Short-term effects on local corneal thickness during the use of soft contact lenses for irregular cornea
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Introduction
Keratoconus is characterized by a presence of corneal ectasia and thinning that results in high irregular astigmatism and thereby poor vision. The correction of choice to date is made by rigid gas permeable (RGP) contact lenses. Sometimes the use of RGP contact lenses becomes intolerable, because of poor comfort and stability of the lens. Other contact lens options have also been introduced, such as soft spherical and soft toric lenses, hybrid lenses, scleral lenses, and piggyback lenses. Compared to corneal RGP lenses, all these options increase the risk of reduced oxygen delivery to the cornea.1 KeraSoft® IC lenses (Ultravision, UK) are designed to fit irregular corneas, including keratoconus, and other corneal irregularities.2 The KeraSoft® IC is a front surface aspheric or aspheric toric prism ballasted lens, available in Filcon II3, 77% water, or Etrolicon A, 74% water. The fitting set is supplied in 77% material.3

Purpose
To measure the thickness in different areas of KeraSoft® IC (Ultravision, UK) and compare it with the corneal pachymetry map of subjects wearing this kind of contact lenses, to verify the presence of induced local corneal swelling.

Methods
For each lens from the fitting set, with different BOZRs, thickness measurements were performed three times in thirteen different areas: one in the centre, four in the middle periphery and eight in the periphery. Contact lens thickness was measured by the ET-3 Electronic Thickness Gauge for Contact Lenses (Createch-Rehder-dev Co., US). Local Dk/t was calculated, using the mean thickness in each area and the declared Dk (53×10⁻¹¹ (cm²/Sec)(mLO₂/(m×mmHg))3

Seven subjects, aged 20-25, free of eye diseases, were fitted in the right eye with Kerasoft IC from the diagnostic set, following the fitting guide.

Pachymetry map was measured by Scheimpflug tomography (Sirius, CSO, Italy)4, at baseline and after 4 and 8 hours of wearing of contact lenses, both in the right eye, and in the left eye (control). The values of corneal thickness, measured in the areas of the cornea corresponding to those measured on contact lenses, were compared with the values of oxygen transmissibility (Dk/t).

Results
The average thickness of the measured lenses was 400 μm, but it varied considerably depending on the lens area, from a minimum of 264 μm at the top of the lens, to a maximum of 556 μm at the bottom of the lens. Due the different thickness, the oxygen transmissibility of the lenses varied from a minimum of 10 Fatt units to a maximum of 20 (average 13).

At baseline (BL) the mean central corneal thickness was 550 μm (range 523 - 610 μm), 576 μm (range 546 – 627 μm) after 4 hours and 574 μm (range 543 – 627 μm) after 8 hours. The mean corneal swelling was 3% (range 1% - 4.4%). The swelling is greater in the areas of the cornea corresponding to the thicker areas of the CL (r² = 0.68). For all the measured areas, the difference was statistically significant both between BL and after 4 hours, and between BL and after 8 hours (p<0.001). There were no significant differences between 4 and 8 hours, and no change in the control eye.

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Table 1: mean corneal thickness (μm) and corneal swelling (%) at baseline and after 4 and 8 hours of wearing

Discussion and conclusion
The use of thick CLs can induce a significant corneal swelling, also in corneas of young and healthy people. The examination performed by Scheimpflug tomography is able to measure this swelling, showing local differences. Patients fitted into these lenses require consistent monitoring for any possible signs of corneal hypoxia.

References