Press Release

Highly precise results with customized treatments

SCHWIND AMARIS ideally smoothes the cornea with two energy levels

Kleinostheim, Germany, September 2008

The longer a laser operation takes, the higher the risk of complications for the eye. The cornea can also dry out from extended ablation time and this can lead to overcorrections[1, 2]. A higher laser speed, therefore, not only saves the patient time on the operating bed but also makes the procedure much safer. There are two approaches for speeding up the laser treatment (ablation volume per second): Increasing the fluence value (ablation volume per pulse) and increasing the pulse frequency (number of pulses per second). The greatest effect is achieved through the combination of both methods. Disadvantage: Although the treatment with higher energy levels and higher pulse frequency is significantly faster, a smooth corneal surface may not be achieved and the lifetime of the system's optical components is also reduced. In order to achieve the perfect combination of high speed and precise results, SCHWIND has equipped the SCHWIND AMARIS, in addition to a 500 Hz pulse frequency, with two energy levels. For this, the SCHWIND researchers developed the worldwide-unique „Automatic Fluence Level Adjustment" method. The optimal energy densities for high and low fluence, as well as their respective ratios for the best possible treatment, were established in complex mathematical simulations. A rigorous simulation model was developed in order to evaluate different ablation algorithms and their surgical results in refractive laser surgery. This included the creation of a shot-pattern for a flying spot laser beam from a general ablation volume and simulation of the ablation process in a shot-by-shot fashion. The result: approximately 80 percent of the laser ablation is performed with a high fluence value and for the remaining 20 percent, the SCHWIND AMARIS automatically switches to the low fluence and ideally smooths out by adding the finishing touches to the cornea. The advantages of the dual fluence approach concerning precision are particularly evident in customized treatments because subjective refractions - combined with higher order aberrations - are treated. Higher order aberrations, as a general rule very finely structured, are more precisely treated with a low fluence than with only a high fluence.

Results of the simulations with the dual fluence approach are also supported by scientific studies[3, 4] which predict a small beam diameter close to 0.5 mm to achieve optimum results and hypothesize the possibility of combining it with a larger beam for providing fast ablations. Based upon their calculations, the capabilities for effective wavefront correction with the 0.54 mm FWHM Super-Gaussian beam of the SCHWIND AMARIS extend beyond the 8th Zernike radial order.

[1]Wirbelauer C, Aurich H, Pham DT, Online optical coherence pachymetry to evaluate intraoperative ablation parameters in LASIK. Graefes Arch Clin Exp Ophthalmol. 2007 Jun; 245(6):775-81
[2]Patel S, Alió JL, Artola A, Changes in the refractive index of the human corneal stroma during laser in situ keratomileusis. Effects of exposure time and method used to create the flap. J Cataract Refract Surg. 2008 Jul; 34(7):1077-82
[3]Huang D, Arif M, Spot size and quality of scanning laser correction of higher-order wavefront aberrations. J Cataract Refract Surg. 2002 Mar; 28(3):407-16
[4]Guirao A, Williams DR, MacRae SM, Effect of beam size on the expected benefit of customized laser refractive surgery. J Refract Surg. 2003 Jan-Feb; 19(1):15-23

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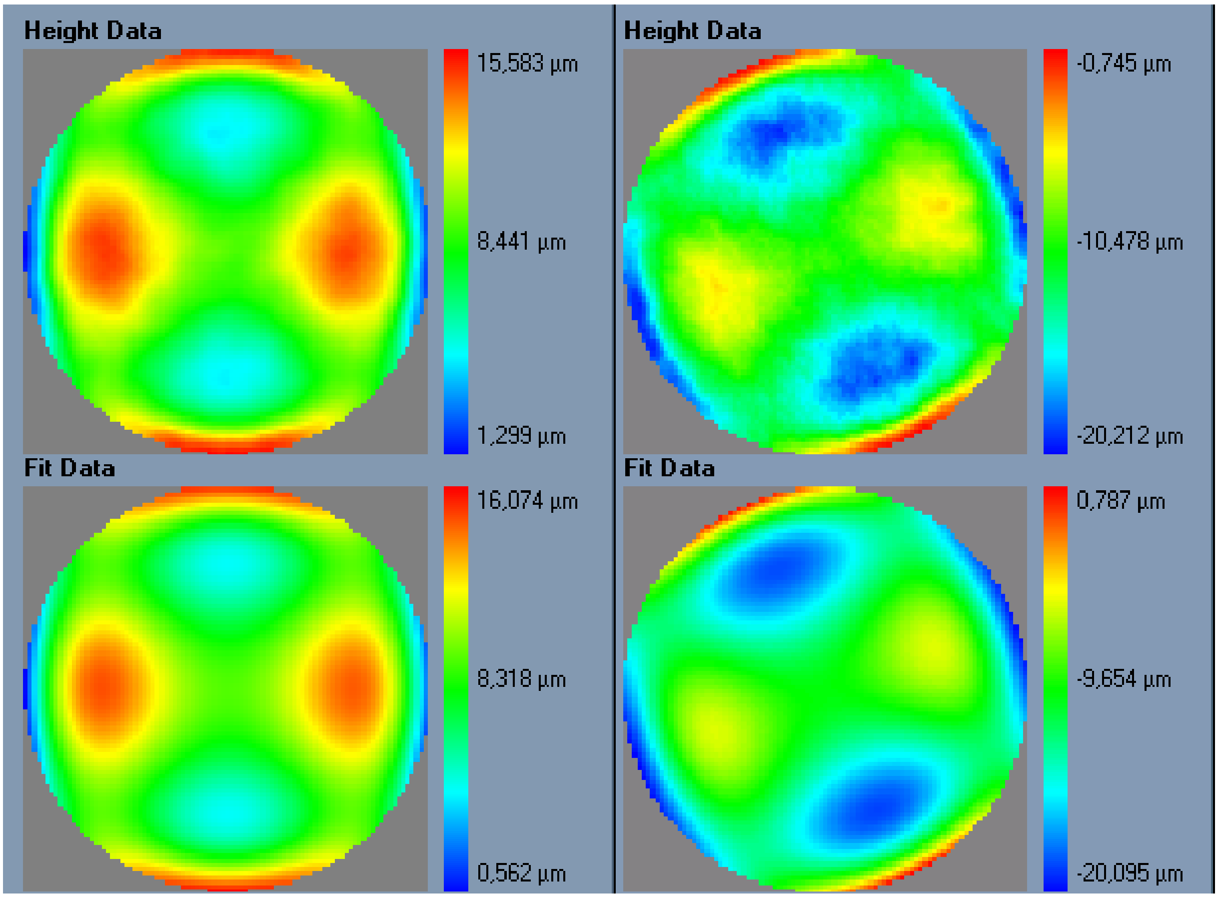

Figure 1: *Left:* Ablation simulation of secondary astigmatism aberration Z[4, ± 2], with 97,9% accuracy, and 98% fit quality. *Right:* Real ablation on a flat plate of PMMA of secondary astigmatism aberration Z [4, ± 2], with 96,0% accuracy, and 96% fit quality

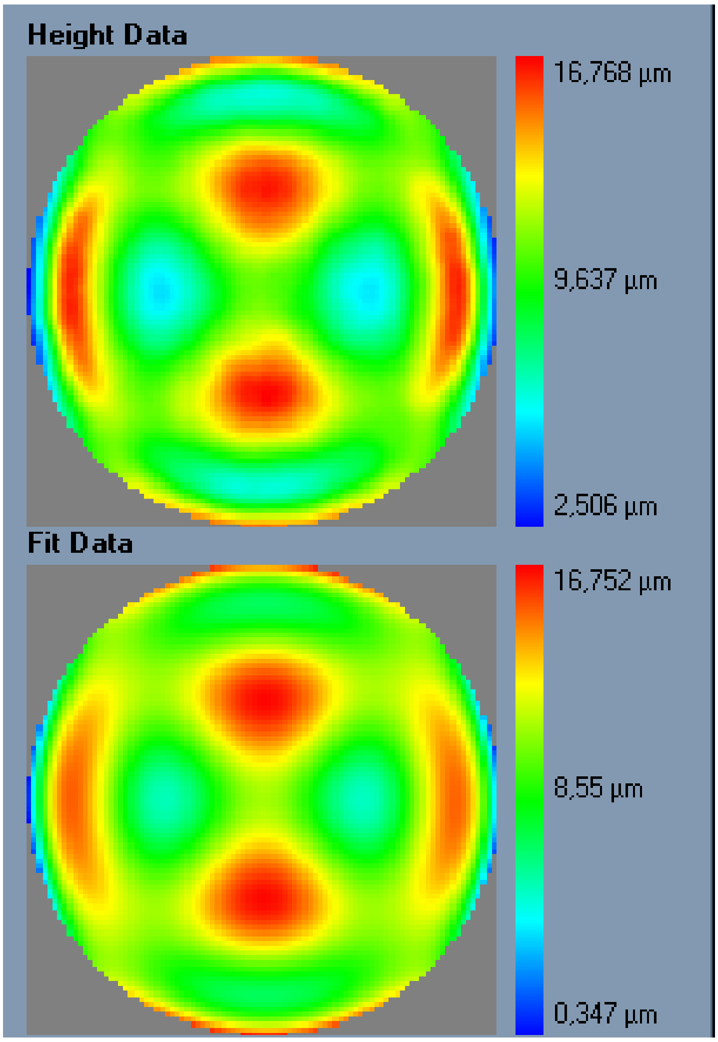

Figure 2: Ablation simulation of tertiary astigmatism aberration Z[6,±2], with 91,3% accuracy, and 97% fit quality