Choroidal Thickness Changes After Argon Laser Trabeculoplasty in Patients With Pseudoexfoliative Glaucoma

Psödoeksfolyatif Glokomlu Hastalarda Argon Lazer Trabeküloplasti Sonrası Koroid Kalınlığı Değişimi

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ABSTRACT

Aims: The purpose of this study was to evaluate changes in choroidal thickness (CT) in patients with pseudoexfoliative glaucoma (PXG) after argon laser trabeculoplasty (ALT).

Methods and Materials: This study included 55 eyes of 33 patients with PXG that required ALT. CT and intraocular pressure (IOP) were measured at three pm before and at one week, one month, three months after ALT. The CT was measured with optical coherence tomography (OCT) at the subfovea and 1500 µm temporal and nasal at the foveal center. The relationships between changes in CT and changes in IOP were explored. Friedman's ANOVA test, Wilcoxon test and Pearson's correlation coefficient were used to statistical analyses. P<0.05 values were considered statistically significant.

Results: Mean age was 69.4±7.9 years. While CT was significantly increasing at subfoveal and temporal locations, it significantly decreased at nasal location after ALT (P=.000). The mean IOP (± SD) decreased from 25.3 (± 3.1) mm Hg to 17.5 (± 2.3) mm Hg (with same antiglaucoma medications) at third month (P =.000). Changes in CT were not correlated with IOP changes.

Conclusions: While subfoveal and temporal localization of choroidal thickness were increasing, it decreased in nasal localization after ALT in PXG, but it was not related to decreasing IOP. We believe that further study is required.

Key words: Pseudoexfoliation, glaucoma, argon laser trabeculoplasty, optical coherence tomography.

ÖZ

Amaç: Psödoeksfolyatif glokomlu hastalarda argon lazer trabeküloplasti (ALT) sonrası koroid kalınlığı değişimini değerlendirmek.

Gereç ve yöntem: Psödoeksfolyatif glokom nedeni ile ALT uygulanan 33 hastanın 55 gözü çalışmaya dahil edildi. Koroid kalınlığı ve göziçi basıncı (GİB) ALT öncesi ve sonrasında 1. hafta, 1. ay ve 3. ay, öğleden sonra saat 3'te ölçüldü. Koroid kalınlığı optik koherens tomografi ile fovea merkezi altı ve fovea merkezinin 1500 mikron temporal ve nazalinden ölçüldü. Koroid kalınlığı ile GİB arasındaki ilişkiye de bakıldı. İstatiksel yöntem olarak Friedmann ANOVA, Wilcoxon ve pearson korelasyon testi kullanıldı. P< 0.05 olan değerler istatiksel olarak anlamlı kabul edildi.

Bulgular: Ortalama yaş 69.4 ± 7.9'du. Koroid kalınlığı ALT sonrası fovea merkezi altı ve fovea temporalinde anlamlı olarak artarken, fovea nazalinde anlamlı olarak azaldı (p=.000). Ortalama GİB 3. ay'da aynı glokom ilaçlarıyla 25.3 ± 3.1'ten 17.5 ± 2.3'e düştü (p=.000). Koroid kalınlığı değişimiyle GİB değişimi arasında bağlantı yoktu.

Sonuç: Psödoeksfolyatif glokomlu hastalarda ALT sonrası koroid kalınlığı fovea merkezi altında ve temporalinde artarken fovea nazalinde azalmaktadır ve bu değişim GİB düşmesinden bağımsızdır. Daha fazla çalışmaya ihtiyaç olduğunu düşünmekteyiz.

Anahtar kelimeler: Psödoeksfolyasyon, glokom, argon lazer trabeküloplasti, optik koherens tomografi.

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PXG is the most common secondary open-angle glaucoma, and is considered a disease of the elderly.[1] ALT has been used for the treatment of open-angle glaucoma since 1979.[2] For successful ALT, energy absorption by melanin within the trabecular meshwork plays an important role. Since eyes with PXG typically exhibit moderate to dense pigmentation in at least part of the trabecular meshwork, ALT can be considered in most cases.[3]

The changes in the choroidal thickness after ALT are not clear. We evaluated choroidal thickness changes in patients with PXG after ALT in this study.

SUBJECTS AND METHODS

This study was a prospective randomized clinical trial. This study included 55 eyes of 33 patients with PXG who had undergone ALT. This study was in accordance with the tenets of the Declaration of Helsinki. Illustrated consent forms were given to all participants and were explained and signed by all participants. Inclusion criteria were the diagnosis of PXG uncontrolled by medical therapy, clear media, and no history of other ocular disease. The PXG was diagnosed on the basis of clinical examination, retinal nerve fiber layer analyses by widefield en-face OCT, and visual field examination. Exclusion criteria included any history of retinal diseases, any systemic abnormalities (for example, vascular disease, hypertension, and diabetes mellitus), a history of previous intraocular surgery or laser therapy, and poor image quality because of unstable fixation or severe cataract.

The participants underwent ophthalmological examinations, including slit-lamp biomicroscopy, gonioscopy, Goldmann applanation tonometry, dilated funduscopy before and after ALT. The CT was measured by using widefield en-face OCT (Avanti, Optovue Inc., Fremont, CA) with enhanced depth-imaging (EDI) modality. The procedure for EDI-OCT measurement was described previously.[4] Subfoveal choroidal thickness (SFCT) was defined as the vertical distance from the hyperreflective line of Bruch's membrane to the hyperreflective line of the inner surface of the sclera. CT was measured at the fovea (SFCT), 1500 µm nasal to the fovea (N-CT), and 1500 µm temporal to the fovea (T-CT). One ophthalmologist (T.S.) took the images and one ophthalmologist (T.E.) assessed the images. All measurements were performed at 3 pm, before ALT and at one week, one month, three months after ALT. ALT was performed by using 532 nm green laser photocoagulator (Nıdek Inc, Fremont, CA). A 50 µm spot size was used to treatment at 180° of the junction of pigmented and nonpigmented trabecular meshwork with the pulse duration set at 0.1 seconds and an average power ranging from 350 to 600 mW directed through a Volk magna view lens (Volk Optical, Inc) to produce blanching or an occasional bubble formation in the anterior trabecular meshwork. Patients were given to instill dexamethasone 0.1% (Maxidex, Alcon, USA) in the treated eye three times a day for 7 days after treatment. Despite the attempt, the patients kept on the same glaucoma medications throughout the study.

The statistical analysis was performed using SPSS-16 (Statistical Package for the Social Sciences-16). The data were analyzed, using analysis of variance with the Friedmans ANOVA test. Wilcoxon test was used to compare each value. The relationships between the IOP and the choroidal thickness changes after ALT were evaluated by Pearson's correlation coefficient. P- value of less than 0.05 was considered statistically significant.

RESULTS

Demographic data of 33 patients (mean age, 69.4 ± 5.9 years; range, 62–80) were shown in Table 1. Mean choroidal thickness at the subfovea, 1500 µm nasal and temporal fovea after ALT were shown in Table 2. SFCT increased significantly after ALT (p=.000). N-CT decreased significantly after ALT (p=.000). T-CT increased significantly after ALT (p=.000). Correlation analyses between changes in SFCT and changes in IOP at one week, one month, three months after ALT were shown in Table 3. Changes in CT were not correlated with IOP changes.. Mean IOP changes after ALT were shown in Table 4. IOP decrease was not significantly observed at one week after ALT (p=.242). IOP significantly decreased at one month and three months after ALT (p=.000). CT values before ALT were shown in Figure 1. CT values at one week after ALT were shown in Figure 2. There wasn't observed IOP spike and choroidal detachment after ALT in follow-up time.

DISCUSSIONS

Wise and Witter were the first to describe the use of ALT for reducing IOP in glaucoma patients.[2] Many studies have shown the benefit of ALT either as the initial approach for PXG, or as an adjuvant to hypotensive medications.[5,6]

Previous studies have suggested that PXG causes significant thinning in the choroid. Eroglu et al recently reported that clinically affected eyes of patients with pseudoexfoliation syndrome (PXF) have significantly thinner choroids compared with the clinically unaffected eyes of patients with

Table 1. *Demographic data of the study*

Number of Eyes/Patients	55/33
female/male	17/16
Age (years, mean± SD)	69.4±7.9
Mean laser power (mW, mean±SD)	411.9±49.2

SD: standart deviation, mW: milliwatt.

Table 2: *Changes of SFCT, T-CT, N-CT before and after ALT.*

	SFCT (µm) mean±SD	p*	T-CT (µm) mean±SD	p*	N-CT (µm) mean±SD	p*
before ALT	240.4±31.5	-	211.7±29.9	-	187.2±25.9	-
One week after ALT	245.1±32.2	.000	215.6±27.5	.000	181.9±23.6	.000
One month after ALT	248.2±31.7	.000	216.7±26.7	.013	179.6±20.7	.001
Three months after ALT	248.9±31.3	.003 P** .000	217.3±26.4	.003 P** .000	177.7±20.1	.000 P** .000

ALT: Argon laser trabeculoplasty, SFCT: Subfoveal choroidal thickness, T-CT: Temporal choroidal thickness, N-CT: Nasal choroidal thickness, SD: Standart deviations, µm: micron, *Choroidal thickness changes were compared with Wilcoxon test between before-one week, one week-one month, one month-three months after ALT **The data were analyzed, using analysis of variance with the Friedmans ANOVA test.

Table 3: *Correlation analyses between changes in SFCT and changes in IOP at one week, one month, three months after ALT.*

	SFCT before ALT	SFCT at one week after ALT	SFCT at one month after ALT	SFCT at three months after ALT
IOP before ALT Pearson correlation	-.125	-.154	-.130	-.120
p*	.524	.260	.344	.382
IOP at one week after ALT Pearson correlation	-.024	-.030	-.037	-.049
p*	.864	.825	.788	.721
IOP at one month after ALT Pearson correlation	-.099	-.133	-.125	-.128
p*	.472	.334	.364	.353
IOP at three months after ALT Pearson correlation	-.079	-.094	-.053	-.061
p*	.565	.493	.698	.658

*Pearson correlation test, SFCT: Subfoveal choroidal thickness, ALT: Argon laser trabeculoplasty, IOP: Intraocular pressure.

Table 4: *IOP changes after ALT.*

	IOP (mmHg)	p*
Before ALT	25.3±3.1	-
One week after ALT	24.7±2.4	.242
One month after ALT	21.8±3.1	.000
Three months after ALT	17.5±2.3	.000 P** .000

IOP: intraocular pressure, ALT: Argon laser trabeculoplasty, *Wilcoxon test was used to compare each value, ** The data were analyzed, using analysis of variance with the Friedmans ANOVA test.

unilateral PXF and eyes of healthy controls.[7] Zengin et al reported that results did not reach any statistical significance although PXF patients had lower mean CT than control group.[8] We did not make an assessment in this respect in this study.

ALT involves the use of a blue/green argon laser to treat the outer part of the trabecular meshwork and thereby improve aqueous flow reducing IOP. ALT treatment induces inflammation in the anterior chamber owing to the fact that the laser disrupts cells in the trabecular meshwork.[9] The changes in the CT after ALT are not clear. We did not find such a study in the literature. Kim et al reported that a patient with uncontrolled primary open-angle glaucoma underwent

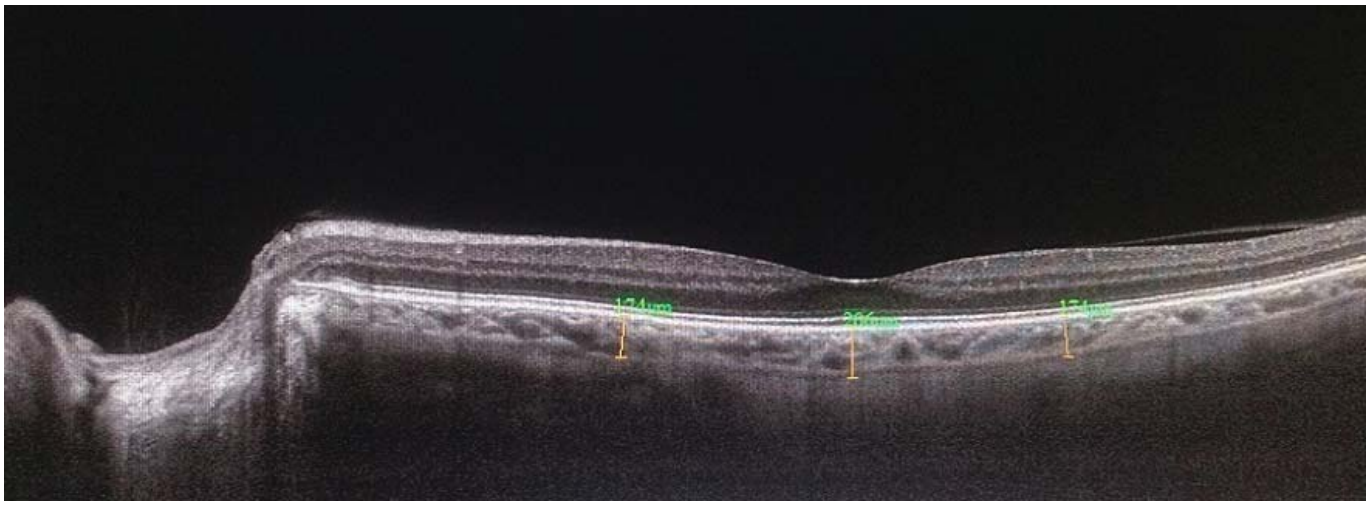

Figure 1: *Choroidal thickness before argon laser trabeculoplasty.*

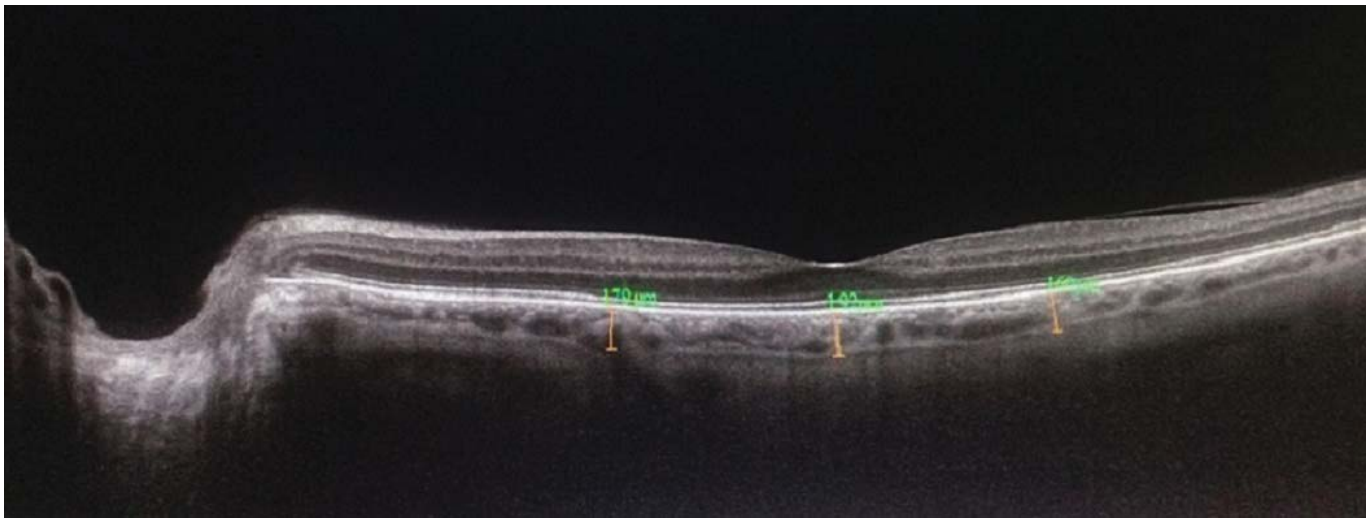

Figure 2: *Choroidal thickness at one week after argon laser trabeculoplasty.*

SLT and developed a significant anterior chamber reaction, shallow anterior chamber, and choroidal effusion.[10] Saeedi et al reported that OCT images in 17 eyes after trabeculectomy were sufficient quality to determine CT. In every patient, CT increased with IOP lowering postoperatively. For each 1 mmHg decrease in IOP, there was a mean increase of 3.4 µm in CT.[11] Kennedy et al reported that suprachoroidal effusion occurring in a 77-year-old woman with bilateral pseudophakia and primary open-angle glaucoma was treated with ALT.[12] We found that CT was significantly increased at subfoveal and temporal locations (subfovea, 1500 µ temporal of fovea). CT was significantly decreased at nasal locations (1500 µ nasal of fovea). This is the first report of CT changes measured with EDI-OCT after ALT.

The relationship between the axial length (AXL), IOP and CT changes is controversial. Pekel et al reported that no relation between SFCT and IOP in the healty subjects.[13] Aslan et al reported that the change in IOP was correlated with the CT changes at all regions, whereas age, AXL, and preoperative IOP had no significant correlations with the changes in CT after phacoemulsification surgery.[14] Bulut et al reported that the myopic children's eyes had significantly thinner SFCT than the emmetropic control eyes. Further, CT was negatively correlated with AXL in the population that included myopic and emmetropic children.[15] Kara et al reported that the change in CT negatively correlated with the change in IOP following successful trabeculectomy surgery.[16] Yılmaz et al reported that the anterior chamber volume difference between pre- and post-selective laser trabeculoplasty 1month was statistically significant, whereas not significant difference was detected between pre-SLT and post-SLT 3months, respectively.[17] We did not evaluate the relationship between the AXL and CT in our study. There is no relationship between IOP and CT in our study.

This study was restricted by some limitations. First, it featured a relatively small sample size. Larger studies are needed to validate these findings. Since OCT measurements were performed manually, there migth have been measurement

errors. Follow-up time of the study was short. We did not evaluate the relationship between the AXL and CT. The relationship should be considered between AX and CT.

As a result we believe that further study is required despite SFCT, T-CT increased and N-CT decreased after ALT in PXG.

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