Evaluation of Corneal Endothelial Polymegethism and Pleomorphism in Patients with Progressive Keratoconus After Accelerated Corneal Collagen Cross-linking

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INTRODUCTION

Accelerated corneal cross-linking (A-CXL) aims to halt the progression of keratoconus[1,2]. Although it effectively stabilizes or reduces K-values[3], there is still a limited amount of data about the changes in the corneal endothelial morphology in post-CXL eyes. Our aim was to assess them after a 10-minute A-CXL in patients with progressive keratoconus (PKC).

METHODS

In this case-control study patients with PKC, who received A-CXL from August 2020 to March 2021 at the Department of Ophthalmology, Hospital of Lithuanian University of Health Sciences Kauno Klinikos (n = 12), as well as age- and gender-matched healthy myopic controls (n = 12) were enrolled.

Only patients with PKC were scheduled to undergo a 10-minute "epithelium-off" A-CXL[4]. All procedures were performed in a single center (Department of Ophthalmology, Hospital of Lithuanian University of Health Sciences Kauno Klinikos) by the same surgeon (U.R.) under local anesthesia. At first, lid speculum was inserted and central 9 mm zone of corneal epithelium was debrided. Then an isotonic solution of 0.1 % riboflavin (MEDIOCROSS® M, Avedro, Waltham, MS, USA) every 2 min for 30 minutes was instilled. The central corneal thickness of treated eye was then measured with an ultrasonic pachymeter (Tomey Bio and Pachymeter AL-4000, Nuremberg, Germany) to ensure it has a minimum of 400 µm prior to UV irradiation. UVA light (375 nm) (UV-X™ 2000 Crosslinking System, Avedro, Waltham, MS, USA) was used to irradiate the cornea for 10 min at 9 mW/cm^2 irradiance (5.4 J/cm^2 total energy). During the irradiation, the riboflavin solution was administered every 2 minutes.

Corneal endothelial cell density (ECD), coefficient of variability (CV) and a number of hexagonal cells (6A) were evaluated at the baseline and 1, 3 and 6 months after A-CXL using specular microscopy. The statistical analysis was performed using IBM SPSS v. 27.0 software.

Table 1. Corneal Endothelial Changes in PKC Group (N = 12) 1, 3 and 6 months after a 10 minute "epithelium off" A-CXL

	Baseline	1st month	3rd month	6th month	p values
ECD, cells/mm^2	2941.08 ± 263.07	2914.83 ± 347.97	2967.00 ± 267.34	2879.33 ± 191.64	(1) 0.638 (3) 0.754 (6) 0.583
CV	32.00 ± 5.59	35.25 ± 9.03	36.83 ± 7.63	34.25 ± 5.36	(1) 0.753 (3) 0.157 (6) 0.208
6A, %	61.67 ± 6.33	58.33 ± 4.58	58.50 ± 6.88	59.17 ± 5.70	(1) 0.119 (3) 0.239 (6) 0.208

ECD – endothelial cell density; **CV** - coefficient of variation; **6A** – number of cells that have a hexagonal shape; **(1)** – baseline vs. 1st month; **(3)** baseline vs. 3rd month; **(6)** baseline vs. 6th month;

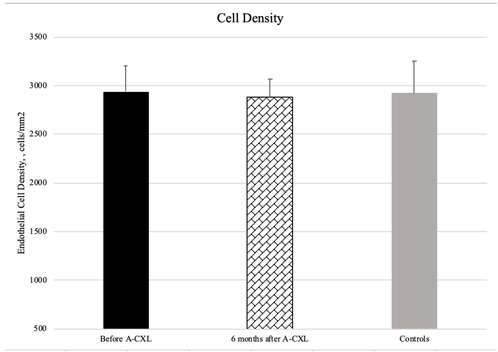


Figure 1. The comparison of mean corneal endothelial cell density

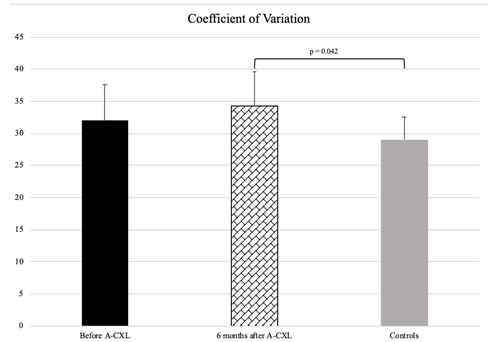


Figure 2. The comparison of mean corneal endothelial coefficient of variation

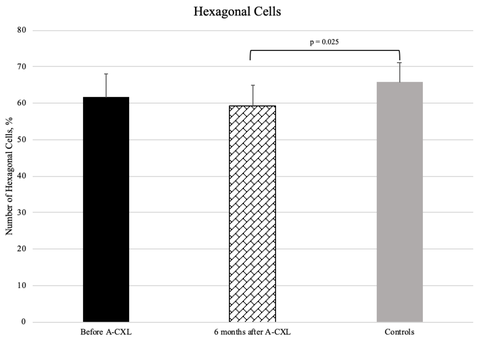


Figure 3. The comparison of mean corneal endothelial number of hexagonal cells

RESULTS

In the PKC group, no statistically significantly changes in the mean values of ECD, CV and 6A were found at the 1st, 3rd and 6th postoperative month compared with the preoperative results (Table 1).

No significant difference was found after comparing mean ECD values before the procedure (2941 ± 263 cells/mm^2), 6 months after A-CXL (2879 ± 191 cells/mm^2) and controls (2924 ± 263 cells/mm^2) (all $p > 0.05$) (Figure 1).

Figures 2 and 3 show a statistically significant change after comparing the 6-month postoperative mean values of CV (34.25 ± 5.36) and 6A (59.17 ± 5.70 %) with controls (29.08 ± 3.40 [$p = 0.042$] and 65.83 ± 5.41 % [$p = 0.025$], respectively).

CONCLUSIONS

There is an increase of CV and a decrease of 6A mean values 6 months after the 10-minute "epithelium-off" A-CXL compared with healthy myopic controls.

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