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Significant peripheral anterior synechiae after repeat selective laser trabeculoplasty

There has been renewed interest in laser trabeculoplasty since the introduction of selective laser trabeculoplasty (SLT).[1,2] Latina and Park[3] showed that SLT targets pigmented trabecular meshwork cells and avoids collateral damage to adjacent nonpigmented cells, unlike argon laser trabeculoplasty (ALT), which causes coagulative damage to the trabecular meshwork.[4,5] SLT is considered safe with a minor risk for transient adverse events, most commonly seen as mild anterior uveitis, conjunctival hyperemia, and transient intraocular pressure (IOP) spike.[1,2,6] In this article, we report 2 cases who developed significant peripheral anterior synechiae (PAS) after repeat SLT.

Case 1

A 57-year-old male has been followed up in our glaucoma clinic with the diagnosis of primary open-angle glaucoma (POAG). Slit-lamp examination was bilaterally normal. Fundus examination revealed cup/disc ratio as 7/10 OD and 9/10 OS. IOP was 19 mm Hg with timolol-dorzolamide fixed combination (TDFC) and latanoprost eye drops OD, and 18 mmHg with TDFC, brimonidine, and latanoprost eye drops OS. To achieve a lower IOP, the left eye was treated with 360° SLT (120 pulses, 103 mJ). During this initial SLT the surgeon had recorded that the angle was Schaffer grade 3 with moderate pigmentation, with no synechiae. After the SLT, IOP was stable around 12 mm Hg with TDFC and latanoprost eye drops. Three years later, the initial SLT failed and IOP increased to 20 mm Hg OS with the same medications. It was decided to perform a 180° repeat SLT to the left eye. The repeat SLT (48 pulses, 40 mJ) was performed by the surgeon who had performed the initial SLT. The surgeon did not notice any previous PAS during the repeat procedure. IOP, anterior chamber reaction, and corneal appearance were checked 1 hour, 1 day, 1 week, and 1 month postoperatively; no significant IOP spike and significant inflammatory reaction or corneal finding was observed during these examinations. Three months later, IOP was 15 mm Hg in the left eye. Interestingly, slit-lamp examination revealed that the pupil was slightly distorted and showed mild peaking (Fig. 1). Gonioscopic examination showed a large area of PAS at the temporal site. The PAS was inserted slightly anterior to Schwalbe's line (Fig. 2). After 2.5 years of follow-up, the extent of PAS remained stable with no further sequelae and IOP was 15 mm Hg with the same topical medications. Specular microscopy showed similar endothelial cell density, pachymetry, coefficient of variation (CV), and hexagonality in

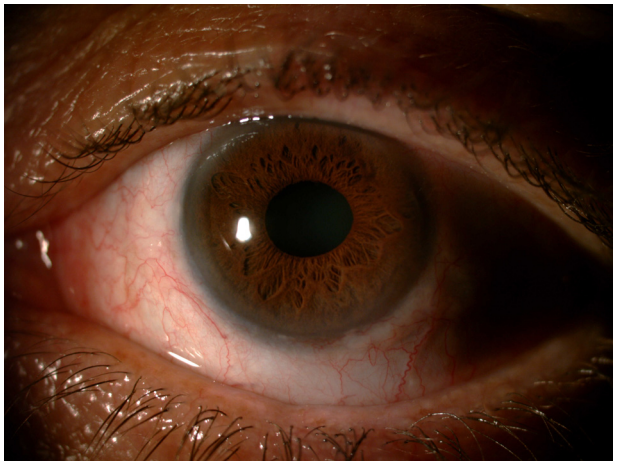

Fig. 1—Mild peaking of the pupil 3 months after repeat selective laser trabeculoplasty.

Fig. 2—Gonioscopic view of significant peripheral anterior synechiae occurring after repeat selective laser trabeculoplasty.

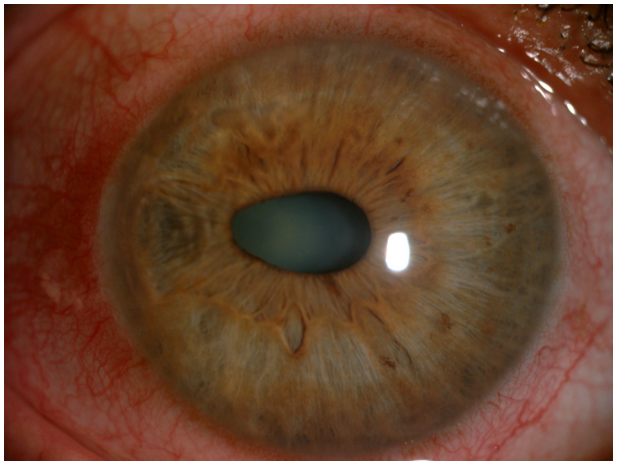

Fig. 3—Irregularity of the pupil 6 months after repeat selective laser trabeculoplasty.

both eyes; polymegathism and pleomorphism were slightly high in both eyes.

Case 2

A 62-year-old male with the diagnosis of POAG has been followed up in our glaucoma clinic. Slit-lamp examination was normal and IOP was bilaterally 24 mm Hg with TDFC and latanoprost. On fundus examination, cup/disc ratio was 8/10 for both eyes. Because the IOP was not lowered sufficiently, it was decided to perform bilateral 360° SLT (112 and 120 pulses, 118 mJ and 135 mJ OD and OS, respectively). After the first SLT the IOP was lowered to 18 mm Hg with the same medications. Four years after the first SLT the patient's visual field showed progressive worsening. Both eyes were treated with 180° repeat SLT (59 pulses, 58 mJ OD, 54 pulses, 51 mJ OS). During the repeat procedure, the surgeon did not note any PAS. IOP, anterior chamber, and corneal appearance were checked 1 hour, 1 day, 1 week, 1 month, and 3 months postoperatively, and there was no asymmetry in postoperative course between the eyes. Six months after the repeat SLT, the patient's IOP was 18 mm Hg in both eyes. However, slit-lamp examination revealed prominent irregularity of the pupil OD (Fig. 3). On gonioscopic examination, broad areas of PAS, located anteriorly to Schwalbe's line, were seen in the quadrant treated with repeat SLT (Fig. 4). Gonioscopy of the other eye was unremarkable. After 2 years of follow-up, IOP control was sufficient and the extent of PAS has remained stable with no further sequelae. Specular microscopy findings did not display any significant differences between the eye with PAS and the fellow eye. Both eyes had slightly high polymegathism and pleomorphism.

Discussion

SLT uses a Q-switched, 532-nm frequency doubled Nd:YAG laser with very short pulses, and targets the melanin content of trabecular cells. Its short pulse duration is less than the thermal relaxation time of the tissue. Therefore, there is no collateral thermal injury in nonpigmented nearby structures and tissues, and no scar formation occurs at the trabecular meshwork.[3] Unlike ALT, SLT has the theoretical advantage of being more repeatable because it uses about 100 times less energy than ALT and causes minimal damage to the trabecular meshwork with no subsequent contractile laser scars.[7–9]

SLT is considered a low-risk procedure. The most frequent adverse effects are transient IOP spike, mild anterior chamber inflammation, photophobia, and conjunctival hyperemia.[1,2,6] PAS is a well-known complication of laser trabeculoplasty in general. The rate of PAS may reach 12% to 47% after ALT,[10,11] whereas it is much less seen after SLT, with an incidence rate of 0% to 2.86% as reported in a recent meta-analysis.[1]

To date, only 2 studies reported the results of repeat SLT after failed SLT; none of these studies reported PAS.[7,8] To our knowledge, this is the first report to demonstrate PAS as a late complication of repeat SLT. Both of our patients had undergone successful and uneventful SLT 3 and 4 years ago by the same surgeon performing the repeat SLT. PAS was not noticed during the repeat SLT procedures and was detected only after 3 to 6 months.

We could not elucidate why PAS occurred in our patients. After ALT, higher PAS formation was noted in those eyes treated posteriorly and receiving higher levels of laser power.[10,11] We had not used excessive number of shots or high energy levels in our patients, which were in compliance with other authors' practice.[1,2,5–8] However, SLT uses a large spot diameter (400 μm) compared with ALT (50 μm), which is large enough to irradiate the entire anterior-posterior height of the trabecular meshwork. This large spot could catch some of the peripheral iris/ciliary body and induce angle inflammation leading to PAS. In addition, SLT can cause keratopathy via unknown

Fig. 4—Large sheets of peripheral anterior synechiae occurring after repeat selective laser trabeculoplasty.

mechanisms, and perhaps this can lead to PAS in some patients.[12,13] However, we do not think that PAS developed because of keratopathy in our patients, because they had uneventful postoperative course regarding anterior chamber reaction, corneal findings, and IOP. Also, specular microscopy findings did not display significant differences between the eyes with PAS and the fellow eyes. Therefore, undetermined personal factors may have been present.

The differential diagnosis of broad and anteriorly located PAS includes iridocorneal endothelial (ICE) syndrome, epithelial downgrowth, trauma, neovascular glaucoma, and less likely inherited conditions such as Axenfeld–Rieger syndrome (ARS). ICE syndrome typically manifests in early adulthood where abnormal corneal endothelial cells proliferate onto iris surface with subsequent contractile membranes resulting in iris atrophy, corectopia, and polycoria.[14] Our patients did not have iris atrophy, polycoria, and typical corneal endothelial abnormalities on specular microscopy. Unlike our patients, ARS is a bilateral condition with developmental abnormalities such as corectopia, polycoria, ectropion uvea, and posterior embryotoxon.[14] The fact that PAS did not progress and remained unchanged after 2 years argues against ongoing evolving diseases such as ICE. In addition, the fact that our patients did not have ectropion uvea makes "contractile membrane" mechanism less likely. Thus, the unilateral PAS that developed after SLT makes inherited conditions unlikely. Neovascular glaucoma was also excluded because our patients did not have neovascularization of the iris/angle and findings related with ischemic retinal diseases. Also, PAS in our patients could not be related with epithelial downgrowth or trauma because our patients had no eye trauma or previous eye surgery.

In our patients, it is also noteworthy that the eyes with PAS were not significantly different from their fellow eyes on specular microscopy. However, both eyes of our patients had slightly increased CV and decreased hexagonality. This might be explained by the fact that these patients were using multiple medications with benzalkonium chloride (BAK) for more than 10 years. Chronic exposure to BAK may be toxic to endothelial cells.[15]

In the cases we presented, significant areas of PAS after repeat SLT were noticeable on slit-lamp biomicroscopy. Fortunately, PAS did not progress in both cases and had no detrimental effect on IOP control. Even though the condition seems innocuous in our patients, large sheets of PAS can possibly lead to increase in IOP in the future and compromise anterior segment surgical procedures. In conclusion, significant areas of PAS can develop after application of SLT to the same angle site (repeat SLT). Surgeons should be aware of this rare complication.

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