

Thermal effect and inflammation in laser refractive surgery



P. Garimoldi M.D., M. Rossi M.D., M. Schmidt M.D., S. Valzelli M.D.



Ospedale di Circolo di Busto Arsizio

Excimer laser refractive surgery produces heating of corneal surface.

Temperature elevation is one of the factor implicated in etiology of post op pain and haze

- **Maldonado et al** (cornea 2001) demonstrated a mean increase of temperature of 7.35°C during PRK on myopia between -2 and -10
- **Betney et al** (cornea 1997) demonstrated a mean temperature elevation from 29.15°C to 37.77°C
- **Niizuma et al** (J. Refract. Corneal surg.;1994) **Kitazawa et al** (J. Cataract Refract. surg. 1999) showed that the cooling of the cornea surface reduces pain, subepithelial haze and myopic regression
- **Stein et al.** (J. Refract. Surg. 1999) demonstrated cooling of the cornea significantly reduces haze in patients with myopia between -6 and -9.75
- **Kitazawa et al** (Surv. Ophthalmol., 1997) histological study showed that the cooling of the cornea surface reduces tissue damage related to subepithelial haze in live rabbit corneas treated with PRK

Purpose

- **To evaluate temperature increase of corneal surface produced by diode refractive laser and by excimer laser**
- **To compare the inflammatory effects and the visual recovery**

Methods

- **Temperature** of corneal surface were measured during laser treatments with thermocamera (thermaCAM s series)
- **Inflammation** was evaluated one day post op considering:
 - level of pain
 - conjunctival injection
 - eyelid oedema
 - corneal oedema
- **Visual acuity** was evaluated 10 and 30 days after surgery
- **Haze** was detected with slit lamp examination and graded
- **Confocal microscope** corneal examination was performed before surgery, 10 and 30 days after

Methods

- 62 eyes of 33 patients affected by myopia or/and myopic astigmatism (s. e. between -1 and -9) divided in 2 groups:
- 36 eyes treated with LaserSoft by Katana Technologies. A diode pumped solid state UV laser. Wavelength radiation of 208-210 nm.
- 26 eyes treated with Zeiss Asclepion Meditec MEL 70 excimer laser

Results

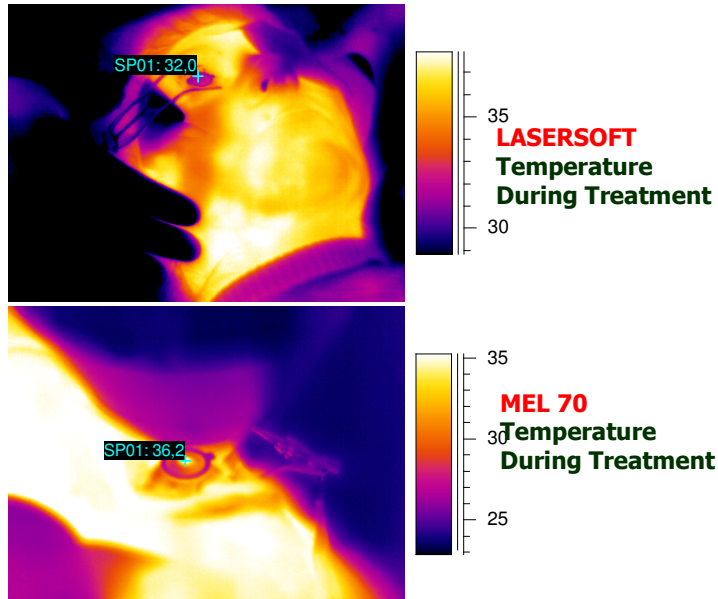
Temperature measurement

Mean temperature increase:

0.8°C in eyes treated with solid state diode laser (max: **1.3° C**)

5.3°C in eyes treated with excimer laser (max: **7° C**)

Corneal Temperature



Results Inflammation

Solid state diode laser

■ conjunctival injection

absent 39% (14 cases)

light 61% (22 cases)

■ eyelid oedema

11% (4 cases)

■ corneal oedema

0%

Excimer laser

absent 8% (2 cases)

light 46% (12 cases)

severe 46% (12 cases)

61% (16 cases)

3.8% (1 case)

Results Pain

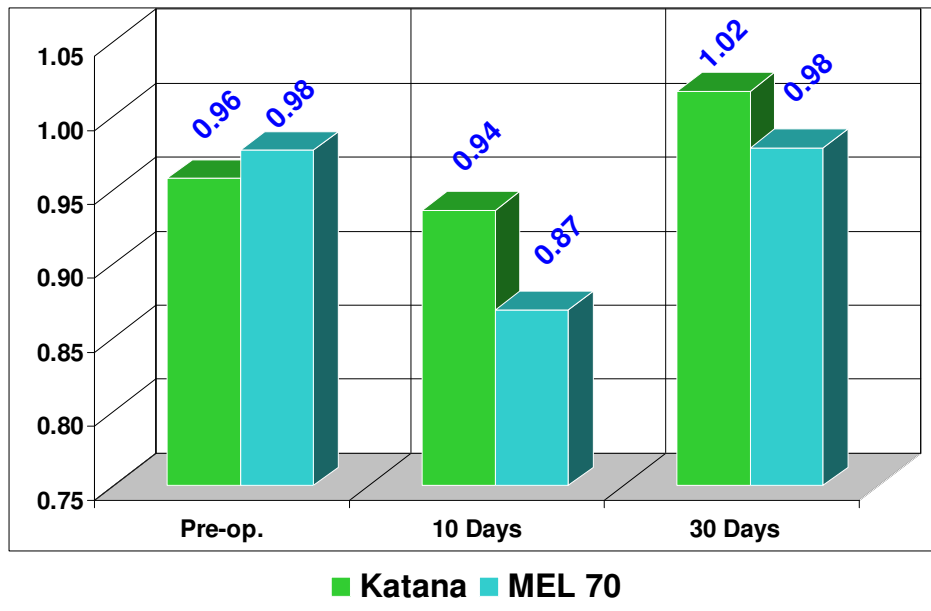
Solid state diode laser

- Absent
39% (14 cases)
- Light
33% (12 cases)
- Medium
14% (5 cases)
- Severe
14% (5 cases)

Excimer laser

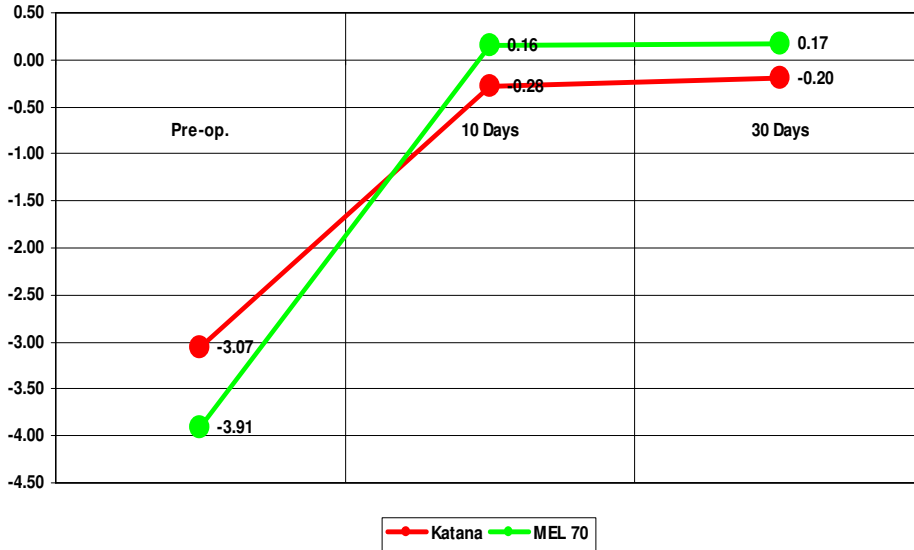
- 7.7% (2 cases)
- 30.8% (8 cases)
- 15.4 % (4 cases)
- 46.1% (12 cases)

Clinical Results - BCVA



Visual acuity

Clinical Results - Spherical Equivalent



Results

Haze 30 days post op

Solid state diode laser

Excimer laser

- **Grade 0:** clear cornea

| | |
|-----------------|----------------|
| 30 eyes (83%) | 6 eyes (23%) |
|-----------------|----------------|
- **Grade 0.5:** trace for faint corneal haze seen by indirect tangential illumination

| | |
|----------------|-----------------|
| 6 eyes (17%) | 18 eyes (69%) |
|----------------|-----------------|
- **Grade 1:** mild haze easily visible with direct focal illumination

| | |
|--------------|---------------|
| 0 eye (0%) | 2 eyes (8%) |
|--------------|---------------|

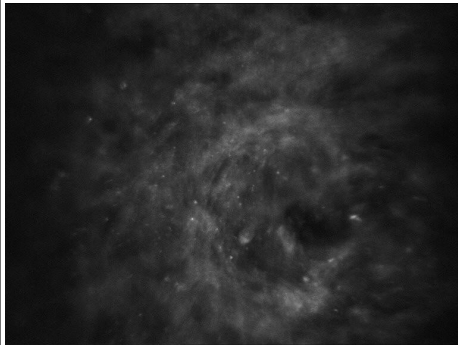
Results

Confocal microscope

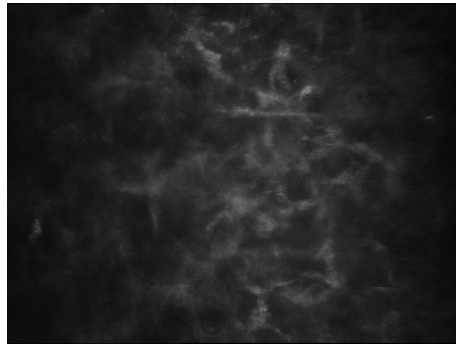
- Images of the anterior stroma taken just after laser treatment show a very reduced " shock glare " in corneas treated with solid state diode laser
- Keratocyte activation in anterior stroma is present in both groups of corneas after 10 and 30 days but is more severe in corneas treated with excimer laser

Shock acoustic glare

Excimer laser



Solid state diode laser



Conclusion

A reduced thermal effect in PRK reduces post op. pain and inflammatory effects (evidence of less stromal damage on confocal microscopy)

A reduced thermal effect is associated with a better and faster visual recovery and a less appearance of haze in the first 30 days after surgery