



Compare the effects of two silicone-hydrogel bandage contact lenses on epithelial healing after photorefractive keratectomy with anterior segment optical coherence tomography



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ABSTRACT

Purpose: To evaluate the efficacy of two silicone hydrogel bandage lenses (SiHy) on epithelial healing following photorefractive keratectomy (PRK) with anterior segment optical coherence tomography (AS-OCT).

Methods: Forty-two eyes of 21 patients who underwent PRK were included in a contralateral eye comparison study. At the end of the procedure, one eye of each patient was fitted with a Lotrafilcon B contact lens whereas the fellow eye was fitted with a Comfilcon A lens. Patients were examined on the day of surgery and at days 1–5 postoperatively. Main outcome measures were number of reepithelialized eyes, epithelial defect size, patient discomfort score and average complete reepithelialization time.

Results: The number of mean reepithelialized eyes was showed no statistical significance between both groups during the follow up. Average epithelial defect size for Comfilcon A and Lotrafilcon B was $32.7 \pm 12.2 \text{ mm}^2$ vs. $33.3 \pm 12 \text{ mm}^2$ at day 1 ($p=0.279$) and $13.1 \pm 6 \text{ mm}^2$ vs. $14.5 \pm 9 \text{ mm}^2$ at day 3 postoperatively ($p=0.018$). Average re-epithelialization time was 3.1 days for Comfilcon A and 3.6 days for Lotrafilcon B ($p=0.03$). Mean subjective discomfort score was 2.25 ± 0.96 in eyes with Lotrafilcon B and 1.64 ± 0.67 in eyes with Comfilcon A on the first exam the day after surgery and until third day the differences were statistically significant ($p=0.011$ and $p=0.012$, respectively).

Conclusions: AS-OCT is a reliable and noncontact method for assessment of reepithelialization under contact lenses after PRK. Eyes with Comfilcon A showed a statistically significant better discomfort score and faster reepithelialization time.

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1. Introduction

Anterior segment cross-sectional imaging is a valuable method to evaluate anterior segment structures quantitatively. Recently, anterior segment optical coherence tomography (AS-OCT), a non-invasive and non-contact method, has emerged as a new imaging technique for anterior ocular structures. It provides high-resolution images by using a long wavelength (1310 nm) of light; it offers rapid quantitative analysis of various structures [1–4]. AS-OCT has demonstrated good repeatability and reproducibility with low intra-observer and inter-observer variability [5–8]. One limitation of AS-OCT is its incomplete penetration through the pigmented

epithelium of the iris; so that it is difficult to obtain accurate images of the ciliary body, lens and zonules behind the pigmented iris [9].

Although laser in situ keratomileusis (LASIK) is widely used and highly efficacious surgical procedure for treating refractive errors, increasing incidence of iatrogenic ectasia and problems related to the creation and manipulation of the corneal flap can lead to complications such as epithelial erosions; flap edema, wrinkles, and melt; epithelial ingrowth; and diffuse lamellar keratitis [10]. Photorefractive keratectomy (PRK) is well-established flapless procedure that is performed for treat refractive errors in patients with large pupils, thin corneas, topographic irregularities, or epithelial basement membrane disease, or who are otherwise not candidates for LASIK [11]. However, eyes with PRK have some notable adverse effects like prolonged visual recovery due to the process of epithelial wound healing and severe pain, which usually starts on the day of surgery and continues until corneal reepithelialization [12]. It is also well established that silicone hydrogel lenses can be used as

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Table 1
Characteristics of contact lenses.

Parameters	Comfilcon A	Lotrafilcon B
Type	Silicone hydrogel-third generation	Silicone hydrogel-first generation
Principal monomers	No TRIS-based derivatives, long chain siloxane macromer	DMA + TRIS + siloxane macromer
Water content	46%	33%
Dk	128	110
Dk/t	160	138
Replacement	1 month	1 month
FDA group	1	1
Modulus	0.75	1
Diameter/base curve (mm)	14.0/8.6	14.2/8.6

DMA: N,N-dimethylacrylamide; TRIS: tris-(trimethylsiloxysilyl) propylviryl carbamate.

bandage purpose to decrease the average time for epithelial healing, and improved visual acuity and to control surface generated pain after PRK [13–15].

Silicon hydrogel bandage contact lenses are used as extended wear basis and made of high oxygen permeability materials for providing corneal metabolism. Providing faster reepithelialization decreases the risk factor for postoperative infections and facilitates earlier visual rehabilitation and reduction of patient discomfort [14,15].

The aim of current study to document the performance of Comfilcon A vs. Lotrafilcon B silicon hydrogel (SiHy) contact lenses on corneal epithelial defect created by PRK by using AS-OCT without removing bandage contact lenses (BCL).

2. Material and method

This study included 42 eyes of 21 consecutive patients with symptomatic low to moderate myopia (12 females, 9 males) who presented for PRK at Medipol University School of Medicine, Department of Ophthalmology between March 2014 and June 2014. The study used an observational case series design.

Patients with previous intraocular surgery, ocular trauma or other intraocular pathology or who were unable to understand the study or communicate were excluded. The study protocol was approved by the Ethics Committee of Medipol University. The tenets of the Declaration of Helsinki were followed and all patients provided informed consent prior to enrollment.

All patients underwent routine ophthalmic examinations including visual acuity, Goldmann tonometry, slit-lamp biomicroscopy and fundoscopy before and five days after surgery. Refractive errors were measured as manifest refraction. All PRK surgeries were performed using a VISX Star S3 excimer laser (VISX, Santa Clara California, USA) using the standard technique by the same surgeon (M.E) [12]. The procedure was performed in 21 right eyes and 21 left eyes. After explaining the procedure and obtaining informed consent, one drop of tropicamide 0.5% and one drop of 0.5% proparacaine (Alcaine, S.A. Alcon-Couvreur, Puurs, Belgium), 0.1% diclofenac (Inflased, Bilim, Turkey), and 0.3% tobramycin (Tobrex, Alcon-Couvreur, Puurs, Belgium) were instilled in each eye. Asepsis of lashes and lids were performed with a povidone-iodine swab. A closed-loop lid speculum was placed between the lids of the eye to be treated, and the other eye was occluded. A 7.0-mm optical zone marker was applied to the cornea, centering it over the image of the pupil. A crescent knife was used to remove the central 7.0 mm of the corneal epithelium. The loose epithelium was removed using a blunt spatula. This was followed by stromal ablation using the VISX Star S3 laser. Ablated stroma was immediately irrigated with a balanced salt solution, and one drop of both 0.3% ciprofloxacin and 0.1% diclofenac were instilled on the surgical site. At the end of the procedure, one eye of each patient, randomly determined by a computer program, was fitted with a Lotrafilcon B contact lens (Ciba Vision, Duluth, GA, US 30-day

recommended replacement) whereas the fellow eye was fitted with an Comfilcon A lens (CooperVision, Fairport, NY, US; 30-day recommended replacement) with contact lens applicator (Janach J2935) (Table 1). Tobramycin 0.3% and diclofenac sodium 0.1% drops, 4 times per day, were prescribed for a week.

All patients were examined on the day of surgery and at days 1–5 postoperatively with AS-OCT. The order in which eyes were evaluated was randomized. The AS-OCT measurements were performed by two experienced technicians before and during controls after the PRK using a Visante AS-OCT device (Carl Zeiss Meditec AG). Technicians were blinded to clinical ophthalmic examination results. For the measurements, pupils were undilated and patients were asked to sit and fixate on an indicator in the AS-OCT under identical lighting conditions. Horizontal and vertical radial scans through the corneal vertex were carried out for each eye on central fixation, right gaze and left gaze to show sections across the central and peripheral cornea including the advancing edge of migrating epithelial tissue. Images of the cornea were captured until the centration and quality were sufficient for analysis. The epithelial defect size was calculated using Image J area calculating program (v 1.43) automatically from the best images selected. BCLs were removed when complete epithelialization was determined using objective AS-OCT assessment (Figs. 1 and 2).

All patients were interviewed in standardized conditions by a physician who was masked. The questionnaires were administered to each patient before their ophthalmic examinations. Pain, photophobia and lacrimation were each given a score from 0 (none) to 4 (as bad as it could be). Patients were asked for each complaint every day. Average discomfort scores calculated.

SPSS software version 17.0 (SPSS Inc, Chicago, IL) was used for statistical analysis. The Wilcoxon Signed Rank and chi square tests were used to compare nonparametric data where appropriate. $p < 0.05$ was considered statistically significant for all testing.

3. Results

In this study, 42 eyes of 21 patients (9 men and 12 women) were studied. The average age of the patients was 26.4 ± 5 years (range 18–34 years). Preoperative refractive error, corneal curvature and corneal thickness details showed no difference statistically (Table 2). Postoperative details including corneal epithelial defect size and subjective level of discomfort scores in Comfilcon A and Lotrafilcon B during control days are presented at Table 3. The mean postoperative photophobia, pain and lacrimation scores at day 1 were 2.3 ± 0.4 (range 2–4), 2.7 ± 0.2 (range 2–4) and 1.9 ± 0.7 (range 2–4), respectively, for Comfilcon A and 3.1 ± 0.2 (range 3–4), 2.9 ± 0.6 (range 2–4) and 2.8 ± 0.8 (range 2–4), respectively, for Lotrafilcon B. Mean discomfort scores after third day decreased progressively in both groups and revealed no differences between groups in photophobia, lacrimation or pain, although mean scores for each variable were slightly lower in the Comfilcon A group (Table 3).

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