LOW-LEVEL NON-INVASIVE LASER THERAPY FOR THE TREATMENT OF OCULAR REFRACTIVE DISORDERS

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Disclaimers

- Presentation author Jim Ohneck is not an equity shareholder in Oculatek, but does act in a Consultant capacity for them
- Presentation Co-author David Friess is not an equity shareholder in Oculatek, but does act in a Consultant capacity for them

- *Caution: Investigational device and limited to investigational use only in the U.S.*

Oculatek, Inc.

- Oculatek, Inc. based in Cleveland, OH, is a privately held corporation formed in 2006 to adapt a novel, therapeutic, non-surgical ophthalmic technology utilizing low intensity light to treat vision disorders, such as progressive myopia and presbyopia.
- Oculatek has the world wide patent rights to the technology used in the device.

What is Trans-scleral Laser Therapy

- Trans-scleral laser therapy is a technique to eliminate the accommodation derangement and normalize ciliary muscle function.
- The effect of infrared low energy laser radiation on the ciliary muscle has been demonstrated to increase metabolism in the cells of the ciliary body and to improve ocular hemodynamics.

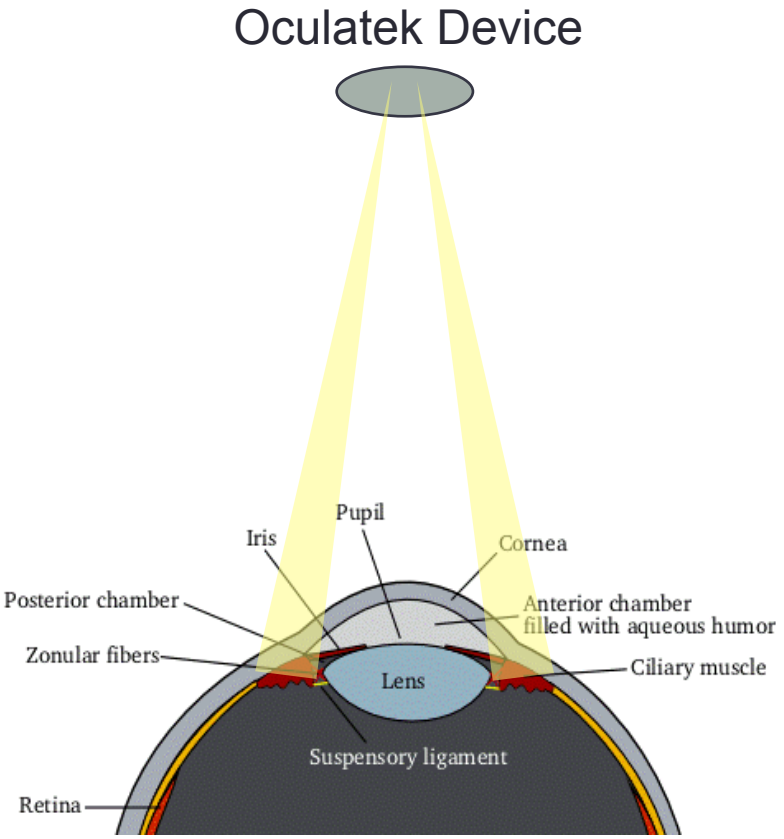
History of Technology

- In 1991-1994, specialists of the Helmholtz Moscow Research Institute of Eye Diseases, in cooperation with experts at MACDEL company in Moscow, developed and performed experimental and clinical testing of the curing method for eye accommodation disorders for myopia and visual fatigue. This method provided trans-scleral contact free influence on the ciliary muscle using infrared laser radiation with the wavelength of 1300nm.

(E.B. Anikina, E.I. Shapiro, and 6, G.L. Gubkina, 1994; E.S. Avetisov et al., 1997)

How It Works

- Directs low energy infrared light at ciliary muscle
- Wavelength selected to optimize photo-biological effect
- Stimulates mitochondrial function, increases blood flow, and ciliary muscle strength and mobility
- Improves lens movement and accommodation reserve
- Improvement seen after three treatments of 9 minutes each



How It Is Administered

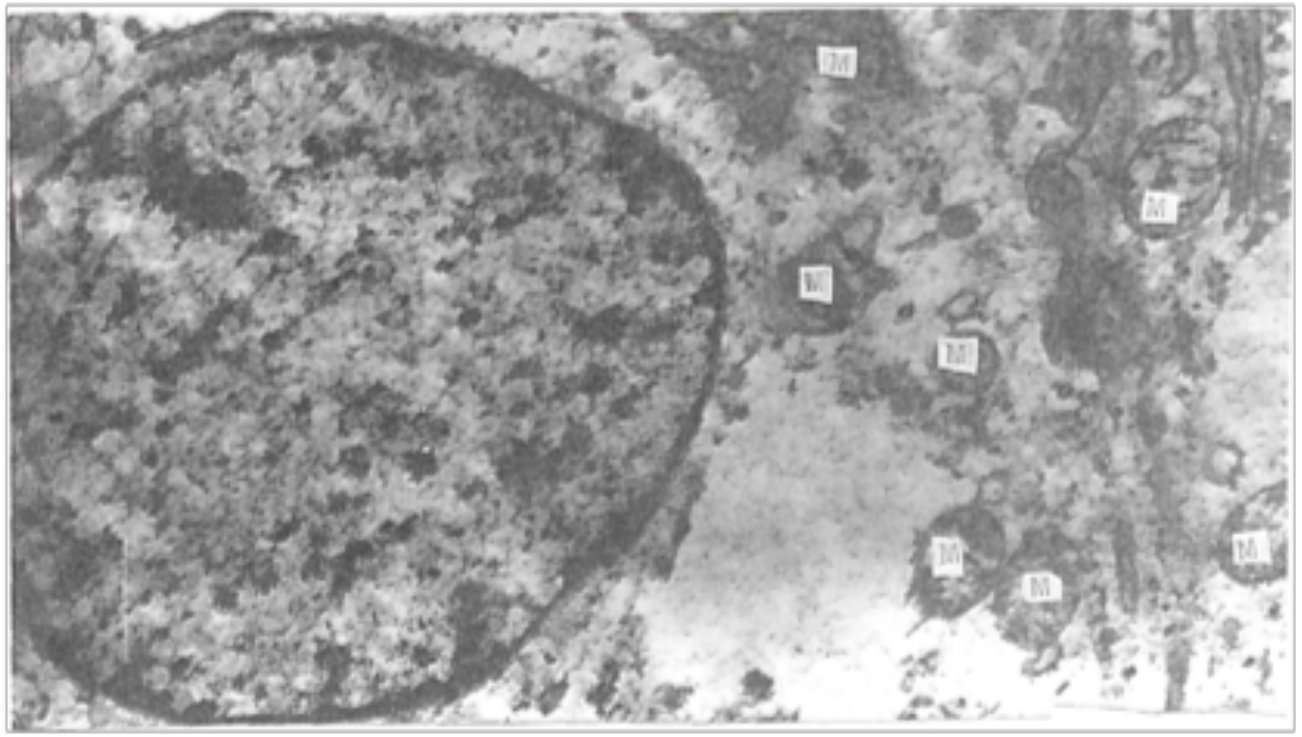
Eye Tissue Study (experimental)

- Laser beam targeted through sclera at prelimbic areas of ciliary body projection in 3 and 9 hour zones of rabbit eyes. Irradiation by 0.2 J/cm^2 (low radiation) and 2 J/cm^2 (high radiation) for three minutes over ten sessions.
- After irradiation 7 and 30 days, respectively, 22 Chinchilla rabbit eyes were enucleated and morphological study was performed. Six non-irradiated eyes were taken for control.

Eye Tissue Study (highlights)

- Morphological studies showed no destructive changes in any of the treated eyes.
- Low energy doses (0.2 J/cm^2) caused positive effect intensifying metabolic activity of both epithelial cells and connective tissue of ciliary body.
- An assembly of mitochondria, higher expressed than in control was observed. This is associated with intensification of oxygen dependent processes aimed at activation of intracellular metabolism.
- Histochemical studies indicated accumulation of glycosaminoglycans in the connective tissue of the ciliary body that were not present in the control.
- High dose radiation did not appear to have the same effect.

Epithelial Cell from Rabbit Study



Ultrastructure of epithelial cell in the ciliary body after low energy laser irradiation. Multiple mitochondria (M) in the cell cytoplasm; ×14,000.

Experimental to Clinical Study Model

- Positive experimental results led to clinical study methodology.
- At the sclera level the 1300nm radiation was set to 2mw, this dose was 2 orders of magnitude below the MPL (maximum permissible level) (S.D. Plentev, 1981).
- At the ciliary body level the laser intensity density with respect to the scleral transparency is less than 10^{-3} W/cm^2
- The same 3 and 9 hour zones were used and each zone was irradiated for 3 minutes.
- Energy exposure at ciliary body equaled 0.2 J/cm^2, 100 times below MPL.

“Trans-scleral Laser Effect on Weakened Ciliary Muscle”, G.L Gubkina

- In 1992-1994 clinical studies were performed on 68 children (136 eyes) aged 7-17 with progressive myopia from 0.5 to 3.0 D.
- Laser radiation effect on eye accommodative ability of eyes was assessed by measuring relative accommodation, the nearest point of clear vision and from rheoophthalmography results.

Positive accommodation changes

Day of laser stimulation	The average value of relative positive accommodation in children		
	7-9 year old	10-12 year old	13-16 year old
1	1.3	1.4	1.8
2	1.3	1.6	2.2
3	1.4	2.3	3.2
4	1.7	2.9	4.3
5	2.5	3.4	4.9
6	3.4	3.9	4.9
7	3.9	3.9	4.9
8	3.9	3.9	4.9
9	3.9	3.9	4.9
10	3.9	3.9	4.9

The change of relative positive accommodation (D) by days of laser stimulation

Nearest Point of Clear Vision, cm

Age of children	Number of children	Nearest point location		Average approach, cm
		Before treatment	After treatment	
7-9	17	M = 7.86 m = ±0.32 σ = ±1.18	M = 6.92 m = ±0.19 σ = ±1.17	0.94
10-12	29	M = 7.51 m = ±0.54 σ = ±1.90	M = 6.35 m = ±0.08 σ = ±0.62	1.16
13-16	22	M = 7.86 m = ±0.39 σ = ±1.71	M = 6.59 m = ±0.07 σ = ±0.65	1.27
7-16	68	M = 7.74 m = ±0.36 σ = ±1.55	M = 6.58 m = ±0.14 σ = ±0.81	1.16

Location of the nearest point of clear vision before and after laser stimulation

Rheographic Coefficient

Number of studied eyes	Rheographic coefficient P (‰)	
	Before treatment	After treatment
108	M = 2.07 m = ±0.21 σ = ±0.61	M = 3.44 m = ±0.03 σ = ±0.85

Rheographic coefficient in children with lower myopia before and after laser stimulation

Dynamics of Relative Accommodation (RAR)

Age of children	Number of children	Positive (reserve) relative accommodation (diopters, D)					
		Before treatment	10 days after	1 month after	3 months after	6 months after	1 year after (6 months after repeated course)
7-9	17	M = 1.64 m = ±0.15 σ = ±0.86	M = 3.69 m = ±0.22 σ = ±0.15	M = 3.89 m = ±0.28 σ = ±0.99	M = 2.86 m = ±0.21 σ = ±1.20	M = 1.88 m = ±0.16 σ = ±0.89	M = 2.97 m = ±0.23 σ = ±1.29
10-12	29	M = 1.75 m = ±0.33 σ = ±0.76	M = 3.86 m = ±0.25 σ = ±0.71	M = 4.66 m = ±0.21 σ = ±0.92	M = 3.67 m = ±0.22 σ = ±0.89	M = 2.15 m = ±0.38 σ = ±0.81	M = 3.54 m = ±0.25 σ = ±0.91
13-16	22	M = 2.05 m = ±0.28 σ = ±1.12	M = 3.74 m = ±0.24 σ = ±0.81	M = 3.75 m = ±0.18 σ = ±1.71	M = 2.75 m = ±0.15 σ = ±1.01	M = 2.21 m = ±0.29 σ = ±1.18	M = 3.62 m = ±0.23 σ = ±0.82
7-16	68	1.5	4.2	4.1	3.09	2.08	3.38

Dynamics of relative accommodation reserve (RAR) in myopic children in different periods after laser stimulation

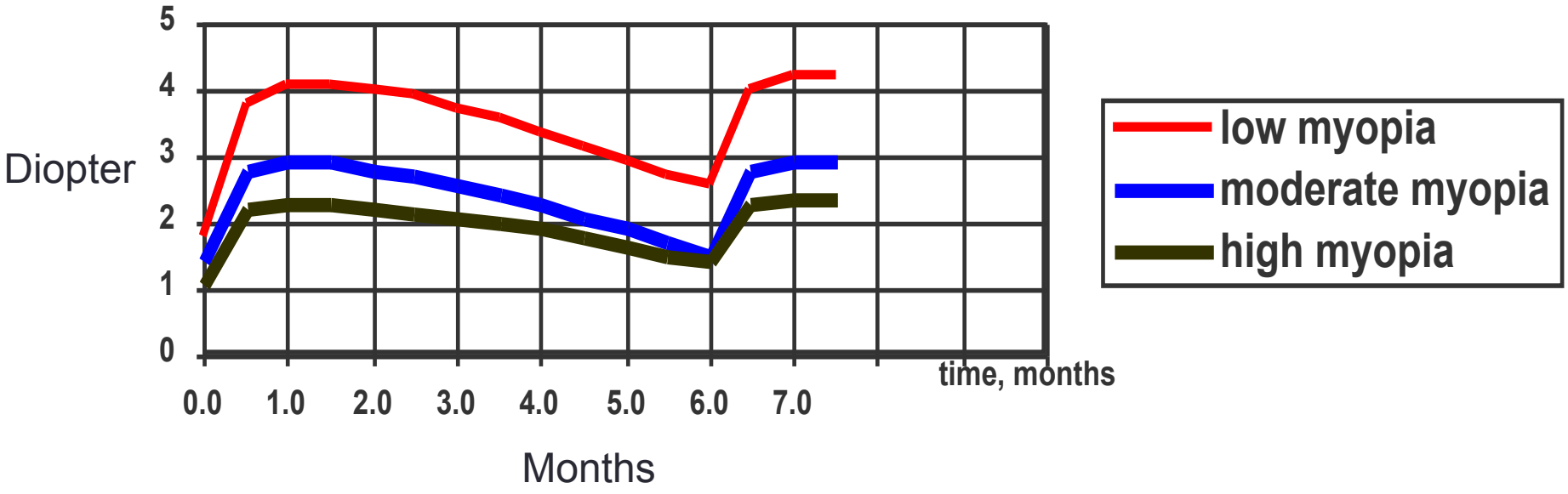
Summary of Studies

Study	Years	Test Subjects	Outcome
Progressive Myopia	8	164	With Device 4.8D/Without 7.3D
Low Myopia	3	117	Stabilization with device in 60% of patients versus 28% without
Eye Fatigue PC use	1	Flight personnel	Increase accommodation reserve Improvement in distance vision Improvement in contrast sensitivity Improvement in visual acuity
Biological effects		22 Rabbits	No change to corneal epithelium collagen of corneal plates in tact endothelial layer, no pathology of iris, lens, episclera and sclera

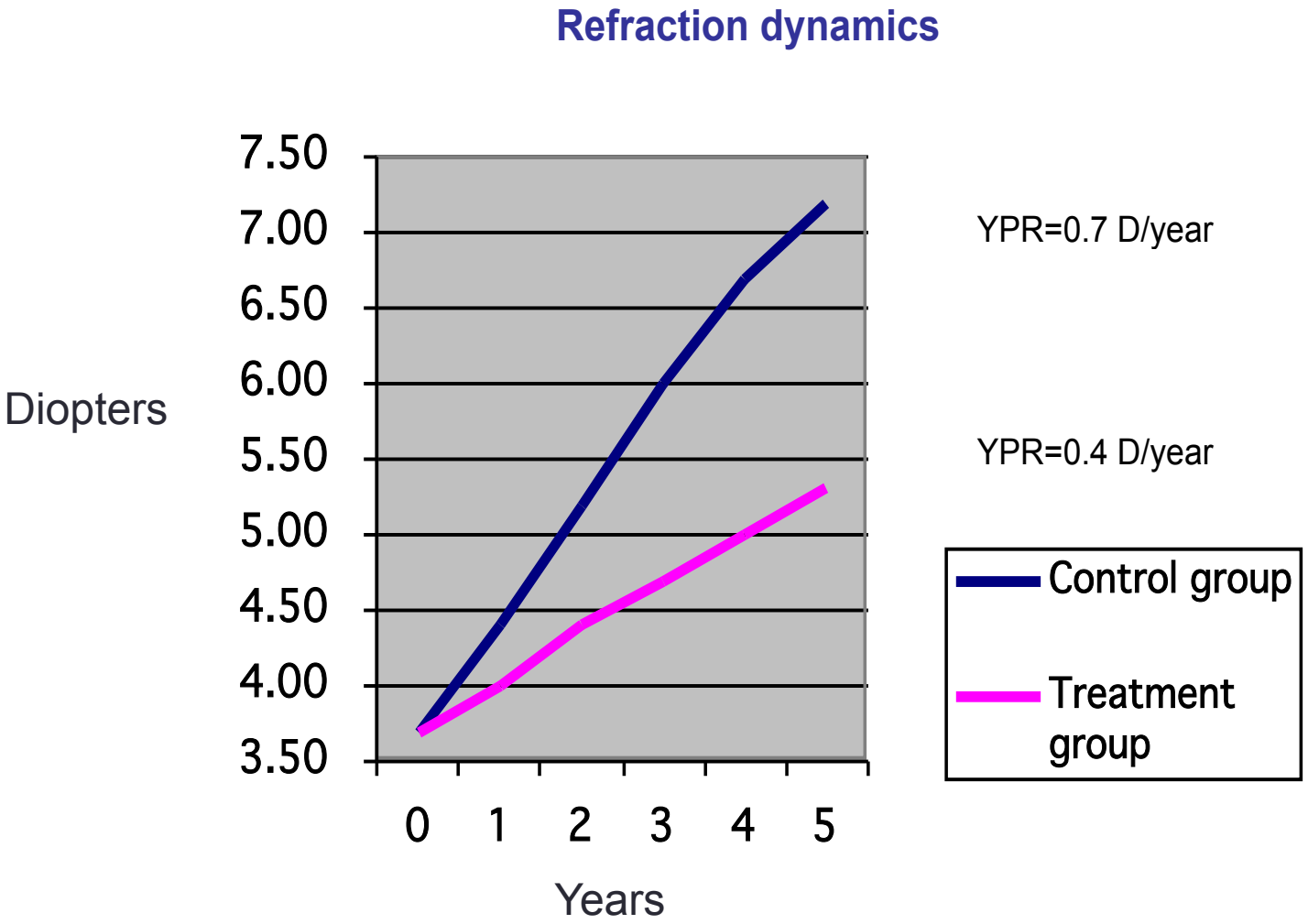
In total fourteen Studies over a fifteen year period!

Changes Over Time

Dynamics of accommodation reserve change



Five Year Refraction Changes



Early Studies in Presbyopia (USA)

- Zelman Study, Ophthalmologist in West Chester, NY - 2007 - 12 patient study
- Results
  - 100% of emmetropes with an initial ADD between 2D-3D eliminated their reading glasses
  - 75% of patients with < 2D ADD whether emmetropes or not eliminated their readers
  - Remaining patients had reduced need for readers
  - Subjectively 72% of the patients were either very satisfied or satisfied with their result

Early Studies in Presbyopia (USA)

Kassalow: Optometrist in New York, NY -2008 - 12 patient IRB approved study

3 treatments of 9 minutes versus recommended protocol of 6 treatments at 9 minutes
Tear test and IOP measured after each treatment
No adverse reactions or events

•Results

67% Positive change after only three 9 minute treatments
6 patients .5 diopters or more change
3 patients 1.25 or more
1 patient 1.75 change
3 Patients eliminated readers
5 reduced the dependence to 75%
4 reduced some dependency by 25%

The Future of Trans-scleral Laser Therapy

- Device is not FDA cleared at this time
- Larger clinical trial needed for FDA clearance
- Regulatory expectation is a Denovo 510(k)
- Technology is sold today in Eastern Europe
- Therapeutic device is a different approach here in the USA

Oculatek
Advanced Vision Therapy