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Comparative Study of Silicone-Hydrogel Contact Lenses Surfaces Before and After Wear Using Atomic Force Microscopy

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Abstract

Purpose: The aim of this study is to analyze changes in surface properties of three silicone-hydrogel contact lenses with and without surface treatment after wear. To understand how and where proteins and other contaminants change lens surface, the topography of unworn and worn lenses were mapped in great detail through atomic force microscopy (AFM) .

Methods: The lenses used in this study were balafilcon A (Purevision™, Bausch & Lomb), lotrafilcon B (O_2Optix™, CIBA Vision) and galyfilcon A (Acuvue® Advance™). During wear, a commercially available and appropriate lens care solution (Renu Multiplus™; Bausch & Lomb) was used. Contact lenses surfaces roughness and topography were studied with AFM tapping mode™ before and after wear. The roughness measurements regarding R_a, R_q and R_{max}, were determined using the Scanning Probe Image Processor (SPIP™).

Results: Worn and unworn contact lenses exhibited different surface roughness (Table 1). After wear, balafilcon A and galyfilcon A showed a significant increase in the quantitative parameters of surface roughness, being galyfilcon A the lens that exhibited the greatest increase. In lotrafilcon B materials no important differences in these parameters were observed before and after wear.Table 1- Quantitative roughness parameters of lenses determined by AFM

	R_a	R_q	R_{max}
Galyfilcon A (a)	2.32	3.04	30.1
Galyfilcon A (b)	30.9	70.16	189.33
Lotrafilcon B (a)	4.5	5.74	40.77
Lotrafilcon B (b)	4.96	7.26	52.67
Balafilcon A (a)	6.86	9.5	81.53
Balafilcon A (b)	18.07	23.67	138.67

(a) Unworn(b) WornHigh quality topographic images in three dimensions were recorded at randomly different worn and unworn contact lens surface locations. Apparently the formation of tear film deposits may have contributed to an increase in the surface roughness of worn contact lenses.

Conclusions: The present study suggests that surface treatment can play an important role in the prevention of an increase in roughness. Galyfilcon A, the one without surface treatment showed a significant increase in this parameter with the higher score of values.

Key Words: contact lens • microscopy: electron microscopy