



## RETINITIS PIGMENTOSA LITERATURE

### **Slowing the degenerative process, long lasting effect of hyperbaric oxygen therapy in retinitis pigmentosa.**

Graefes Arch Clin Exp Ophthalmol. 2008 Jan;246(1):93-8. Epub 2007 Aug 3.

**Vingolo EM, Rocco M, Grenga P, Salvatore S, Pelaia P.**

**BACKGROUND:** Retinitis pigmentosa (RP) therapy is still an unsolved challenge. Recent reports have underlined that hyperbaric oxygen (HBO) therapy could play a role in slowing the retinal degenerative process. The aim of this study was to assess the efficacy of HBO therapy on visual function in RP patients. **METHODS:** We performed a single-center, comparative, longitudinal case-controlled randomized clinical trial, which lasted 10 years. We randomly divided RP patients into two groups. Group 1, the control group, consisted of 44 RP patients (21 males and 23 females; mean age 35.5) who took Vitamin A. Group 2, with 44 RP patients (21 males and 23 females; mean age 35.02), underwent HBO therapy. No statistically significant difference was found at the beginning of the study between the two groups. We compared the results concerning visual acuity, Goldmann perimetry, static perimetry Humphrey field analyzer (HFA), and electroretinogram (ERG) obtained in the two groups at 5 and 10 years follow-up. Statistical analysis was performed with Kaplan-Meier life-table with the evaluation of log-rank coefficient. **RESULTS:** At 5 year follow-up, 87.5% of group 2 patients preserved 80% of the initial visual acuity, while the same result was achieved in only 70.4% of group 1 patients ( $X(2) = 8.2$ ;  $p < 0.01$ ); at 10 year follow-up, 63.33% of group 2 patients preserved 80% of the initial visual acuity, while the same percentage of residual visual acuity was maintained in 40% of group 1 patients ( $X(2) = 3.22$ ;  $p = 0.05$ ). At 10 year follow-up, Goldmann perimetry (target I4e) did not change in 31.6% of group 2 and in 10.5% of group 1; evaluation of mean defect (MD) with static perimetry HFA showed that 53% of HBO patients had 80% of residual mean sensitivity compared to 23.5% of the control group patients ( $X(2) = 4.72$ ;  $p = 0.035$ ). ERG b-wave mean values at the end of the protocol were significantly higher in the HBO treated group ( $X(2) = 4.53$ ;  $p = 0.013$ ). **CONCLUSION:** Our study underlines that HBO therapy can be a safe alternative approach to RP patients, contributing to the stabilization of their visual function concerning visual acuity, visual field, and ERG responses while waiting for a definite cure.

### **Long-term outcome of hyperbaric oxygen therapy for retinitis pigmentosa.**

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ATSUMI KAZUNARI(Sogo Kami-Iida Daiichi Byoin) OKITA KAZUHISA(Sogo Kami-Iida Daiichi VOL.56;NO.6;PAGE.1126-1128(2002)

We treated 28 patients with typical retinitis pigmentosa using hyperbaric oxygen therapy. Their ages ranged from 29 to 82 years, average 57 years. The patients were placed for one hour in a capsule containing 100% oxygen at 2 atmospheric pressure. The treatment was repeated for 20 consecutive days. The patients were followed up for 1 to 10 years, average 5.1+-.3.1 years. Log visual acuity averaged -0.99+-.0.87 before treatment, -0.61+-.0.76 ( $p < 0.00001$ ) one year after, and -0.11+-.1.1 ( $p = 0.32$ ) at the last observation. Critical fusion frequency (CCF) averaged 23.6+-.13 before treatment, 35.4+-.8.5 ( $p < 0.00001$ ) one year after, and 22.9+-.12 ( $p = 0.76$ ) at the last observation. Subjective symptoms improved in 79% of patients immediately after treatment and in 21% at the last observation. The findings show that hyperbaric oxygen therapy may not be effective for retinitis pigmentosa on a long-term basis.



## RETINITIS PIGMENTOSA LITERATURE

### **Retinal degeneration and local oxygen metabolism.**

Exp Eye Res. 2005 Jun;80(6):745-51.

**Yu DY, Cringle SJ.**

Vision loss due to various forms of outer retinal degeneration remains a major problem in clinical ophthalmology. Most retinal degenerations are precipitated by genetic mutations affecting the retinal pigment epithelium and sensory retina, but it is becoming increasingly evident that resultant metabolic changes within the retina may also contribute to the further progression of photoreceptor cell loss. In particular, a role for the local oxygen environment within the retina has been proposed. The correct balance between retinal oxygen supply and oxygen consumption in the retina is essential for retinal homeostasis, and disruption of this balance is a factor in many retinal diseases. In animal models of photoreceptor degeneration, manipulation of environmental oxygen levels has been reported to be able to modulate the rate of photoreceptor degeneration. Clinically, hyperbaric oxygen therapy has already been used in retinitis pigmentosa patients and other types of oxygen therapy have been proposed. It therefore seems appropriate to review our current understanding of the oxygen environment in the normal and degenerating retina, and to build a clearer picture of how the retinal oxygen environment can be modulated. We focus on techniques that have been, or may be, applied clinically, such as modulation of systemic oxygen levels and modulation of retinal oxygen metabolism by light deprivation. Data from direct measurements of intraretinal oxygen distribution in rat models at different stages of photoreceptor degeneration will be reviewed. These models include the Royal College of Surgeons (RCS) rat, and the P23H rat model of outer retinal degeneration. Microelectrode based techniques have allowed the intraretinal oxygen distribution to be measured as a function of retinal depth under well-controlled systemic conditions at different stages of the degeneration process. Both models showed changes in the intraretinal oxygen distribution during the degenerative period, with the changes reflecting the gradual loss of oxygen metabolism of the degenerating photoreceptors. This results in higher than normal oxygen levels in the remaining outer retina and a significant alteration in the oxygen flux from the choroid to the inner retina. The maintenance of normal oxygen levels in the inner retina implies that inner retinal oxygen uptake is well preserved, and that there is also reduced oxygen input from the deeper capillary layer of the retinal circulation. Choroidal oxygen tension and the oxygen tension in the pre-retinal vitreous were unaffected at any of the time periods studied prior to, and during, the degeneration process. It is well known that both hypoxia and hyperoxia can cause neural cell stress and damage. Logically, any therapeutic intervention based on oxygen therapy should attempt to restore the oxygen environment of the remaining retinal cells to within the physiological range. Before any oxygen based therapies for the treatment of retinal degeneration should be seriously considered, the oxygen environment in the degenerating retina should be determined, along with clinically usable methods to restore the oxygen environment to the critical cell layers.



## RETINITIS PIGMENTOSA LITERATURE

### **Does hyperbaric oxygen (HBO) delivery rescue retinal photoreceptors in retinitis pigmentosa?**

Doc Ophthalmol. 1998-1999;97(1):33-9.

**Vingolo EM, Pelaia P, Forte R, Rocco M, Giusti C, Rispoli E.**

As previously reported in the literature, hyperbaric oxygen delivery seems to modify the natural course of retinitis pigmentosa. In order to evaluate these first encouraging data, 48 affected subjects were separately studied in two subgroups (cases and controls). All patients underwent yearly an ophthalmological examination completed by a maximum amplitude electroretinogram, conducted according to our 'differential derivation' system, a new recording technique specifically designed to enhance the signal-to-noise ratio. Oxygen delivery was provided regularly for 90 min daily (2.2 Absolute Atmosphere) in three cycles according to a standard protocol. In the cases, electroretinographic mean values were as follows: at T0 (basal) 4.68 +/- 3.81 microV; after one year (T1) 8.46 +/- 5.71 microV; at two years (T2) 10.7 +/- 7.6 microV; at the end of the study (T3) 14.4 +/- 11.7 microV. In the controls, electroretinographic mean values were as follows: at T0 4.92 +/- 3.05 microV; at T1 5.04 +/- 3.07 microV; at T2 3.46 +/- 2.77 microV; at T3 2.97 +/- 3.61 microV. Amplitudes showed a remarkable ( $p < 0.001$ ) increase in the cases, while a slightly significant ( $p < 0.02$ ) decrease was evident at the end of the study in the controls. In our opinion, retinal oxygen availability may be critical in retinal degeneration and hyperbaric oxygen delivery, inducing hyperoxia, seems to be able to bring about the rescue of the retinal photoreceptors helping them in their metabolic requirements. Unfortunately, our study demonstrates an increase in electroretinographic responses only, which may not necessarily also mean an evident change in visual acuity.