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Examination of ocular biomechanics with a new Scheimpflug technology after corneal refractive surgery

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ABSTRACT

Purpose: To analyze the early results of a new device measuring ocular biomechanics after corneal refractive surgery.
Patients and methods: Thirty nine refractive surgery patients were enrolled in the study (age: 32.6 ± 9.9 years). Laser in situ keratomileusis (LASIK) was performed on 52 eyes of 26 patients and photorefractive keratectomy (PRK) was done on 26 eyes of 13 patients. Ten device-specific biomechanical parameters, intraocular pressure (IOP) and pachymetry were measured preoperatively and at day 1, week 1 and month 1 after the surgeries with a new technology based on Scheimpflug imaging (CorVis ST, Oculus).
Results: In case of LASIK, the day after the procedure, radius values showed significant differences compared to preoperative data. One month after surgery, radius values, velocity of the second applanation and pachymetry showed significant differences compared to preoperative data. In case of PRK, the day after the procedure, significant differences in IOP, maximum amplitude at the apex, A1 time, A2 velocity and highest concavity time were measured. After 1 month of PRK, there were no differences in the parameters compared to preoperative data except pachymetry.
Conclusions: We observed that some specific biomechanical parameters changed measured with CorVis ST after LASIK and PRK, in the early postoperative time. However, most of these parameters remain unchanged after one month of LASIK and PRK compared to preoperative data.

1. Introduction

The ophthalmological diagnostic techniques currently used in common practice only have the potential to measure the static parameters of the anterior segment of the eye; despite the cornea being a tissue with viscous and elastic properties [1]. Until recently, the only device which conducted in vivo measurements of the ocular biomechanical properties was the Ocular Response Analyzer (ORA, Reichert Ophthalmic Instruments, Depew, New York, USA), which has been available since 2005 [2,3].

With ORA, the biomechanical properties of the cornea can be measured, which can help us the diagnosis of glaucoma and in the assessment of the outcomes of different refractive surgeries [4–8]. The first publication about results with ORA has already reported significant differences in the biomechanical parameters between healthy and keratoconus eyes and in those subsequent to refractive surgeries [9].

Recently, a new device has been made available for measuring ocular biomechanical properties. The CorVis ST (Corneal Visualization Scheimpflug Technology, Oculus Inc., Wetzlar, Germany) uses ultra high-speed Scheimpflug photography and an air impulse to measure the specific parameters of the cornea. Our aim was to evaluate early ocular biomechanical changes after laser in situ keratomileusis (LASIK) and photorefractive keratectomy (PRK) with this new technology.

2. Patients and methods

2.1. Patients

Thirty nine corneal refractive surgery candidates were enrolled in this study. All subjects had no history or signs of previous or present systemic and ocular disorder other than refractive errors. A complete ophthalmological examination was performed on each subject preoperatively. The research protocol adhered to the tenets

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of the Declaration of Helsinki and detailed informed consent was signed by all patients.

2.2. LASIK procedure

LASIK surgery was performed using an InPro Gauss excimer laser device (InPro Intraokulare Prothetik GmbH, Norderstedt, Germany) and a Zyoptix XP microkeratome (Bausch&Lomb Inc., Rochester, New York, USA). Before the operation, topical anaesthetic eye drops (tetracaine hydrochloride) were instilled three times over a five-minute interval. An anterior corneal flap was created, with a diameter of 9.5 mm and a thickness of 120 μm. Postoperatively, patients received tobramycine and dexamethasone eye drops five times a day for two weeks. Preservative-free artificial tears (Refresh Classic, Allergan) were also administered five times a day from days 1 to 60.

2.3. PRK procedure

Topical anaesthetic (tetracaine hydrochloride) eye drops were administered at least twice before the surgery. De-epithelization was performed with a blunt keratome blade knife after epithelial marking at 7.0–7.5 mm. The epithelium was scraped gently from the periphery to the centre. Residual epithelial debris was removed with a sterile microsponge. The PRK was performed using an InPro Gauss excimer laser device (InPro Intraokulare Prothetik GmbH, Norderstedt, Germany). Postoperative treatment consisted of pain killers (diclofenac) during the first and the second day, antibiotic (tobramycine) drops or ointment and a patch until the epithelium was healed. Topical corticosteroid eye drops (dexamethasone) were used five times daily in the first month, four times daily in the second month and three times daily in the third month.

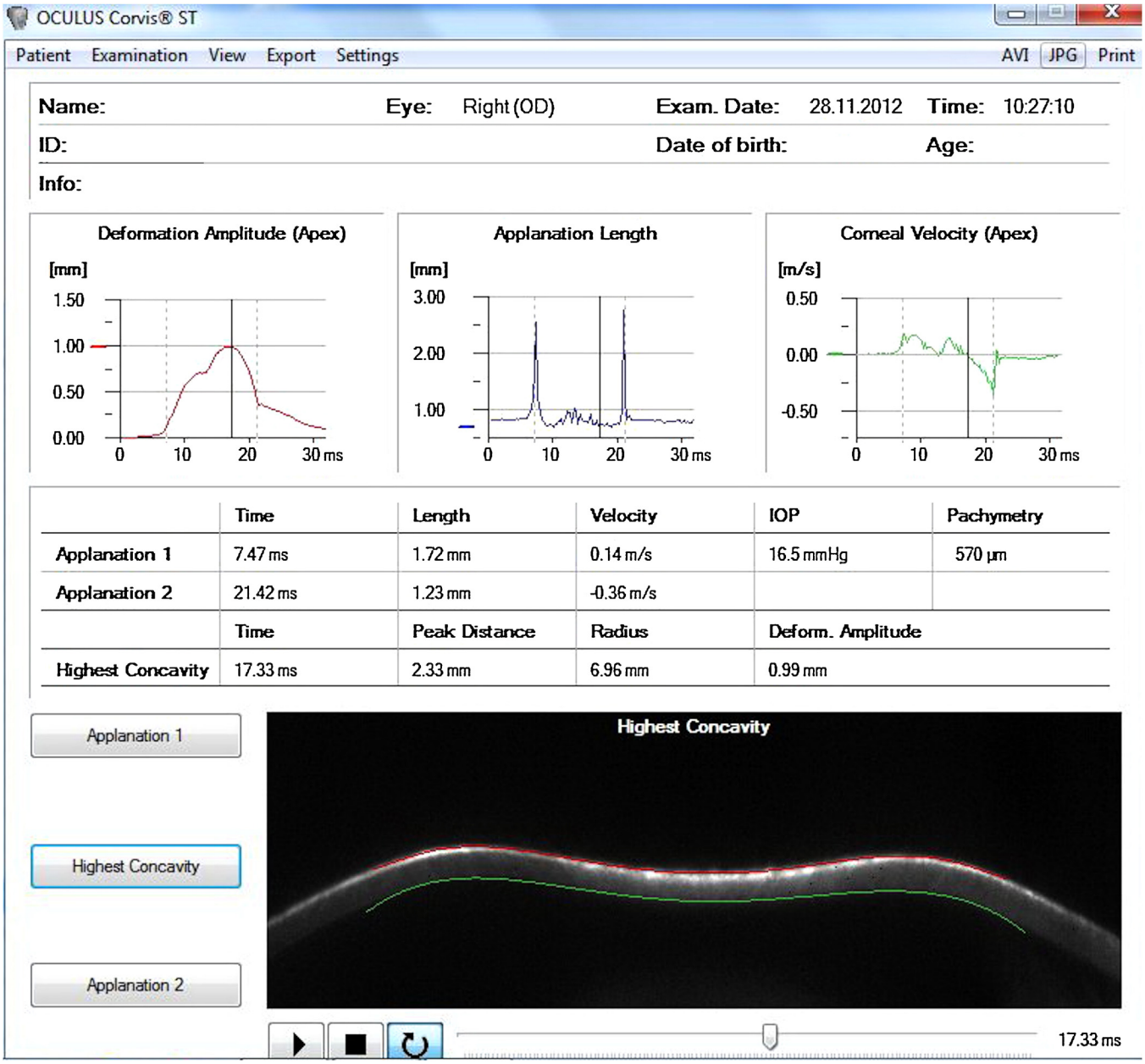

Fig. 1. Demonstrative picture obtained with CorVis ST at the highest concavity time. The device measures the maximum deformation amplitude of the cornea, time taken to reach it, first and second applanation times, applanation lengths, two corneal speed values, peak distance and a radius value at the time of the highest concavity.