



New interactive platform to topographically verify the effective ablation rate of an ultrafast excimer laser with close loop feedback compensation

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iVis Suite



Precisio (iVis Technologies)

- Self evaluation of accuracy and repeatability ($<3\mu\text{m}$);
- Automated evaluation of surgical follow-up (Real PostOp topography vs Simulated PostOp topography)



pMetrics (iVis Technologies) :

- Binocular real time measurement of pupil dynamics;
- 6 different light conditions simulated;
- Active interface with platform components.



Cipta (iVis Technologies)

- Software to customize refractive and therapeutic treatments based on topographical information;
- Simulation of post operative cornea morphology and pachimetry.



Ires (iVis Technologies)

- Ultrafast excimer laser (1KHz);
- Autocalibration procedures;
- Beam size $<0.65\text{mm}$;
- Realtime cyclotorsional eyetracker;
- Constant energy per square millimeter;
- Energy coeff. value based on surgical follow up statistics.

Purpose

To verify the effective point by point stromal tissue removal by using an objective topographic automated procedure which has the capability to control the effective ablation performed on the patient cornea compared with the theoretical ablation pattern. Integrated software will automatically calculate a new laser coefficient to compensate possible discrepancies.

Materials and methods

- 50 eyes of 32 patients
- 32 patients : 11♂ and 21♀

Mean age 33.6 ± 5.07 yrs., range 23 to 48

Follow Up: 3 months

iVIS Platform:

Topographer: *Precisio*

Pupillometer: *pMetrics*

Custom Abl. Software: *Cipta*

Excimer Laser: *iRes*

FollowUp software: *iVerify*

iVerify FollowUp performed 60days after treatment

Data Analysis

During the postoperative period, every treated eye have been acquired by Preciso and a point by point comparison between simulated and real post operative topography have been automatically performed.

Preciso "weighted" the results throught the acceptance criteria which requires a platform accuracy within 3 microns.

All patients data have been collected and analyzed by a dedicated statistics software which verify if the actual "Laser Energy Coefficient" is working properly and it eventually suggest a new value for it.

Anterior Post-Op Difference Map

Max local diff. at 5mm: 8.0 μm at X= -2.40 Y= -0.70 mm

Total average diff. at 5mm: 1.6 μm

Hemi average diff. at 9mm: | 2.8 μm -- 0.2 μm / 0.4 μm \ 2.4 μm

Quad average diff. at 9mm: + 0.8 μm x 4.4 μm

Reciprocal rotational angle: 1.5°

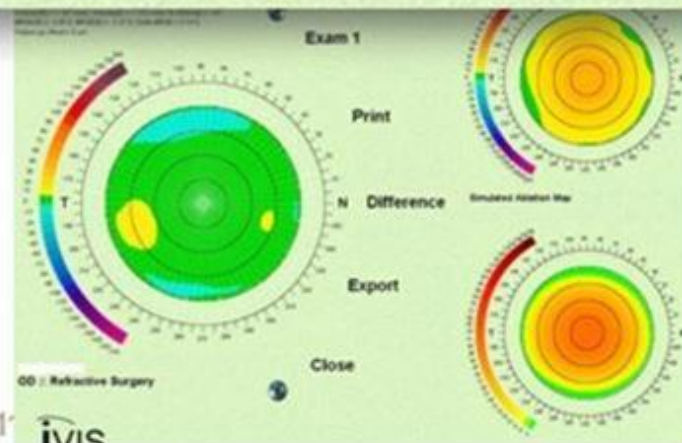
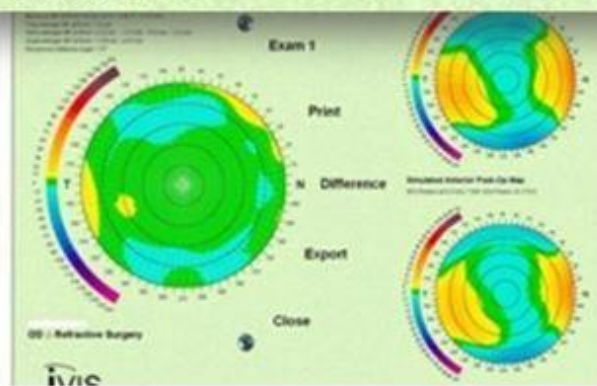
Ablation Difference Map

Max depth(R) = 50 μm ; Max depth(E) = 49 μm ; % D(R)/D(E) = 101

Volume(R) = 1.167 mmc; Volume(E) = 1.152 mmc % V(R)/V(E) = 101

MRSE(R) = -2.55 D; MRSE(E) = -2.37 D; Delta MRSE = 0.18 D

Follow-up Offset = 0 μm



Results

No adverse events have been reported.

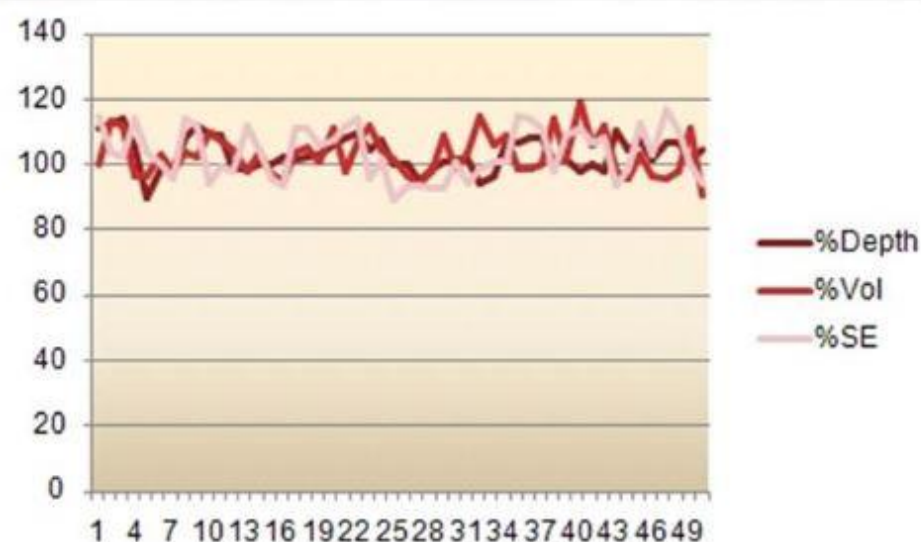
Every postop topography have been compared with simulated one and following are the results:

-Volume of Ablation → Real/Expected = MeanValue 103.66% ;

-Depth of Ablation → Real/Expected = MeanValue 104.84% ;

-Spherical Equivalent correction → Real/Expected = MeanValue 101.19%.

Unless the Volume and Depth of ablation were slightly overcorrected it was not subjectively evaluable. However based on this first statistics, a new energy coefficient have been automatically calculated to further improve the efficiency.



Conclusions

This new topographic automated procedure to numerically compare the theoretical ablation with effective ablation is a powerful suite to control all procedure in custom ablations giving a powerful and objective effort in surgical followup to understand the weak point of surgical procedure where the refractive outcome was not what desired and can compensate for.

