 1 day ($P<.05$). No changes in FVA from baseline values were noted in the PDE group (Figure 3). At 1 week, the FVA recovered to the preoperative level in all patients.

Corneal Topography

At 1 day, the SRI 10 in the 12 eyes in the DDE group with decreased FVA significantly increased compared to the eyes in the PDE with stable FVA ($P<.05$). The SRI 10 was 2.20 ± 0.54 in DDE group and 1.54 ± 0.62 in the PDE group, as shown in Figure 4. At 1 week, no significant between-group differences were observed in the SRI 10 values ($P>.05$). The variation in the SRI 10 from baseline to 1 week was statistically significant in both groups ($P<.05$). At 1 day, the mean SRI was 1.39 ± 0.33 in the DDE group and 1.28 ± 0.55 in the PDE group ($P>.05$). The SRI 10 was 2.20 ± 0.54 and 1.54 ± 0.62, respectively ($P<.05$). The increase in SRI from 0 to 10 seconds was statistically significant ($P<.05$) in the DDE group, as shown in Figure 5.

Discussion

Dry eye is a major reason patients consider LASIK, and it is a common post-LASIK complication. Toda and coauthors[4] report that more than 75% of patients having LASIK have preoperative dry eye; 35.2% have DDE and 41.2% have PDE, according to the modified criteria of the Japanese Dry Eye Association.[7] It has

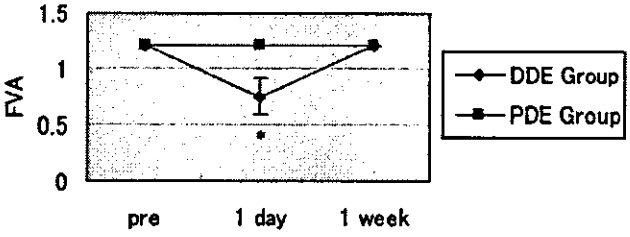

Figure 3. (Tanaka) The change in FVA after LASIK.

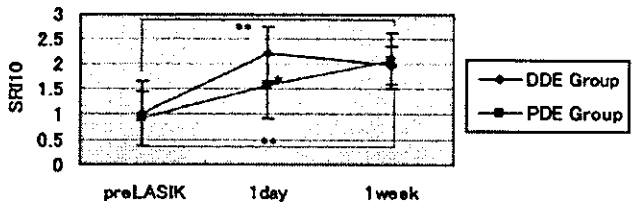

Figure 4. (Tanaka) The change in SRI after LASIK.

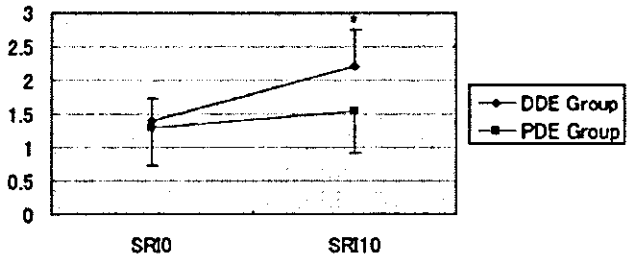

Figure 5. (Tanaka) The change in SRI from 0 to 10 seconds.

been demonstrated that post-LASIK, dry eye develops with compromised tear function for at least 1 month; some patients may have dry eye 1 year after LASIK.[3,4] It is well known that LASIK is associated with significant improvements in uncorrected and best corrected visual acuity, even in dry-eye patients. Although standard visual acuity testing is an excellent measure of 1 aspect of visual function, contrast sensitivity and glare testing provide more important and precise information about specific aspects of visual function.

Recently, FVA testing, described as "functional visual acuity for 10 seconds without blinking," was reported to be an important method of defining "detailed visual function."[1] The method has been shown to be efficient in detecting "masked impairment of visual function" in dry-eye patients who complain of decreased visual acuity despite normal conventional visual acuity test results.[1] The definition of FVA testing has been proposed as an important indication of an individual's performance of certain daily activities such as driving, reading, and VDT work.[2]

In this study, we examined the effects of dry eye on FVA in the first post-LASIK week since the modern LASIK procedure enables most patients to return to daily activities the day after LASIK. All patients attained 20/20 uncorrected conventional visual acuity the day after surgery and the first post-LASIK week. A group of patients complained of difficulties reading and driving and visual fluctuation the day after LASIK. The analyses and findings in the PDE patients (BUT-deficiency type) and DDE patients (BUT- and aqueous-deficiency type) made us realize that it was the DDE patients who had these complaints and who also displayed a significant reduction in FVA 1 day after LASIK despite normal conventional visual acuity.

In corneal topography, the SRI has been shown to reflect the regularity and optical quality of the cornea and also to correlate with the potential visual acuity.[6,8] The SRI values in our patients showed a significant increase from baseline to 1 week in both groups. The DDE patients also had significantly higher SRI 10 values than the PDE patients at 1 day. The increase in the mean SRI value from baseline at 0 second to 10 seconds was also significant in the DDE group compared with the PDE group. An investigation of preoperative refractive differences as well as LASIK parameters such as the amount of myopic correction and the ablation depth showed no significant differences between the 2 groups, suggesting that the SRI changes probably resulted from tear stability differences and minute corneal surface irregularities. Thus, the changes in early FVA in our patients may be explained by poor tear spreading and the surface depression created by LASIK or a greater contribution by the dynamic precorneal tear film to the optical power of the eye after LASIK. A further reduction in post-LASIK BUT scores in the first week might also have contributed. Holladay and coauthors[9] report that finer markers of visual function such as contrast acuity and glare testing revealed marked deterioration on the first day after LASIK. They attributed these changes to microscopic corneal irregularities that do not affect clinical visual performance assessed by conventional methods.

We think investigations into the changes in tear stability and function in dry-eye patients having LASIK, as evaluated by tear-film lipid-layer interferometry or the recently developed tear stability analysis system, which measures blink-free corneal topography changes over 10 seconds, would be very interesting. It would be even more interesting to look into the relationship between these parameters and tests defining finer visual function such as wavefront analysis, glare testing, contrast sensitivity, and FVA.

Our preliminary findings suggest that BUT- and aqueous-deficient dry-eye patients who have LASIK experience a reduction in FVA on the first post-LASIK day; this is associated with complaints of difficulties in driving or reading. It has been shown that blink rates decreased considerably during reading and driving when most patients kept their eyes open for more than 10 seconds.[10] Although we did not measure the blink rate in our patients, the relationship between early post LASIK FVA and blink rate in a large number of patients would provide useful information.

In conclusion, DDE patients having LASIK experience a transient reduction in FVA, which returns to baseline within 1 week. Further research in a large number of patients is therefore essential to clarify the restrictions and define the necessary precautions, if any, in relation to daily activities in DDE patients having LASIK.

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Ocular Surface Treatment Before Laser in situ Keratomileusis in Patients With Severe Dry Eye

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ABSTRACT

PURPOSE: To evaluate the efficacy and safety of laser in situ keratomileusis (LASIK) in patients with severe dry eye associated with Sjögren's syndrome.

METHODS: Three patients (six eyes) with Sjögren's syndrome who underwent bilateral LASIK were retrospectively evaluated for visual outcome, intraoperative and postoperative complications, dry eye status (subjective symptoms and objective findings, Schirmer test, vital staining of the ocular surface), and outcome satisfaction by subjective questionnaire. All patients had negative reflex tearing and were treated with topical autologous serum and/or punctal occlusion prior to LASIK to improve the ocular surface. This treatment was continued postoperatively.

RESULTS: Mean attempted correction of six eyes was -8.46 ± 1.55 D (range -7.00 to -10.63 D). One year after LASIK, mean uncorrected visual acuity was 1.07 (range 0.7 to 1.5), mean best spectacle-corrected visual acuity was 1.29 (range 1.2 to 1.5), and mean refraction was -0.19 ± 0.51 D (range -1.00 to +0.50 D). Tear production, rose bengal and fluorescein staining, and dry eye symptoms were not exacerbated after LASIK. No complications, such as intraoperative epithelial defect, diffuse lamellar keratitis, epithelial ingrowth, or recurrent erosion occurred. All three patients were satisfied with the outcome of their surgery.

CONCLUSION: LASIK can be safely and effectively managed in patients with severe dry eye with reduced reflex tearing by preoperative and postoperative treatments consisting of a combination of artificial tears, topical autologous serum, and punctal occlusion. Careful assessment of preoperative and postoperative ocular surface status is mandatory in such patients. [*J Refract Surg* 2004;20:270-275]

Contact lens intolerance due to dry eye conditions is often a motive for refractive surgery.[1,2] Furthermore, if dry eye patients have high myopia, high astigmatism, and/or anisometropia, it is often difficult for them to wear spectacles that sufficiently correct their refractive error. In such cases, refractive surgery may be the only option that achieves satisfactory uncorrected visual acuity. We recently reported that patients who had preoperative dry eye could safely undergo photorefractive keratectomy (PRK) or laser in situ keratomileusis (LASIK) without increased risks of complications or lower predictability for the attempted corrections.[2,3] However, the patients in these studies had mild to moderate dry eye with positive reflex tearing measured by Schirmer test with nasal stimulation.[4]

Sjögren's syndrome is associated with reduced reflex tearing. Reflex tearing plays an important role in the maintenance of ocular surface integrity. When LASIK is performed in such patients, ocular surface management and the control of dry eye-related symptoms are of utmost importance. Ocular surface management is probably most important in the early postoperative period as symptoms and signs of dry eye could temporarily worsen for several weeks postoperatively.[5-8]

Recently, a combination of autologous serum eye drops and punctal occlusion has been used effectively in the treatment of ocular surface disorders associated with severe tear deficiency, including Stevens-Johnson's syndrome, ocular cicatricial

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The authors have no proprietary interest in the materials presented herein.

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Table 1
Dry Eye Patient Data Before LASIK

Patient	Age (yr)	Eye	UCVA	BSCVA	Refraction (D)	Schirmer (mm)	Tear Break-up Time (sec)	Preoperative Treatment	Correction (D)
M.K.	47	R	0.05	1	sphere -6.75 cylinder -1.75	5	0	Serum, artificial tears	sphere -6.75 cylinder -1.75
		L	0.05	1	sphere -6.50 cylinder -1.00	4	0	Serum, artificial tears	sphere -6.50 cylinder -1.00
S.K.	52	R	0.08	1.2	sphere -7.25 cylinder -0.75	3	2	Serum, plugs (4)	sphere -6.75 cylinder -0.50
		L	0.04	1.2	sphere -9.50	3	2	Serum, plugs (4)	sphere -8.50
H.H.	53	R	0.03	1.5	sphere -10.50	1	2	Serum, plugs (4)	sphere -10.00
		L			sphere -9.75 cylinder -1.75	1	1	Serum, plugs (4)	sphere -9.75 cylinder -1.75

Serum=autologous serum eye drop (number of puncta occluded)
**Some plugs lost*

Table 2
Dry Eye Patient Data 1 Year After LASIK

Patient	Age	Eye	Postoperative	UCVA	BSCVA	Refraction (D)	Schirmer (mm)	Tear Break-up Time (sec)	Satisfaction Grade
M.K.	47	R	Serum, plugs (2)	1.5	1.5	sphere 0 cylinder 0	5	4	1
		L	Serum, plugs (2)	1.2	1.5	sphere +0.50 cylinder 0	4	4	1
S.K.	52	R	Serum, plugs (4)*	1.2	1.2	sphere 0 cylinder 0	2	2	2
		L	Serum, plugs (4)*	0.7	1.2	sphere -0.75 cylinder -0.50	4	2	2
H.H.	53	R	Serum, plugs (4)	1.2	1.2	sphere 0 cylinder 0	not done	2	1
		L	Serum, plugs (4)	1.2	1.2	sphere 0 cylinder 0	not done	1	1

Serum=autologous serum eye drop (number of puncta occluded)
**Some plugs lost*

pemphigoid, and Sjögren's syndrome.[9-11] Corneal transplantation used to be contraindicated for patients with severe dry eye, however, by using autologous serum eye drops and punctal occlusion, successful surgical outcomes were achieved in many of these patients. We predicted that LASIK would be safely performed in patients with severe dry eye such as Sjögren's syndrome if the ocular surface was managed by such means. However, for successful outcomes, it is imperative that the ocular surface is improved to optimal condition before surgery, by punctal occlusion and eye drops, and that this treatment is continued after surgery.

We performed LASIK on three patients with severe dry eye associated with Sjögren's syndrome and evaluated its safety and efficacy, focusing in particular on wound healing-related epithelial complications and dry eye status.

PATIENTS AND METHODS

Three middle-aged females with Sjögren's syndrome were included in this study. Preoperative profiles of these patients are listed in Table 1. All patients were highly myopic and had used hard contact lenses preoperatively but complained of dryness, foreign body sensation, ocular fatigue, discharge, and/or redness that worsened with contact lens wear. These symptoms made contact lens wear impossible for long periods. A complete ophthalmic examination and assessment of dry eye status were performed at baseline. Basic tearing and tear stability determined by Schirmer test with anesthesia and tear break-up time were less than 5 mm and 5 seconds, respectively. Reflex tearing measured with Schirmer test with nasal stimulation[4] was less than 10 mm (negative) in all patients. All four puncta were occluded with silicone punctal plugs (Eagle

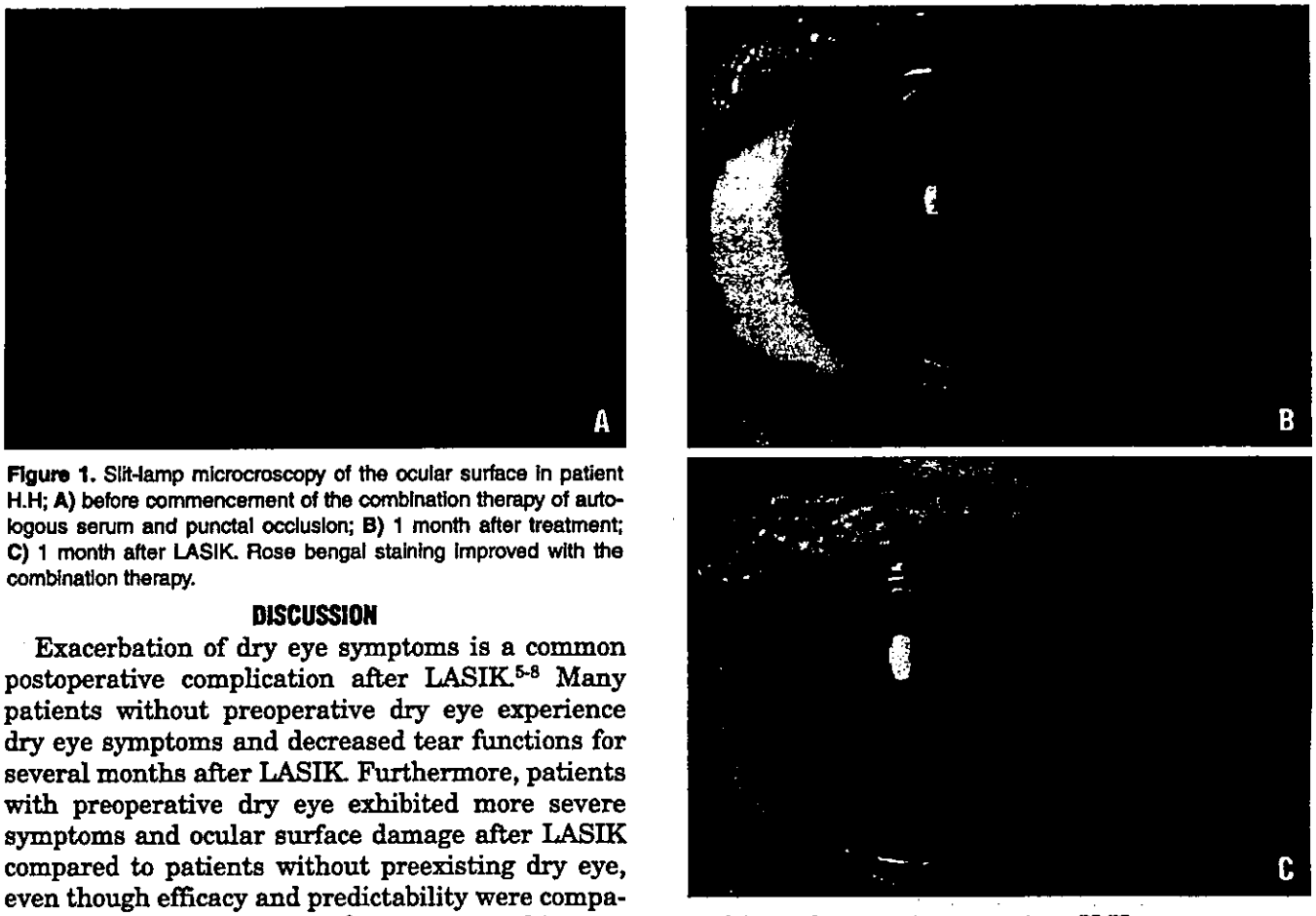

Figure 1. Slit-lamp microcroscopy of the ocular surface in patient H.H; A) before commencement of the combination therapy of autologous serum and punctal occlusion; B) 1 month after treatment; C) 1 month after LASIK. Rose bengal staining improved with the combination therapy.

DISCUSSION

Exacerbation of dry eye symptoms is a common postoperative complication after LASIK.[5-8] Many patients without preoperative dry eye experience dry eye symptoms and decreased tear functions for several months after LASIK. Furthermore, patients with preoperative dry eye exhibited more severe symptoms and ocular surface damage after LASIK compared to patients without preexisting dry eye, even though efficacy and predictability were comparable between these groups.[3] We performed LASIK on severe cases of dry eye associated with Sjögren's syndrome after strict informed consent, and found that with proper management, these patients can be candidates for LASIK.

In patients with severe dry eye with decreased reflex tear secretion, ocular surface dessication has adverse effects on the ocular surface epithelium and insufficient tear components may compromise normal wound healing. Problems with epithelial wound healing may lead to flap dislocation, epithelial ingrowth[15], or diffuse lamellar keratitis.[16] If postoperative LASIK dry eye is extremely severe, epithelial defect or corneal ulcer may appear. In our patients, all of whom had decreased reflex tearing, such problems were not experienced during the 1-year postoperative follow-up. Postoperative refraction and visual acuity were also good in these patients. The good visual outcome and lack of complications is probably mostly attributable to extensive management of dry eye with autologous serum eye drops and punctal plugs. We scheduled LASIK only after ocular surface findings were sufficiently improved.

Of our three patients, patient H.H. was most successfully treated with punctal plugs with no plug loss. The ocular surface showed no staining with fluorescein and rose bengal immediately prior to LASIK and dry eye symptoms were dramatically improved. On the other hand, patient M.K., who had plugs placed only in her upper puncta, and patient S.K., who experienced frequent loss of punctal plugs, complained of dry eye symptoms with moderate staining of the ocular surface. These results may suggest that the management of dry eye before surgery, especially with complete occlusion of lacrimal puncta, is a key for preventing severe postoperative LASIK dry eye and reducing subjective symptoms. Punctal occlusion is an effective treatment for dry eye, however, plug loss is a problem.[17] Surgical punctal occlusion may be advocated in some cases.

Autologous serum eye drops have been used successfully in many severe corneal epithelial disorders.[9,18] Autologous serum is considered to supply essential components that are necessary for epithelial wound healing, such as epithelial growth hormone and vitamin A, and positively promotes

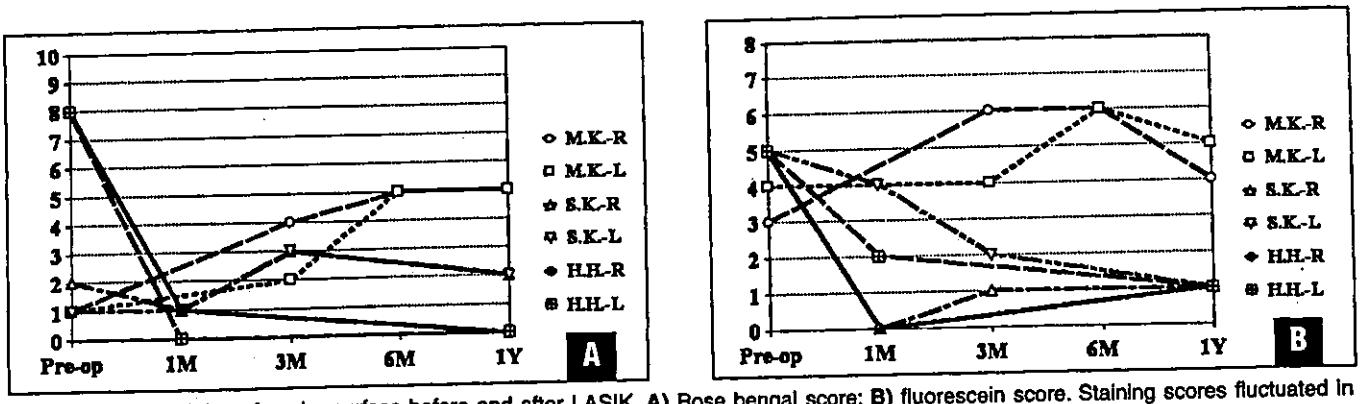

Figure 2. Vital staining of ocular surface before and after LASIK. **A)** Rose bengal score; **B)** fluorescein score. Staining scores fluctuated in patients M.K. and S.K., whereas the scores were continuously low in patient H.H. after LASIK. (Two of three patients had been diagnosed with Sjögren's syndrome and treated with artificial tears for some time before examination at our clinic, hence their rose bengal score was relatively low.)

epithelialization in these patients.[11,19] Autologous serum significantly improved ocular surface abnormality of severe dry eye with Sjögren's syndrome.[11] We suspect that combination of autologous serum eye drops, which supply defective tear components, and punctal occlusion, which prolongs the effects of these factors on the ocular surface, may make LASIK possible in patients with severe dry eye.

In Sjögren's syndrome, lacrimal glands are progressively destroyed with lymphocytic infiltration, leading to a decrease in tear secretion.[20,21] Although the degree of destruction of the lacrimal gland and decrease in tear secretion do not always parallel each other, it is expected that no tears can be produced if healthy acini and ducts in the glands are completely destroyed. We sometimes encounter patients whose ocular surface damage does not respond to extensive treatment of dry eye, even though they have been managed effectively by the same treatment previously. These patients usually have a long history of Sjögren's syndrome, possibly with very little residual healthy lacrimal gland components. Such patients with "absolute" dry eye are probably not candidates for LASIK. Punctal plugs are not expected to be effective because of very little residual tears. Clear lens extraction or phakic intraocular lens may alternatively be indicated for these patients. We decided that LASIK was indicated for our patients, who were not diagnosed with absolute dry eye, because ocular surface damage was improved with punctal plugs. Thus, it is imperative that dry eye treatment with autologous serum and punctal plugs be commenced before surgery; LASIK should not be performed until the ocular surface damage is greatly reduced.

Although we report only three cases, our results suggest that LASIK can be safely and effectively performed in severe dry eye patients associated with Sjögren's syndrome when extensive preoperative and postoperative dry eye management by a combination of autologous serum eye drops and punctal plugs is performed. However, careful attention must be paid to preoperative dry eye status and treatment compliance of the patients when patient selection is made. LASIK should be scheduled only after the ocular surface findings have sufficiently improved. Patients should be educated to use autologous serum eye drops every 2 hours at least for 3 months postoperatively, when dry eye is expected to worsen from LASIK. Thorough informed consent concerning possible complications of LASIK in patients with severe dry eye should be obtained. Careful assessment of preoperative and postoperative ocular surface status is mandatory. Also, it may be appropriate to inform these patients that clear lens extraction or phakic intraocular lens may be an alternative procedure to correct refractive errors.

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