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Myopic Shift Following Selective Laser Trabeculoplasty: A Case Report

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Authors' contributions

This work was carried out in collaboration between all authors. Authors JS examined the patient before and after treatment. Authors AS, TP, and MS performed the literature search. All authors read and approved the final manuscript.

Case Study

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ABSTRACT

Introduction: Selective laser trabeculoplasty (SLT) (Lumenis, Santa Clara, CA) was developed in 1999 as a means to lower IOP in patients with glaucoma. It is a relatively safe procedure. We report a rare side effect of anterior chamber shallowing with myopic following SLT.
Case Presentation: A 48 year-old white female who underwent SLT OD developed a 4-diopter myopic shift and anterior chamber shallowing 1 week following SLT. Both the anterior chamber shallowing and the myopic shift resolved within 5 weeks.
Conclusion: Anterior chamber shallowing and myopic shift following SLT is a rare side effect but is reversible. Physicians and patients should be aware of this potential side effect of SLT.

Keywords: Selective laser trabeculoplasty; side effect; myopic shift; glaucoma.

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1. INTRODUCTION

Selective laser trabeculoplasty (SLT) (Lumenis, Santa Clara, CA) was developed in 1999 as a means to lower IOP in patients with glaucoma [1]. It was purported to be a gentler more gentle laser than argon laser trabeculoplasty (ALT) with no minimal histologic scarring or coagulative damage to the trabecular meshwork [2] because it selectively targets the pigmented trabecular meshwork cells, thus reducing collateral damage to surrounding tissues and incidence of iritis and elevated IOP compared to ALT [3]. The thermal relaxation time of SLT is less than that of melanin, which allows for the selective targeting of only the pigmented cells. SLT did not induce inflammation with 90º treatment [4]. Although studies [5-7] have demonstrated various efficacies depending the amount of trabecular meshwork treated, the efficacy of SLT generally has ranged from 40-70%. Several studies [8,9] have demonstrated that SLT and ALT have similar efficacies. Due to minimal side effects, quick recovery, and relative ease of the procedure, SLT remains a good method to lower IOP, either as adjunct therapy or as primary therapy [10,11].

The mechanism of SLT is not entirely known. The mechanism involves the recruitment of macrophages from the spleen to the trabecular meshwork [12,13]. The side effect of SLT are minimal, and has been demonstrated to be safe in pediatric glaucoma patients [14]. The most common side effects include pain, inflammation, and elevated IOP [14,15]. There have been several case reports of rare but serious side effects, including elevated IOP, [16] corneal edema, [17,18] diffuse lamellar keratitis, [19,20] hyphema, [20,21] hyperopic shift, 20 and choroidal effusion [21]. Our report describes anterior chamber shallowing with a myopic shift following SLT in a previously healthy patient.

2. CASE PRESENTATION

Our patient was a 48 yo year-old white caucasian female who was diagnosed with juvenile open-angle glaucoma at age 20 years. She had previous undergone ALT in both eyes with minimal success. She underwent trabeculectomy with mitomycin-C in the left eye in 1994, at age 27 years and had done well. Her right eye was prescribed 4 four topical glaucoma medications: Dorzolamide-timolol, brimonidine, and latanoprost.

Preoperatively, the patient's visual acuity with correction was OD: 20/30 pinhole no improvement and OS: 20/20. Her preoperative refraction was OD:-7.25-0.75x124 and OS:-5.75-2.25x44. Her preoperative IOPs were 23 mmHg OD on 4 four topical medications and 13 mmHg OS without medications. Slit lamp examination revealed an avascular trabeculectomy bleb in the left eye, deep and quiet anterior chambers in both eyes, and early cataracts in both eyes. Gonioscopy revealed open anterior chambers angles to grade 4 with rare pigment. Dilated examination revealed 0.9 optic nerve cupping in both eyes, with normal vessels, maculae, and periphery. Her preoperative central corneal thicknesses (CCTs) 508 and 505 µms, respectively, by ultrasound pachymetry. Visual field testing revealed an early inferonasal defect in the right eye and a superior arcuate defect and early inferonasal defect in the left eye.

The patient was stable for the next few months. However, it was noted that her intraocular pressures IOP in the right eye fluctuated from 12.5 mmHg to 19 mmHg in the next few months. A repeat visual field test revealed worsening visual field defects in that eye. After discussing the available treatment options with her, she elected to undergo SLT in the right eye in lieu of incisional surgery. The settings included a burst energy of 0.8 mJ 360º for a

total of 102 spots. Postoperatively, her IOP was 14 mmHg 30 minutes following the procedure.

One week later, the patient reported foggy vision and photosensitivity. On examination, her visual acuity in the right eye with correction was 20/40 pinhole 20/20. Her refraction in the right eye was -11. 00 -0.75 x 135 (20/30-2), a 4 3.75 diopter myopic shift. Her intraocular pressure IOP was 15 mmHg. The anterior chamber was deep, but and and there was rare cell and flare in the anterior chamber. Fundus examination revealed no vitreous cell or macular edema. CCTs were unchanged. Three weeks after SLT, her refraction was unchanged. Her intraocular pressures IOPs were 15 mmHg in the right eye and 12 mmHg in the left eye. A-scan ultrasound revealed axial lengths of 26.4 mm in the right eye and 26.0 mm in the left eye. Her anterior chamber depths were 3.24 mm in her right eye (0.15 mm shallower compared to her left eye) and 3.39 mm in her left eye. Her lens thicknesses were symmetrical at 4.20 mm and 4.23 mm, respectively.

Five weeks following SLT of her right eye, her refraction normalized back to baseline. Her intraocular pressures IOPs were 17 mmHg in her right eye and 13 mmHg in her left eye. Her anterior chamber depth deepened 0.22 mm back to baseline at 3.46 mm (from 3.24 mm following SLT); her axial lengths and lens thickness remained unchanged at 26.4 mm and 4.20 mm, respectively.

3. DISCUSSION

Although SLT is a relatively safe procedure, there is an increasing number of reported side effects, including elevated IOP, [16] corneal edema, [17,18] diffuse lamellar keratitis, [19,20] hyphema, [20,21] and choroidal effusion [22]. To date, including our patient, there are 7 reported cases of SLT-induced keratitis keratopathy with a hyperopic refractive shift [18-20, 23]. Our patient is the first reported case of a myopic shift and documented shallowing of the anterior chamber.

SLT purportedly stimulates cytokine production from the trabecular meshwork. These cytokines include interleukin-alpha (IL-1α), interleukin-1 beta (IL-1β), and tumor necrosis factor-alpha (TNF-α) [24,25]. The result is recruitment of macrophages from the spleen that phagocytose debris in the trabecular meshwork extracellular matrix. In addition, there is an increase in lipid peroxidase and a decrease in free radical scavenging superoxide dismutase and glutathione S transferase in aqueous fluid, suggesting free oxygen radical formation that may account for the postoperative inflammation [24]. Wood, et al. [26] demonstrated that SLT causes trabecular meshwork cell death. Other laser treatments (such as diode laser cyclophotocoagulation) have been found to increase central corneal thickness, [27] which may represent corneal endothelial decompensation. A comparison of SLT and ALT found that inflammation was greater in SLT patients (possibly due to the greater spot side), which could affect a larger surface area of tissue (the ciliary body and the iris root), thus possibly accounting for the spread of inflammation to the cornea in our patient.

Aykan et al. [28] reported increased ciliary body and iris thicknesses within the first month of treatment. This is in line with the increased inflammation seen with SLT compared to ALT. Following ALT, the greatest inflammatory response was 48 hours post-treatment, implying that the trabecular meshwork can synthesize prostaglandins that act as mediators of inflammation. Interestingly, the thickest area of the ciliary body was in the superior quadrant, away from the area treated (inferior angle), implying that the SLT's biologic response affected areas not directly irradiated by SLT. The swelling of the ciliary body and its resultant

anterior rotation could account for the 0.22 mm shallowing in her anterior chamber and resultant 4-diopter myopic shift in her refraction.

Hong et al. [29] demonstrated that cytokines IL-1 and TNF-α activate monocytes, chemotactic and activating factor (MCAF) and granulocyte colony-stimulating factor (G-CSF). Patients taking bimatoprost have significantly higher levels of IL-1β and TNF-α in their tears [30]. Our patient was taking a topical prostaglandin (latanoprost) at the time of her SLT treatment, which may have contributed to more inflammation.

More studies are needed to identify those patients at high risk of developing side effects from SLT. Patients with identifiable risk factors can be counseled about the potential for side effects.

4. CONCLUSIONS

Although SLT is relatively safe and efficacious, the side effect of anterior chamber shallowing and myopic shift due to ciliary body swelling is a possible side effect. Physicians and patients should be aware of this reversible, though significant, side effect.

CONSENT

Written informed consent was obtained from the patient for publication of this case report and any of accompanying images.

ETHICAL APPROVAL

The ethical approval section was not applicable in this manuscript.

COMPETING INTERESTS

The authors declare that they have no competing interests.

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