

SOFT CONTACT LENSES AND LONG TERM CORNEAL HYPOXIA: WHAT IS CHANGING WITH SILICONE HYDROGEL LENS?

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SUMMARY – The aim of the study was to analyze the effect of silicone hydrogel high Dk contact lenses on the signs of long term corneal hypoxia noticed in patients who previously had worn soft contact lenses with low Dk. In 75 patients who had worn soft contact lenses, the signs of long term corneal hypoxia, i.e. limbal and bulbar hyperemia and corneal neovascularization were observed. Three and six months after refitting with silicone hydrogel lenses, regression of the signs of long term corneal hypoxia was estimated. The signs of long term corneal hypoxia showed regression in a significant number of patients at three months, and in almost all patients at six months. Refitting with silicone hydrogel contact lenses is indicated in previous wearers of soft contact lenses with signs of corneal hypoxia.

Key words: *hypoxia, corneal oxygen deficiency, soft contact lenses, silicone hydrogel contact lenses*

Introduction

Soft contact lenses of different manufacturers have been used for years in correction of refractive errors. Most of the soft contact lenses used for daily wear were presumed to meet the criteria of oxygen permeability, defined more than twenty years ago, in the prevention of corneal edema¹. Analyses performed later have shown that oxygen permeability which meets the criteria of Holden and Mertz ($24 \times 10^{-9} \text{ cm} \times \text{mLO}_2$) is always evident in the central part of the soft contact lens but not in the peripheral zone, especially in toric design and high powered contact lenses. Revised criteria of Holden and Mertz assume a minimum of oxygen permeability of $124 \times 10^{-9} \text{ cm} \times \text{mLO}_2$, to avoid augmentation of corneal edema over 3%^{2,3}.

One of the studies showed that 81% of patients had limbal redness, the earliest sign of corneal hypoxia and corneal lesion, due to the inadequate level of lens oxygen permeability (low Dk) in peripheral parts of the cornea⁴.

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Bulbar redness is less common than limbal redness, but may be more frequently found in patients wearing standard soft contact lenses than in those wearing high Dk/t lenses⁵. One of recent studies has shown that approximately 30% of patients wearing disposable soft contact lenses with low Dk have corneal neovascularization, another sign of corneal hypoxia⁶ (Fig. 1).

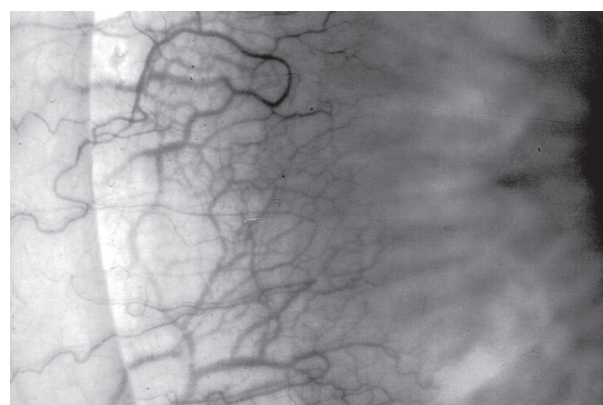


Fig. 1. Signs of limbal hyperemia and corneal neovascularization in a patient wearing low Dk soft contact lenses. Note the edge of soft contact lens.

Epithelial microcysts, usually located in the medial and/or peripheral corneal zone, are a sign of chronic hypoxia in patients wearing extended wear soft contact lenses with low Dk⁷. A minimum of ten microcysts *per* eye is the number showing corneal hypoxia with high accuracy^{7,8}, and could be found in more than 90% of wearers of extended wear soft contact lenses with low Dk, but also in more than 70% of wearers of rigid gas permeable lenses with low Dk⁹.

Silicone soft contact lenses have been in clinical use for the last five years. They have eliminated corneal hypoxia in most of patients wearing them, with less adverse effect on corneal homeostasis than soft contact lenses¹⁰.

The aim of this study was to estimate the effect of silicone hydrogel contact lenses on the signs of corneal hypoxia in patients previously wearing conventional soft contact lenses and frequent replacement soft contact lenses.

Material and Methods

Seventy five wearers of soft contact lenses with one or more signs of corneal hypoxia (limbal and bulbar redness, corneal neovascularization) were refitted with silicone hydrogel contact lenses (lotrafilcon B - Dk 110). Patients were previously fitted with different types of soft contact lenses: HEMA with 38% H₂O - Dk 9, HEMA with 75% H₂O - Dk 36, alphafilcon A with 66% H₂O - Dk 32, and etafilcon A with 58% H₂O - Dk 28.

First control and qualitative evaluation of limbal redness, bulbar redness and corneal neovascularization was done at three, and second control at six months. All three parameters were graduated from zero to four by Efron grading scale¹¹. Grade two or more was accepted as path-

Table 1. Incidence and regression of signs of prolonged corneal hypoxia in soft contact lens wearers who were refitted with silicone hydrogel lenses

N=75	Improvement at 3 months	Improvement at 6 months
Limbal hyperemia n=75 (100%)	64 (85%)	73 (97%)
Bulbar hyperemia n=28 (37%)	18 (64%)	25 (89%)
Corneal neovascularization n=31	14 (45%)	29 (94%)

ological finding. In limbal and bulbar redness, the level of hyperemia was evaluated, and in corneal neovascularization the level of emptying of corneal vessels was estimated.

Results

At three months, significant regression of the signs of corneal hypoxia was evident. Regression of limbal redness was found in 85%, regression of bulbar redness in 64%, and emptying of corneal vessels in 45% of patients. At six months, additional regression of the aforementioned signs was recorded, i.e. regression of bulbar redness in 89%, regression of limbal redness in 97%, and emptying of corneal vessels in 94% of patients (Table 1, Fig. 2). Corneal microcysts as a sign of hypoxia were not found in our patient group.

Discussion

The study by Chalmers *et al.* included two groups of patients: one group of patients who had worn conventional daily wear soft contact lenses, and another group who had worn extended wear soft contact lenses. Both groups were refitted with extended wear hydrogel silicone contact lenses. Control examinations were per-

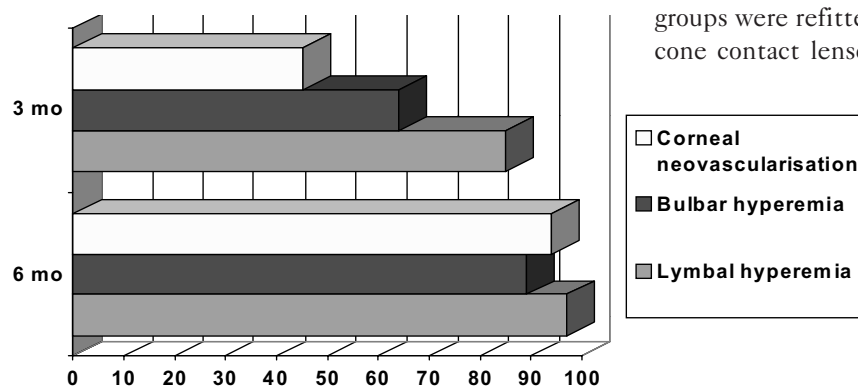


Fig. 2. Improvement of signs of hypoxia at 3 and 6 months (in percentage).

formed at one week, one month, six months and one year. In both patient groups, regression of limbal and bulbar hyperemia was evident, with regression of corneal neovascularization in a significant number of patients. The first signs of improvement were observed at one week¹².

Dumbleton *et al.* studied a group of patients with conventional contact lenses who were refitted with daily wear silicone hydrogel contact lenses. Control examinations were performed at one week, and one and two months. Their results showed significant regression of prolonged corneal hypoxia after refitting with high Dk silicone hydrogel contact lenses¹³. A recent study by Riley *et al.* showed significant regression of bulbar and limbal redness within two weeks, after refitting patients with soft contact lenses with silicone hydrogel contact lenses¹⁴. In this short term study, the signs of emptying of corneal neovascularization were not analyzed, because a longer period is needed to achieve regression of this sign of hypoxia, as observed in this study.

Corneal microcysts are almost always seen in patients wearing extended wear soft contact lenses⁷, so it is no surprise that this finding was not present in our patient group.

Conclusion

Replacement of soft contact lenses with silicone hydrogel contact lenses in patients with the signs of prolonged corneal hypoxia resulted in significant reduction of limbal and bulbar hyperemia, and partial regression (emptying) of corneal neovascularization after three months. After six months, regression of the signs of prolonged corneal hypoxia was almost complete in all patients. These findings support refitting of these patients with silicone hydrogel soft contact lenses.

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Sažetak

MEKANE KONTAKTNE LEĆE I DUGOTRAJNA HIPOKSIJA ROŽNICE: KAKVE PROMJENE DONOSI SILIKONSKA HIDROGEL LEĆA?

K. Ćuruvija-Opačić

Cilj rada bio je analizirati učinak silikonskih leća s visokim Dk na znakove hipoksije rožnice zamijećene u bolesnika koji su ranije nosili mekane kontaktne leće s niskim Dk. Kod 75 bolesnika koji su nosili mekane kontaktne leće nađeni su znakovi dugotrajne hipoksije rožnice: limbalna i bulbarna hiperemija te neovaskularizacija rožnice. Tri i šest mjeseci nakon što su bolesnicima pacijentima aplicirane silikonske mekane leće ocijenjen je stupanj regresije znakova hipoksije rožnice. Regresija znakova hipoksije nađena je u značajnog broja bolesnika nakon tri mjeseca, a u gotovo svih bolesnika nakon šest mjeseci. Primjena silikonskih hidrogel leća opravdana je u svih bolesnika koji imaju znakove dugotrajne hipoksije rožnice, a nose mekane kontaktne leće.

Ključne riječi: *hipoksija, kornealni nedostatak kisika, mekane kontaktne leće, silikonske mekane kontaktne leće*