Nd:YAG laser in the treatment of recurrent interface epithelial ingrowth after laser in situ keratomileusis

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Abstract

Purpose: To report a case of recurrent interface epithelial ingrowth after laser in situ keratomileusis (LASIK) treated with Nd:YAG laser.

Method: A 59-year-old female presented to our service with blurred vision in both eyes (OU), for the preceding 6 months. She had a history of LASIK OU 12 years prior in 1998, with enhancements OU 6 months after primary surgery. In addition, she had a history of surgical intervention for epithelial ingrowth twice in each eye in 2008. She was diagnosed with significant interface epithelial ingrowth in the left eye. All potential options were discussed in detail with the patient. After consideration, she underwent 3 sessions of Nd:YAG laser treatments in the left eye.

Results: The patient was followed up for 2 years after the treatment with Nd:YAG laser in the left eye. Slit lamp biomicroscopy revealed elimination of the epithelial ingrowth.

Conclusion: Epithelial ingrowth after LASIK is not a rare complication in a referral cornea practice. Nd:YAG laser should be considered as a potential, minimally invasive therapeutic option to treat interface epithelial ingrowth after LASIK.

Keywords: LASIK, epithelial ingrowth, laser in situ keratomileusis, complications, Nd:YAG laser.

No author has a financial or proprietary interest in any material or method mentioned.

Uso del láser Nd:YAG para el tratamiento del crecimiento epitelial recurrente en la interfase luego de la queratomileusis *in situ* con láser

Resumen

Objetivo: Descripción de un caso de crecimiento epitelial recurrente en la interfase luego del procedimiento de queratomileusis *in situ* con láser (LASIK, por sus siglas en inglés) tratado con láser Nd:YAG.

Método: Paciente de 59 años de edad de sexo femenino atendida en nuestro servicio que se presentó con visión borrosa de seis meses de evolución en ambos ojos (AO). Sus antecedentes fueron: LASIK en AO 12 años antes en 1998, con retoques en AO 6 meses luego de la primera cirugía. Además, la paciente se sometió a dos intervenciones para el tratamiento de su crecimiento epitelial en cada ojo en 2008. El diagnóstico fue crecimiento epitelial significativo en la interfase en el ojo izquierdo. Se le explicaron todas las opciones potenciales en detalle y luego de considerarlas, se le realizaron tres sesiones de láser Nd:Yag en el ojo izquierdo.

Resultados: La paciente tuvo un seguimiento de 2 años posteriores al tratamiento con láser Nd:Yag del ojo izquierdo. En el examen biomicroscópico con lámpara de hendidura se comprobó la eliminación del crecimiento epitelial.

Conclusión: El crecimiento epitelial posterior a la cirugía LASIK es bastante común en los consultorios especializados en córnea. El procedimiento con láser Nd:Yag debería ser considerado una opción terapéutica mínimamente invasiva para el tratamiento del crecimiento epitelial de la interfase luego del LASIK.

Palabras clave: LASIK, crecimiento epitelial, queratomileusis *in situ* con láser, complicaciones, láser Nd:Yag.

Uso do laser Nd: YAG para o tratamento do crescimento epitelial recorrente na interfase logo da ceratomileusis *in situ* com laser

Resumo

Objetivo: Descrição de um caso de crescimento epitelial recorrente na interfase logo do procedimento de **ceratomileusis** *in situ* com laser (LASIK, pelas suas siglas em inglês) tratado com laser Nd: YAG.

Método: Paciente de 59 anos de idade de sexo feminino atendida em nosso serviço, quem se apresentou com visão turva de seis meses de evolução em ambos os olhos (AO). Seus antecedentes foram: LASIK em AO, 12 anos antes, no ano 1998, com retoques em AO 6 meses depois da primeira cirurgia. Além disso, a paciente foi submetida a duas intervenções para o tratamento do crescimento epitelial em cada um dos olhos no ano 2008. O diagnóstico foi crescimento epitelial significativo na interfase no olho esquerdo. Foram explicadas para a paciente todas as potenciais opções em detalhe e, logo de considerar todas elas, se realizaram três sessões de laser Nd:Yag no olho esquerdo.

Resultados: A paciente teve um seguimento de dois anos depois do tratamento com laser Nd:Yag do olho esquerdo. No exame biomicroscópio com lâmpada de fenda se comprovou a eliminação do crescimento epitelial.

Conclusão: O crescimento epitelial posterior á cirurgia LASIK é bastante comum nos consultórios especializados em córnea. O procedimento com laser Nd:Yag deveria ser considerado como uma opção terapêutica minimamente invasiva para o tratamento do crescimento epitelial da interfase logo do LASIK.

Palavras chave: LASIK, crescimento epitelial, *ceratomileusis in situ* com laser, complicações, laser Nd:Yag.

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Introduction

Rapid visual recovery and minimal postoperative discomfort after laser-assisted in situ keratomileusis (LASIK) have popularized the procedure among corneal refractive surgeries in last two decades. LASIK's advantage over other corneal refractive procedures such as surface ablation are due to the flap, but the flap is occasionally associated with intraoperative problems like buttonhole, shredded flap, partial flap, free cap, thin flap and postoperative issues such as flap dislocation and epithelial ingrowth.

Epithelial ingrowth is an important complication after LASIK and depending on severity is associated with decreased visual acuity due to irregular astigmatism, scarring and even flap necrosis[1]. Treatment of epithelial ingrowth is often based on severity as proposed by Probst and Matchat[2]. There are a variety of methods to manage epithelial ingrowth including observation[1, 3], flap lift and scrape[4], adjuvant methods with sutures or tissue glue for proper apposition of the flap[5], alcohol for destroying the epithelial cells[6, 28, 29], excimer laser phototherapeutic keratectomy[7], amniotic membrane as a pressure patch[8], and most

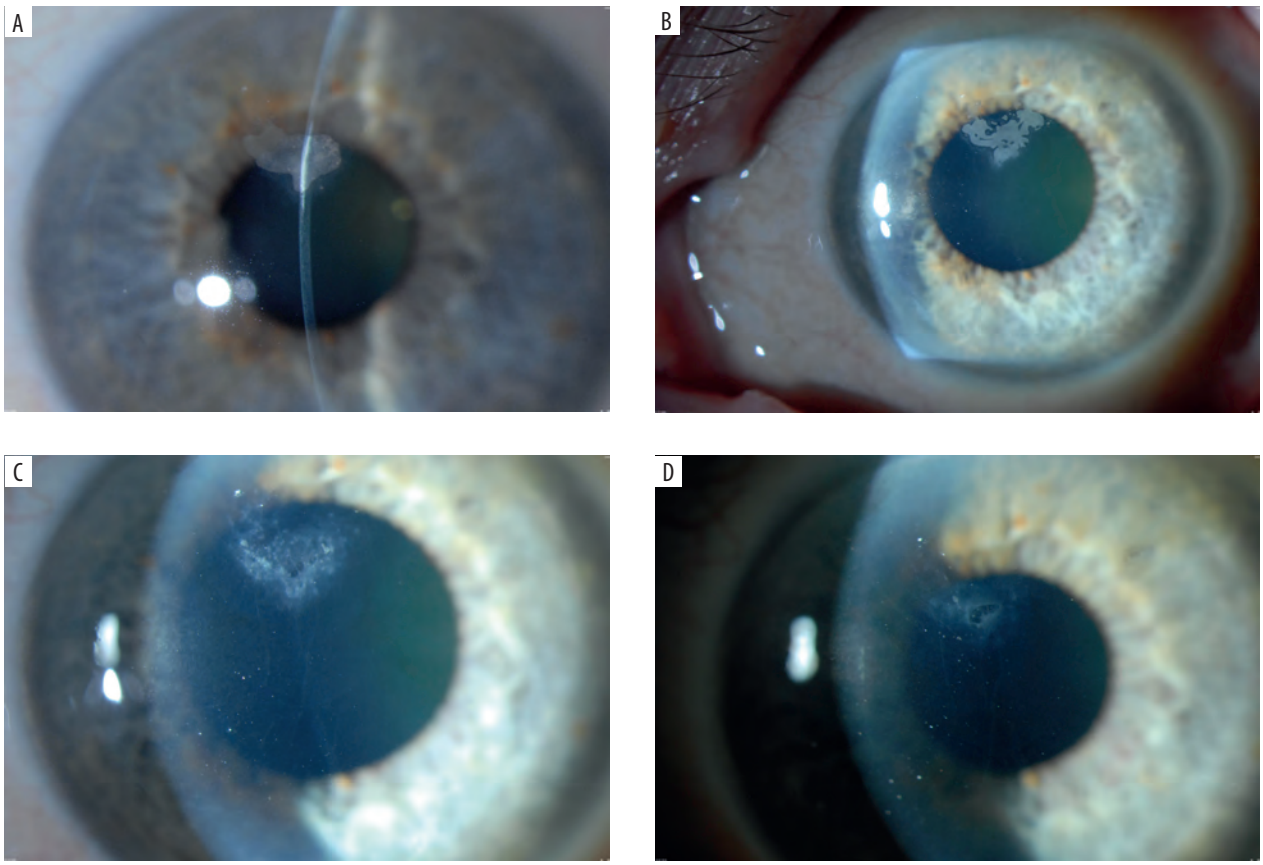

Figure 1. Slit-lamp photograph, OS a) Slit view demonstrating epithelial ingrowth at the interface. b) demonstrating epithelial ingrowth with well defined borders at 1 month after 1st session of Nd:YAG laser treatment. c) demonstrating epithelial ingrowth with decreased density and size at 1 month after 2nd session of Nd:YAG laser treatment. d) 2 years after Nd:YAG laser treatment demonstrating minimal scarring in the interface at the site of previous epithelial ingrowth.

recently Neodymium:Yytrium–Aluminum– garnet (Nd:YAG) laser treatment[9].

The Nd:YAG laser (wavelength -1064 nm) produces short individual pulses of focused infrared light. The effect of Nd:YAG laser is by a nonlinear absorption process that causes plasma formation by strong heating, generation of cavitation bubbles and acoustic transients. The energy contained within a single short pulse results in plasma formation giving rise to small vacuoles that join together to produce large vacuole. This creates an acoustic wave that disrupts nearby tissue[10-12].

We describe a case of successful management of recurrent epithelial ingrowth using Nd:YAG laser.

Case report

A 59-year-old female with a systemic history of diabetes type 2 was referred to the Wills Cornea Service with the chief complaint of decreased vision in both eyes, the left being worse than the right. She underwent LASIK at another institution 12 years prior to the visit, in 1998. Flap lift enhancements were done in both eyes (OU) 6

months after the primary surgery, and epithelial ingrowth removal was performed twice in each eye between 3 and 6 months before her visit at Wills in 2008. There were no details of the previous surgeries, but the patient's records revealed that when the LASIK flap of left eye (OS) was lifted for removal of epithelial ingrowth, it came off completely (free cap) during the surgery. It was replaced and covered with a bandage soft contact lens.

On presentation to our Service, the uncorrected visual acuity (UCVA) was 20/40 in the right eye (OD) and 20/30 in the OS. On examination the patient had dry eyes with silicone plugs in OU in all four puncta. In OS, there was significant epithelial ingrowth superiorly encroaching on the visual axis (fig. 1a). There was also a small degree of epithelial ingrowth noted peripherally at 1 and 9 o'clock in the OD. She had grade I nuclear sclerosis in OU. The topography showed mild irregular astigmatism in the OS (fig. 3). As her vision was fairly good, the ingrowth was paracentral, she had undergone 2 previous unsuccessful manual removals of the epithelial ingrowth and had a history of a free LASIK cap, the advantages and disadvantages of attempting to treat the epithelial ingrowth in OS with a Nd:YAG laser were discussed in detail with the patient, who agreed to proceed.

After topical anesthesia, an Abraham YAG capsulotomy contact lens was placed on the left eye. Using the slit lamp mounted Nd:YAG laser (Coherent Medical Group, Taracan Pty Ltd, Adelaide, S.A 5000) laser shots were focused on the epithelial ingrowth, starting in the center of the area of epithelial ingrowth. The power was adjusted to the minimal amount to form bubbles (average 0.7 mJ) (fig. 2). At the margin of each bubble, new spots of laser were shot until the entire area of the epithelial ingrowth was treated.

Three sessions of Nd:YAG laser were performed at approximately 1 month intervals between each in the OS. Approximately 25 laser spots were performed at each session. After each treatment prednisolone acetate 1% was used four times per day for one week, twice a day for one week, once a day for one week, and then stopped. After each session of Nd:YAG laser treatment there was decrease in size of the epithelial ingrowth and the borders became well defined (figs. 1b, 1c). After the third session of Nd:YAG laser treatment, the epithelial ingrowth almost completely disappeared. At 2 years after Nd:YAG laser treatment the BSCVA was 20/30 (-2.25+1.75Dx160º) OS. Slit lamp biomicroscopy showed no evidence of epithelial ingrowth but only minimal scarring in the area of previous epithelial ingrowth (fig. 1d). Corneal topography (Atlas System, model 995, Carl Zeiss Meditec, Dublin, CA). Before and at 2 months after 3rd session of Nd:YAG laser treatment were 40.75D, 38.87D and 40.62D, 40.00D respectively showing a mild change in astigmatism (fig. 3a, 3b).

Discussion

Some degreee of epithelial ingrowth is seen in 90% of cases within first 2 months after LASIK[13]. The incidence of epithelial ingrowth varies from 0-20%[14-17] but can be as high as 32% in cases of enhancements[18]. Chan *et al* have shown that the high incidence of epithelial ingrowth in enhancements may be due to trauma caused while lifting or manipulating the flap[19]. Epithelial ingrowth occurs as a result of direct implantation of epithelial cells during surgery or postoperative migration of surface epithelial cells under the edge of the flap[20].

Several risk factors have been reported that may lead to the development of epithelial ingrowth. These include epithelial basement membrane dystrophy, previous epithelial ingrowth in the fellow eye, hyperopic LASIK correction, flap instability, intraoperative epithelial defects, recurrent corneal erosions, diabetes mellitus with epithelial keratopathy, decentered flaps, trauma, increasing age, the surgeon's experience, the use of bandage contact lens during enhancements, the type of excimer laser system, and a thinner LASIK flap[9, 13, 19-25].

Clinically, epithelial ingrowth may present as epithelial pearls in the interface, a sheet of confluent opacity, a fibrotic demarcation line or melting of the flap[26-27]. Epithelial ingrowth is usually treated based on clinical severity. Treatment is advocated in cases where ingrowth has approached

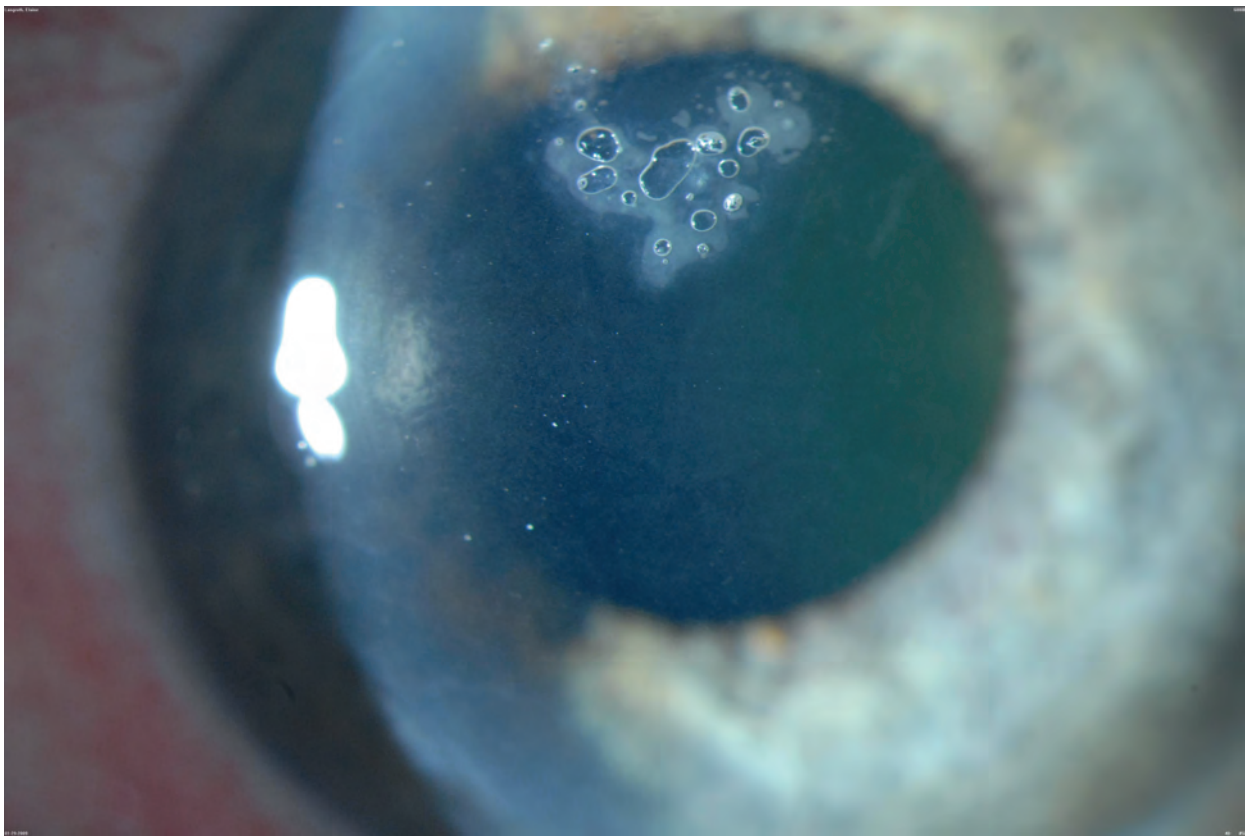

Figure 2. Slit-lamp photograph, OS demonstrating epithelial ingrowth in the pattern of a map, bubbles can be seen in the interface immediately after 1st session of Nd:YAG laser treatment.

greater than 1-2 mm from the flap edge, presence of visual symptoms from irregular astigmatism, thickening of the flap, flap melting or erosion due to epithelial ingrowth. Initially epithelial ingrowth was treated by lifting the flap and scraping the bed and the posterior surface of the flap but it was associated with clinical significant recurrence in 23% of cases [include my paper, ref 1, here and give a range of success rates][13]. Later adjuvant treatment like 50% ethanol and 70% isopropyl alcohol were used but were associated with recurrence, diffuse lamellar keratitis or melting of the flap[6, 28-29]. Rojas *et al*[15] and Narvaez *et al*[5] have tried combination treatment by lifting the flap, scraping the bed, flap and then either suturing the flap or application of fibrin glue with good success. Excimer laser PTK was used by Fagerholm *et al* to treat primary as well as recurrent epithelial ingrowth with good success except for development of cystic ingrowth which required surgical intervention[7].

Ayala MJ *et al* reported treating thirty eyes with Nd: YAG laser for clinically significant epithelial ingrowth after LASIK[9]. It was noted that the opacities caused by the epithelial ingrowth disappeared in eighty percent of the cases with the Nd:YAG laser treatment. In forty percent of the cases, two or more sessions of Nd:YAG laser treatment were necessary to eliminate the epithelial ingrowth areas entirely. In sixty percent of the cases, visual acuity improved by one or more lines of vision and the treatment, symptoms such as glare and halos improved in all cases. The intensity of the laser treatment was adjusted in each case and was focused on the epithelial ingrowth areas. There were no complications reported.

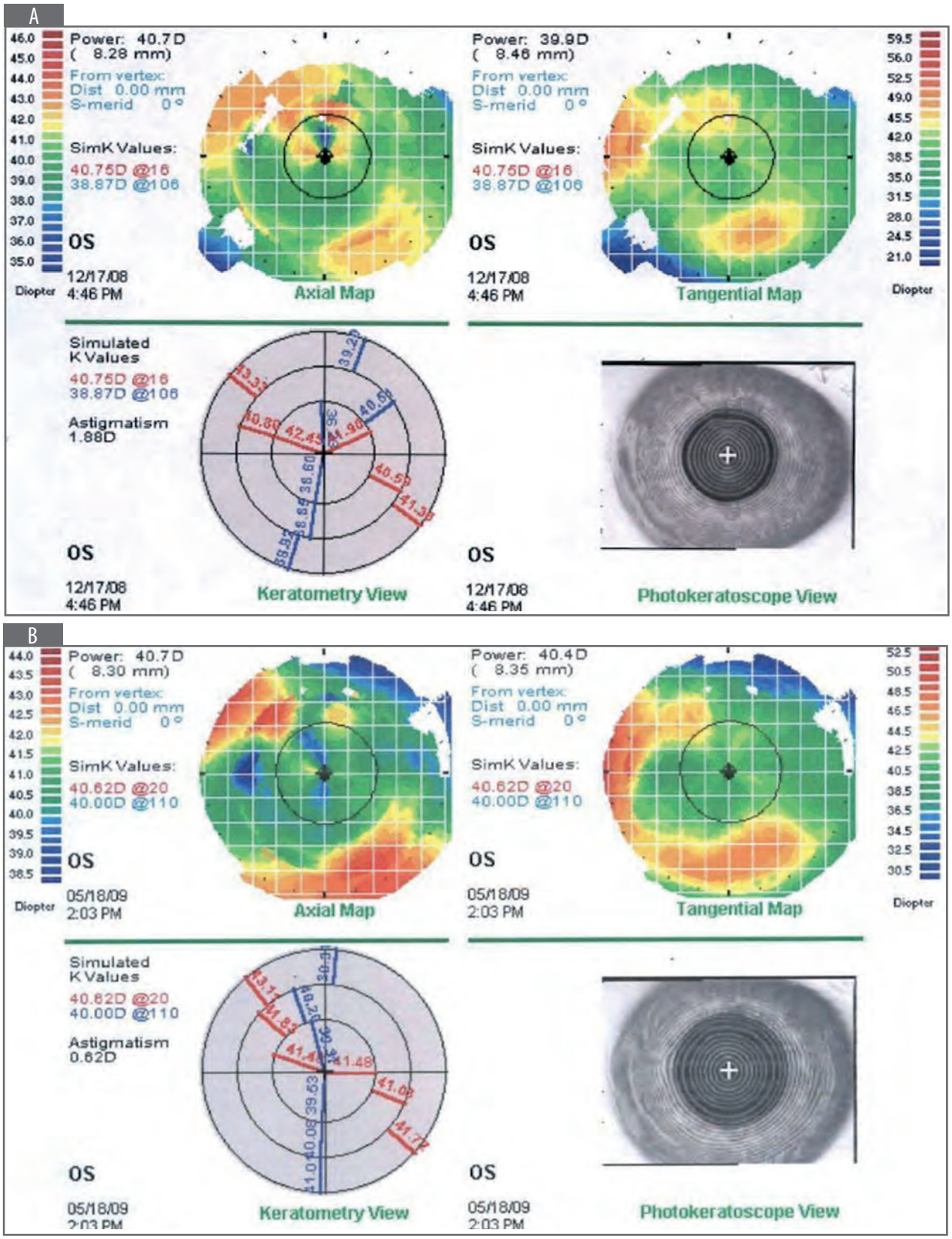

Figure 3. Corneal topography at presentation (a) and at 2 months after 3rd session of Nd:YAG laser treatment (b).

The primary surgical mechanism of Nd: YAG laser is tissue evaporation by the laser plasma, whereas the collateral damage from single laser pulses is mainly caused by the cavitation and jet formation. The damage range after a 4-mJ laser pulse is 0.8 mm which is slightly larger than the corresponding cavitation bubble radius[30]. The amount of laser used for removal of ingrowth is very less and hence there is less chance for the occurrence of any complications due to Nd: YAG laser.

Keeping in mind our previous experience, published literature and the patient having recurrent epithelial ingrowth and a free cap in OS, we decided not to lift the flap and used Nd:YAG laser treatment due to its non-invasive nature. In our case, the epithelial ingrowth resolved and the vision remained stable. The treatment of epithelial ingrowth with Nd:YAG laser is a straightforward technique, which was well tolerated by the patient. However, as in this case multiple treatments may be required.

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