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Press Release

Thermodynamic measurements confirm high safety of the SCHWIND AMARIS' Intelligent Thermal Effect Control

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With the unique Intelligent Thermal Effect Control (ITEC) of the SCHWIND AMARIS, the patient's cornea is warmed less than four degrees during the laser treatment. This is the result of scientific thermodynamic measurements carried out at the Eye Laser Clinic Recklinghausen, Germany (Diego de Ortueta, MD) by the University of Applied Sciences, Aschaffenburg. Seven myopic eyes were investigated with preoperative spherical equivalent (SEQ) ranging from -2.75 to -9.25 dioptres. The measurements were performed with a high-resolution infrared thermographic camera which recorded thermal images of the eye at a rate of one time per second from a distance of 66 centimetres. Cornea temperature rise was evaluated within the optical zone as well as in the entire ablation zone.

The preoperative cornea temperature corresponded to the values cited in scientific publications with measured values ranging from 29.3° to 31.4° C[1]. By temperatures higher than 40° C the proteins of collagen change their structure[1] and the cornea is possibly damaged[2]. This may cause corneal haze[3] and may negatively influence the treatment result. In all measured eyes, an intraoperative temperature rise between 2.7° and maximum 3.8° C was observed. The maximum temperature was less than 35° C. This confirms that the ITEC method efficiently preserves the corneal tissue – despite the 500 Hertz pulse frequency of the SCHWIND AMARIS. It furthermore showed that with ITEC the amount of the refraction and consequentially the length of ablation has no influence on temperature rise.

The ITEC method is based on complex mathematical models, simulations and clinical studies. The result is a unique thermal control system considering all aspects of the dynamics of heat propagation while using a high laser pulse frequency and two energy levels. Among the fundamental principles is that heat locally deposited in the tissue propagates in all spatial directions in the tissue and cools down at the same time. Therefore, the SCHWIND AMARIS sorts the laser pulses spatially and temporally. The result is that a blocked zone becomes smaller during the cooling phase and following laser pulses are able to move closer more quickly to the position of the last laser pulses. In this manner, the local spot frequency is dynamically limited without significantly affecting the laser pulse frequency. The higher the pulse energy, the lower the maximum allowed local spot frequency and thus greater the blocked zone.

„The measurement results give me even more safety for treatment of higher myopes“, comments Diego de Ortueta, MD. „The high pulse frequency of the SCHWIND AMARIS allows a very short treatment time without significantly warming the corneal tissue.“

[1]Bende T, Seiler T, Wollensak J. Side effects in excimer corneal surgery. Corneal thermal gradients. Graefes Arch Clin Exp Ophthalmol; 1988; 226: 277-80.
[2]Ishihara M, Arai T, Sato S, Morimoto Y, Obara M, Kikuchi M. Measurement of the surface temperature of the cornea during ArF excimer laser ablation by thermal radiometry with a 15-nanosecond time response. Lasers Surg Med. 2002;30(1):54-9.
[3]Betney S, Morgan PB, Doyle SJ, Efron N. Corneal temperature changes during photorefractive keratectomy. Cornea. 1997 Mar;16(2):158-61.

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Eye	SEQ (D)	Treatment method	Max temperature increase (°C)
OD	-2.75	LASEK	3.52
OD	-9.25	LASIK	3.73
OS	-5.75	LASIK	3.28
OD	-3.10	LASEK	3.10
OS	-3.10	LASEK	3.18
OD	-3.25	LASEK	2.95
OS	-3.50	LASEK	2.67

Figure 1: Result of thermodynamic measurements

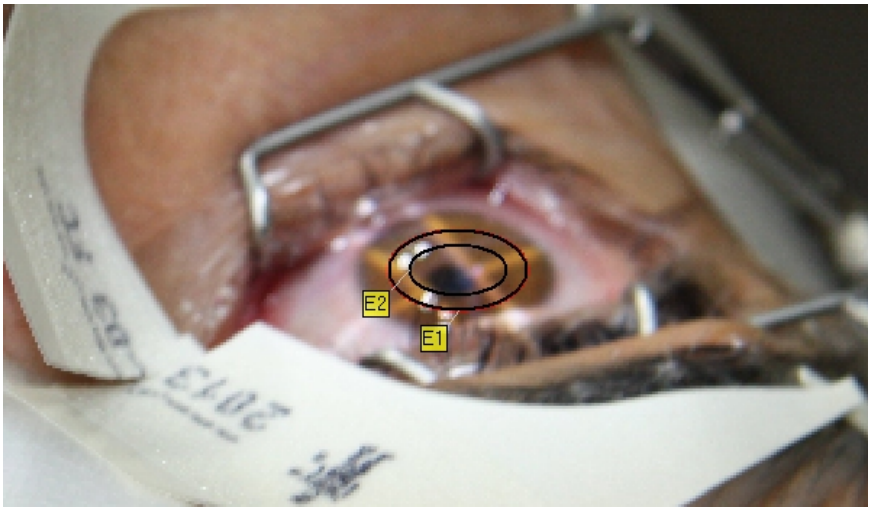

Figure 2: Normal view of the eye

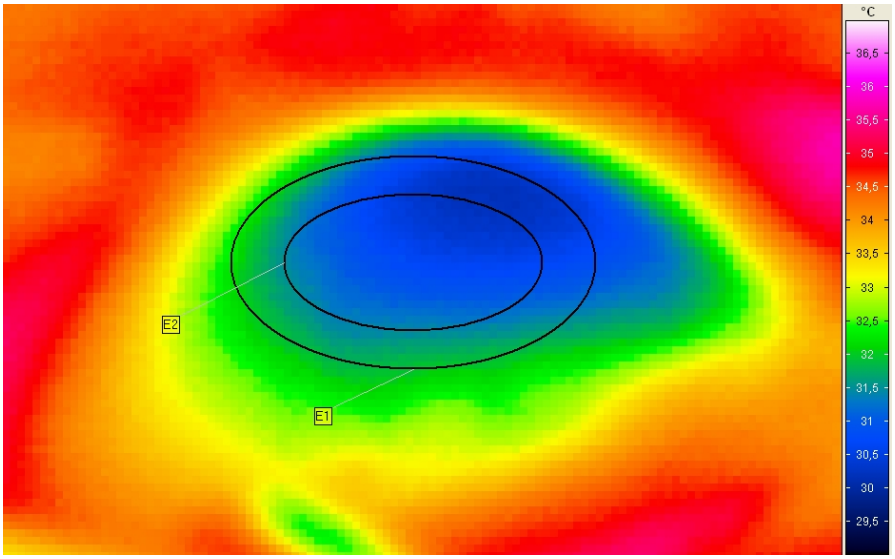

Figure 3: Eye under the thermographic camera