SELECTIVE LASER TRABECULOPLASTY: HYPOTENSIVE EFFICACY, ANTERIOR CHAMBER INFLAMMATION AND POSTOPERATIVE PAIN

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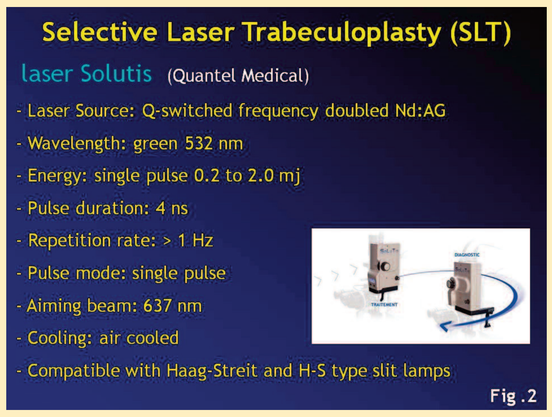
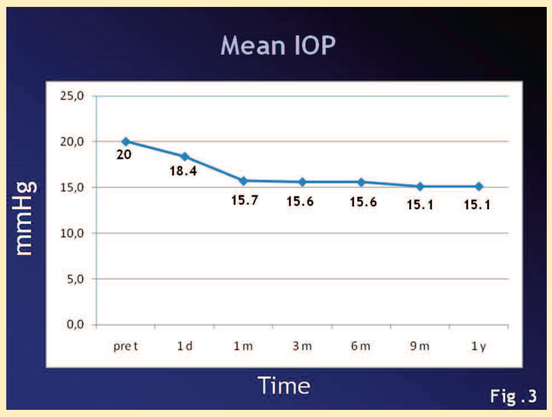
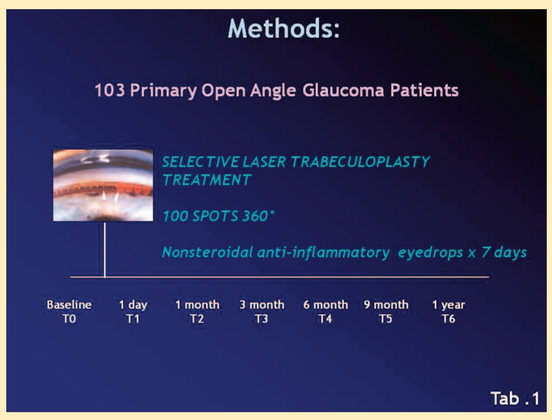
Introduction
Argon laser trabeculoplasty (ALT) has been purposed for intraocular pressure (IOP) lowering in patients with glaucoma by Wise e Witter in 1979[1] and more recently, in 1995 a frequency-doubled,Q-switched, neodymium:yttrium aluminium garnet (Nd:YAG) laser was developed to lower IOP[2]. It has the benefit of using 80-100 times less energy than ALT, preserving the trabecular meshwork architecture in animal models, and being potentially repeatible[3]. Selective laser trabeculoplasty (SLT) causes selective photothermolysis of pigmented trabecular cells without any collateral structural damage to the trabecular meshwork (TM)[4]. SLT as an adjunctive or a primary therapy marks an advancement in the tratment of open angle glaucoma. The aim of our study was to evaluate the safety and efficay of SLT to lower IOP in primary open angle glaucoma patients.

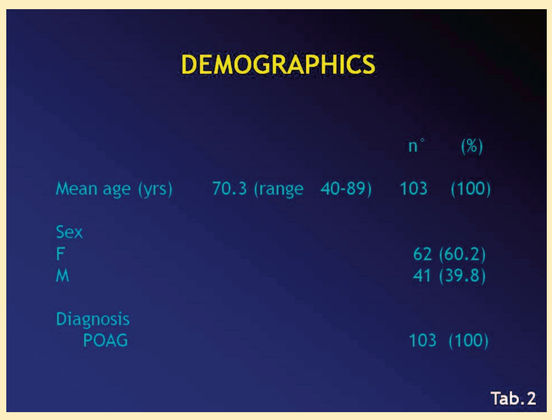


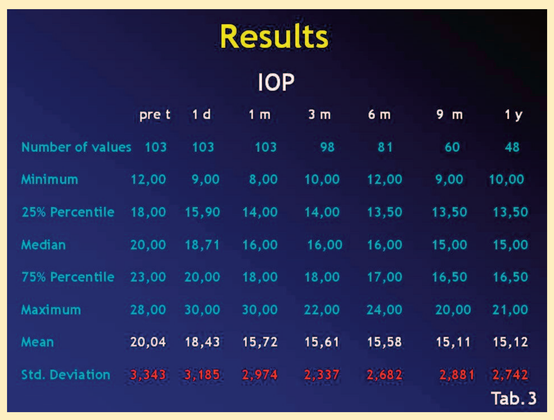


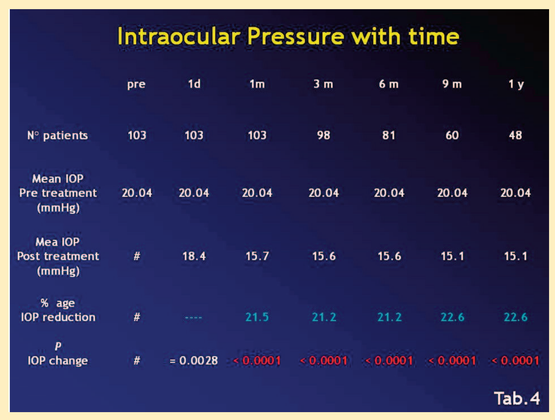
Methods
The patients already attending the glaucoma center at the Ophthalmology Unit of Unversity Hospital of Siena were included in a prospective clinical trial if they had primary open angle glaucoma requiring therapy in addition to their current medications. The therapy was recomended when patients were unable to reach their clinically determined target IOP while taking medications, were unable to tolarate the medications that were keeping IOP at an adeguate target level or were noncompliant with medication use. All of the patients had been fully informed about the procedure and informed consent was obtained from all of them.
Patients underwent a full ophthalmologic examination that included Snellen visual acuity, applanation tonometry, slitlamp examination with gonioscopy, pachimetry, evaluation of the optic disc and visual-field assessment (Humphrey 30-2 perimetry). The grade of pigmentation of the TM was assess before treatment.
On the day of SLT the only pretreatment preparation was topical anaesthesia with benoxinate hydrochloride 0.4% (Novesina 0.4%, Novartis Farma) eye drops. We used a new laser the Laser Solutis SLT laser (Quantel Medical, Clermont-Ferrand, France) a frequency doubled, Q-switched Nd:YAG laser emitting at 532 nm, with a pulse duration of 4 ns, a spot size of 400 µm and pulse Energy ranging from 0.2 to 2 mj, coupled to a Haag-Streit slit lamp (figg. 1-2). One Surgeon (PF) performed the laser procedure and the Latina SLT laser lent was used. Using a 400 µm spot the entire width of the trabecular meshwork was irradiated with each pulse. The laser energy was initially set at 0.7 mj and a single pulse was delivered at the 12 o'clock position. If cavitation bubbles appeared, the energy was reduced by 0.1 mj increments until no bubble formations were observed and treatment continued at this energy level. If no cavitation bubbles occurred, the energy was increate by increments of 0.1 mj until bubble formation and then decreased as describe above. The entir TM was treated with 100 non-overlapping spots. A drop of nonsteroidal anti-inflammatory agent was instilled after the SLT and the patients was advised to use the diclofenac sodium ophthalmic solution 0.1% (Voltaren Ofta, Novartis Farma) bid for 5 days. Treatment success for IOP control was defined as at least a 20% reduction from baseline measurement. The IOP in the treated eye was assessed and recorded 1 day, 1 moonth and every 3 months after treatment for one year (tab 1). Complete ophthalmic examination, gonioscopy, and visual field analysis were performed before, 6 months after and 1 year after treatment.
Statistical analysis was performer using a paired *t* test for paired data for assessing change in intraocular pressure from baseline values.

Results
Selective laser trabeculoplasty was performed in 103 eyes of 103 primary open angle glaucoma patients, 41 (39.8%) men and 62 women (60.2%) with a mean age of 70.3 years (range, 40-89 years) (tab.2). We esamine the safety and efficacy of the laser treatment to reduce IOP from its preoperative levels. The mean IOP prior the treatment was 20.04 mmHg ± 3.3 SD range 12-28 mmHg, one day after the treatment IOP was 18.43 ± 3.1 SD, range 9-30 (P= 0.002), 1 month after the treatment IOP was 15.7 mmHg ± 2.9 SD, range 8-30 (P< 0.001), 3 months after the treatment IOP was 15.7 mmHg ± 2.3 SD, range 10-22 mmHg (P< 0.001), after six months intraocular pressure was 15.5 mmHg ± 2.6 SD range 12-24 mmHg (P< 0.001), 9 months after the treatment IOP was 15.1 mmHg ± 2.8 SD range 9-20 mmHg (P< 0.001) and 1 year after the treatment IOP was 15.1 mmHg ± 2.7 SD range 10-21 mmHg (P< 0.001) (tab.3). Figure 3 graphically shows the IOPs over time for all treated eyes. Table 4 lists the mean change in IOPs and percent IOP reduction from baseline for all treated eyes. The greatest drop in IOP occurs after 9 months (22.6%) and then again at 1 year after the procedure. An IOP reduction of at least 20% after SLT was defined as a succesfull treatment and from 1 months after the treatment the averange percent IOP reduction from baseline for all treated eyes was 21,82% (4.62 mmHg). The average number of SLT spots was 100 and the average energy per laser spot was 1.17 mj +/- 0.12 SD (range, 0.8-1.5 mj). The mean trabecular meshwork pigmentation was 1.48 (range, 0-3). There were not any kind of complications during the treatment and after the treatments. One year follow up was not completed for 4 eyes for uncontrolled IOP or for visual fiel worsening (tab.5).
Anterior chamber reaction disappeared within 24 hours, 39 patients (37.8%) had a mild disconfort 1 day after the treatment and only 8 after 1 month. One day after the treatment no eyes show any sings of anterior chambre inflammation (flare in anterior chambre (AC) and Cells in AC) (tab.6). During follow up there were no change in visual acuity and no peripheral anterior sinechia were noted at gonioscopy 6 months and 1 year after SLT. In our study 95% of eyes treated had IOP reduction on 2 consecutive visits. As listed in table 7 before treatment the mean number of glaucoma medications for the treated eyes was 2.7 ± 0.9 SD remained essentially unchanged throughout the trial with 2.3 ± 0.5 at 1 year of follow-up.

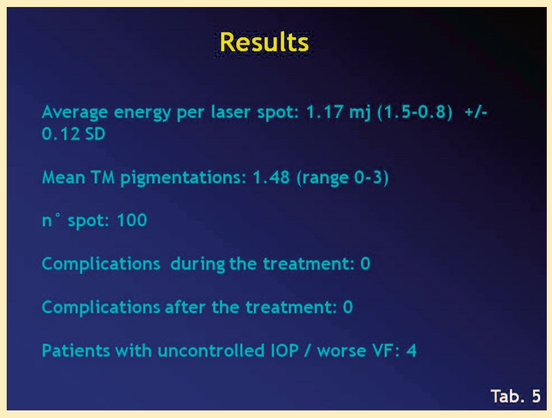


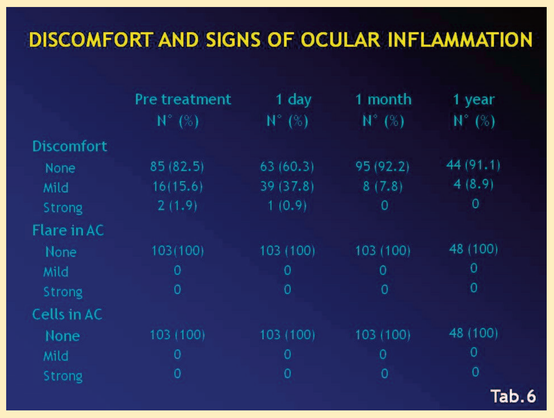


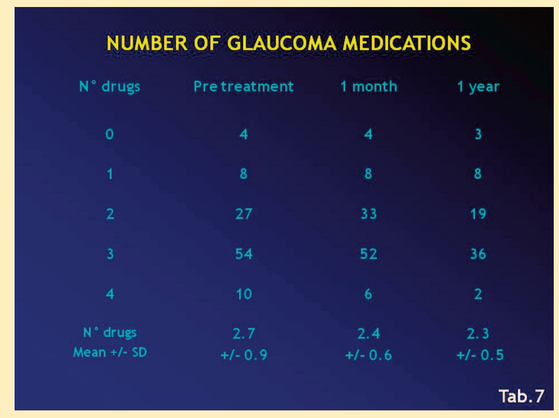




Conclusions
SLT is a potentially usefull addition to the techniques available for glaucoma therapy. The main advantage of SLT over traditional argon laser tecniques is considered to be the selective tageting of the pigmented trabecular meshwork cells, avoiding thermal damage to nonpigmented cells or other local structures, such as the scleral beams of meshwork tissue[5]. The results of our study show that selective laser trabeculoplasty is a safe and effective method of lowering IOP in patients with open-angle glaucoma. This is the first clinical trial using Laser Solutis SLT laser (Quantel Medical, Clermont-Ferrand, France) a frequency doubled, Q-switched Nd:YAG laser emitting at 532 nm. In our patients we found an important and statistically significant ($p<0.001$) reduction of intraocular pressure during the follow-up period of month 1 to 12 after the selective laser trabeculoplasty. None of our patients show "cellular" reaction 1 day after treatment.
In conclusion, in our study we demontstrated an IOP decrease after SLT that was similar to those reported by other clinical studies, althoug there was a lower tendency for reduced IOP response with a 12 months follow-up. As there were notcomplications this treatment modality may be a good alternative to long-term medical therapy in primary open angle glaucoma patients.







Reference
[1] Wise JB, Witter SL. Argon laser therapy for open angle glaucoma. Arch Ophthalmol 1979, 97: 319-22.
[2] Latina MA, Parck C Selective targeting of trabecular meshwork cells:in vitro studies of pulsed and CW laser interaction. Exp Eye Res 1995;60:359-71
[3] Noecker RJ, Kramer TR, Latina M, et al. Comparison of acute morphologic changes after selective laser trabeculoplasty and argon laser trabeculoplasty by electron microscopic evaluation. Invest Ophthalmol Vis Sci. 1998;9: S472
[4] Anderson RR, Parrish JA.Selective phototermolysis: precise microsurgery by selective absorpion of pulsed radiation. Science 1983;220:524-7.
[5] Latina MA, Gulati V. Selective laser trabeculoplasty: stimulating the meshwork to mend its ways. Int Ophtalmol Clin 2004;44:93-103.