Purpose: To understand the ablation process and to establish quantitative data about the treatment of eyes with the new solid-state laser system LaserSoft of Katana Technologies GmbH.

Methods: Fig eyes were irradiated with a new frequency-shifted diode pumped solid-state laser using a computer controlled fast scanning. The system Lasersoft runs at a repetition rate of 1 kHz with a small spot size of about 0.25 mm at the target. A sequential frequency conversion with nonlinear crystals shifts the wavelength of the laser radiation into the range between 208-210 nm. The cw (continuous wave)-diode pumping leads to very stable shot-to-shot and long-term stability of the UV output. The resonator structure as well as the beam delivery ensure an emission of the laser radiation with a true Gaussian beam, providing an excellent UV light spot distribution on the cornea, without the need for beam-forming elements in the beam path. The ablation pattern utilized in LaserSoft with accurate overlap of true gaussian spots ensures an extremely homogeneous corneal surface. The eye tracker has a latency of 1 ms and controls the centration of the ablation at very high repetition rates. The preoperative and postoperative 3D shapes of the eyes were measured using a contactless optical scan method (Fries Technologies GmbH, Germany). The ablation depth was calculated from pachymetric values taken before and immediately after the ablation procedure with the ultrasonic pachymeter (DGH Technology, Inc). The corneal maps have been taken using a topographic system TMS-2N (Tomey Inc.).

Successively nine human eyes were treated with photorefractive keratectomy. Four eyes had myopia, 3 eyes had compound myopic astigmatism and 2 eyes had compound hyperopic astigmatism. The follow up was 1 month for 5 eyes and 3 months for 4 eyes. The mean outcome measures were UCVA, BCVA, corneal topography and corneal transparency.

Results: The experimental ablation depths for different values of corrections of myopia and PTK correlate extremely well with the calculated depth taking into account the measured ablation depth for single shot experiments (Table 1). We achieved the necessary steepening for the treatment of hyperopia and flattening for myopia (Figures 1-4).

The clinical results showed high efficacy and safety. No eye lost lines of the BCVA and all eyes improved their UCVA. 100% of eyes were within ±1D and 89% were within ±0.5D of spherical equivalent refraction. (Table 2 and Figures 5-7).

The corneal maps showed a nice regular pattern with a wide ablation zones (Figures 8-11). The surface quality of the treated corneas were exceptionally good. The complete reepithelialisation was achieved between the third and fifth day from the treatment. No corneal haze was observed during the whole follow-up (Figure 12).

Conclusions: LaserSoft is a very promising new surgery system with parameters well suited for customized laser ablation. The small true gaussian spot produces a very smooth and clear cornea during and after surgery.

Due to the high repetition rate (1kHz) the energy per pulse is lower then in excimer treatments. This leads to an ablation with strongly reduced stress waves. Experimental results and clinical data of patient treatments confirm high efficacy and safety of the refractive procedure performed with this device.