

# Plasma Concentrations of Thiols and Malondialdehyde in Patients with Age-Related Macular Degeneration Treated by Major Ozonated Autohaemotherapy

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**SUMMARY** - We measured the plasma levels of SH protein and malondialdehyde expressed as thiobarbituric acid reactive substances (TBARS) in 15 healthy subjects and in 15 patients with age-related macular degeneration before and after treatment with major ozonated autohaemotherapy. Patients showed an increase in SH protein groups and a decrease of TBARS after 12 sessions of major ozonated autohaemotherapy, with an improvement in quality of life.

## Introduction

Age-related macular degeneration (AMD) is an acquired degenerative disease of the retina affecting individuals over the age of 55 years. The disease has a major social impact as it is a leading cause of blindness in the Western world. Changes in central vision at onset and during the disease course cause considerable disability and have a major impact on quality of life<sup>1,2</sup>.

The causes of AMD are multifactorial and in addition to age risk factors include arterial hypertension, obesity and a diet poor in antioxidants.

Oxidative neurotoxic damage to the retinal pigment epithelium plays an important role in AMD pathogenesis with the formation of free radicals in the retina. AMD can therefore be considered a disease caused by chronic oxidative stress in which pathological changes occur following the imbalance between the body's antioxidant and oxidant substances.

Treatment to date has consisted in the administration of antioxidant supplements, but no studies have yet demonstrated the true benefits of vitamin and mineral intake in patients with AMD<sup>3</sup>. Many AMD patients have been treated at our institution using major ozonated autohaemotherapy (MAHT) with the aim of reducing chronic oxidative stress. To assess possible changes in plasma antioxidant and oxidant levels during ozone therapy, we measured some indices of the redox balance like plasma

thiols – the main antioxidants against free radicals, and plasma malondialdehyde expressed as thiobarbituric acid reactive substances (TBARS), deemed an important index of lipid peroxidation.

We report the basal values of thiols and malondialdehyde in healthy subjects and AMD patients and the changes in the redox balance measured after MAHT in AMD patients.

## Materials and Methods

Fifteen healthy control subjects (*group 1*) and 15 patients with age-related macular degeneration (*group 2*) were enrolled in the study. Control subjects were matched with AMD patients in terms of age, sex and anthropometric characteristics.

Three ml of blood were taken from all subjects in groups 1 and 2 and centrifuged. SH protein groups and malondialdehyde were measured and expressed as thiobarbituric acid reactive substances (TBARS) as reported elsewhere<sup>4</sup>.

Group 2 patients underwent a cycle of 12 twice weekly treatments of MAHT at an ozone concentration of 60 mg/ml. At the end of the twelfth treatment session blood samples were taken to measure SH protein groups and plasma malondialdehyde.

All patients completed the cycle of treatment without no side-effects and with a general improvement in quality of life.

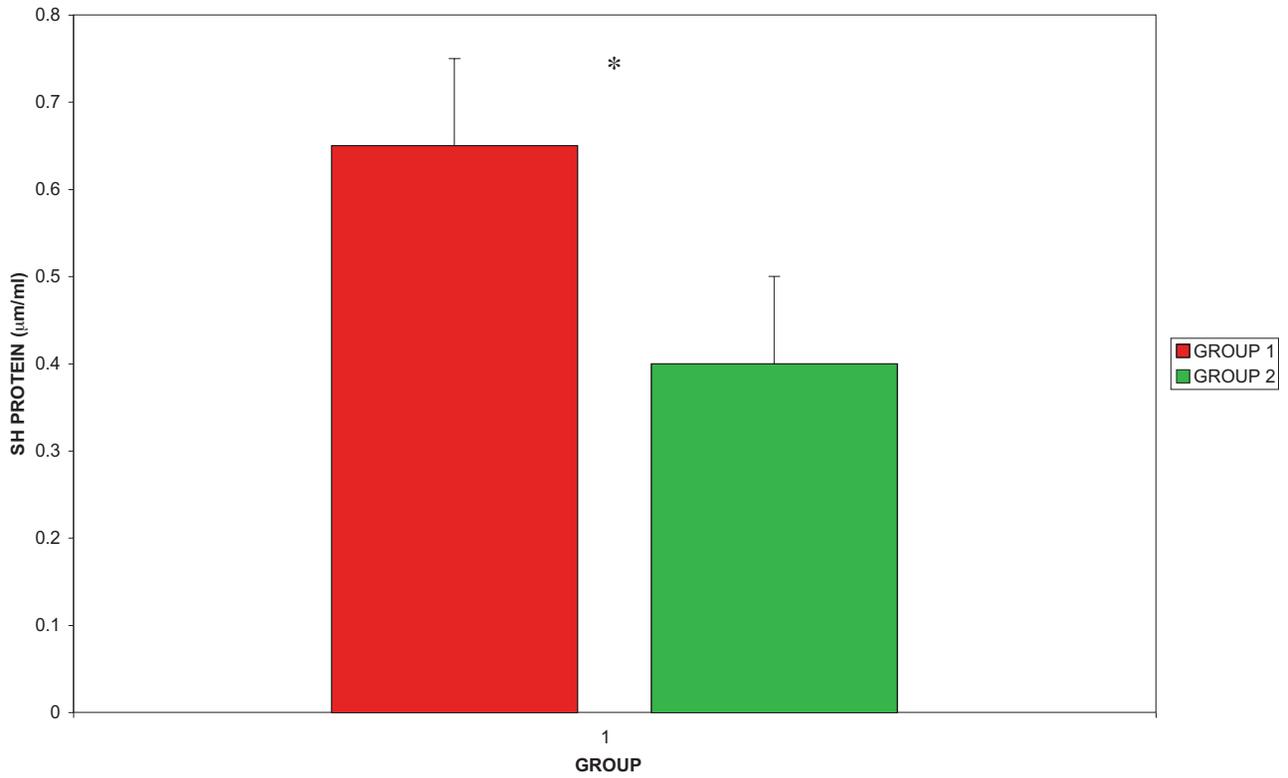


Figure 1 Protein SH values in the control group (group 1) and in AMD patients (group 2):  $p < 0.05$  between the two groups.

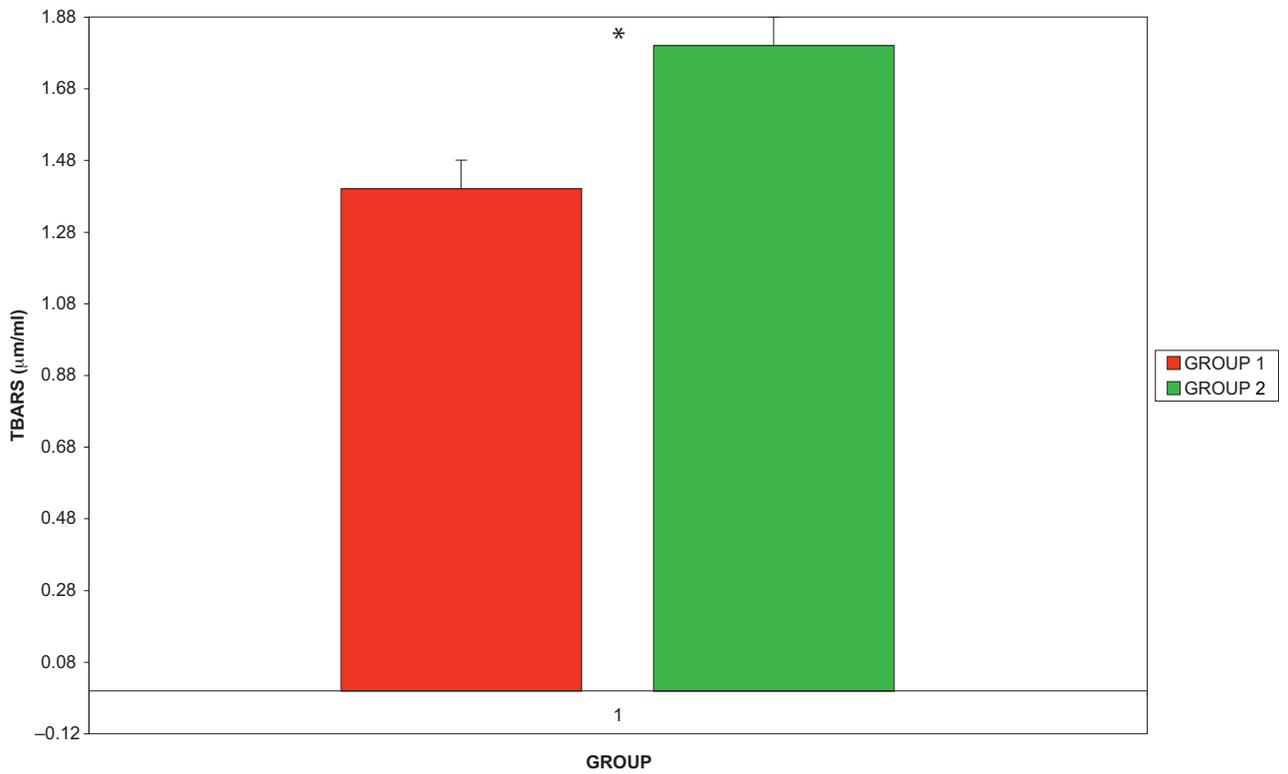


Figure 2 Malondialdehyde values (TBARS) in the control group (group 1) and in AMD patients (group 2):  $p < 0.05$  between the two groups.

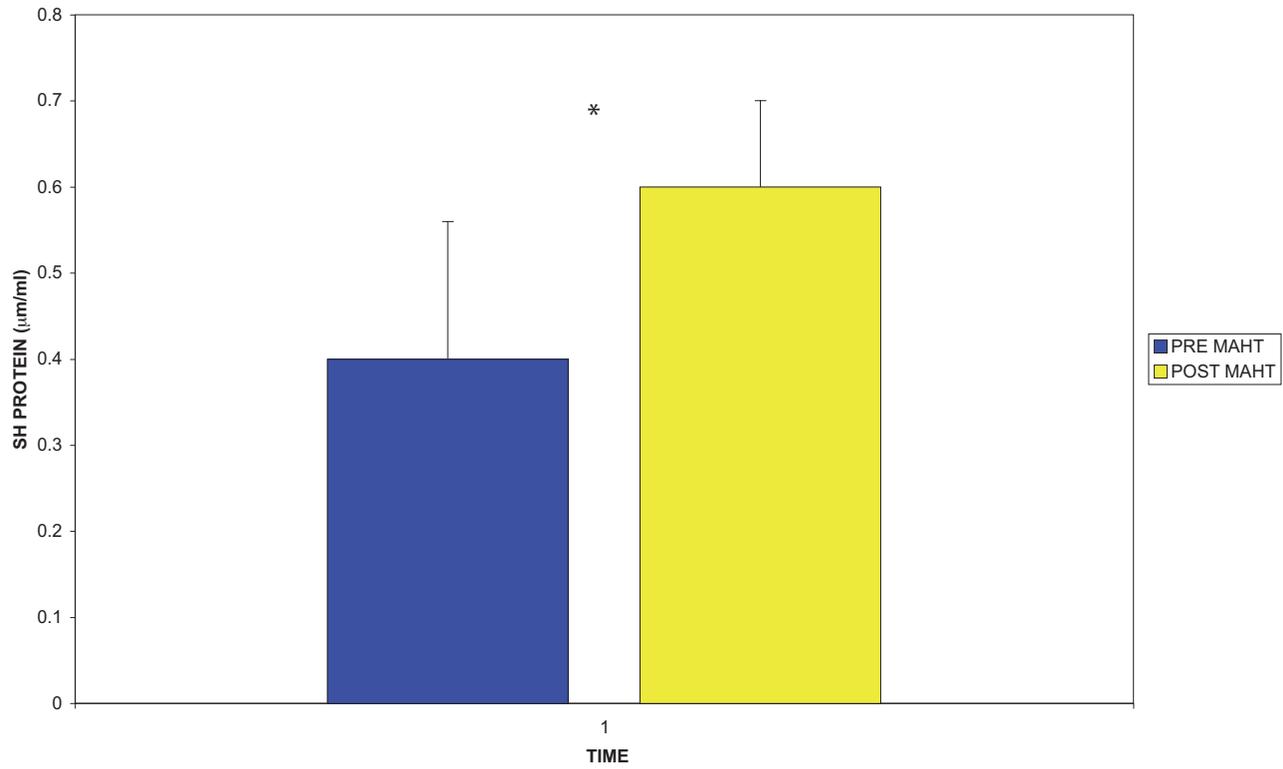


Figure 3 Comparison between values of SH protein before and after the cycle of major ozonated autohaemotherapy (pre MAHT – post MAHT) in AMD patients:  $p < 0.05$ .

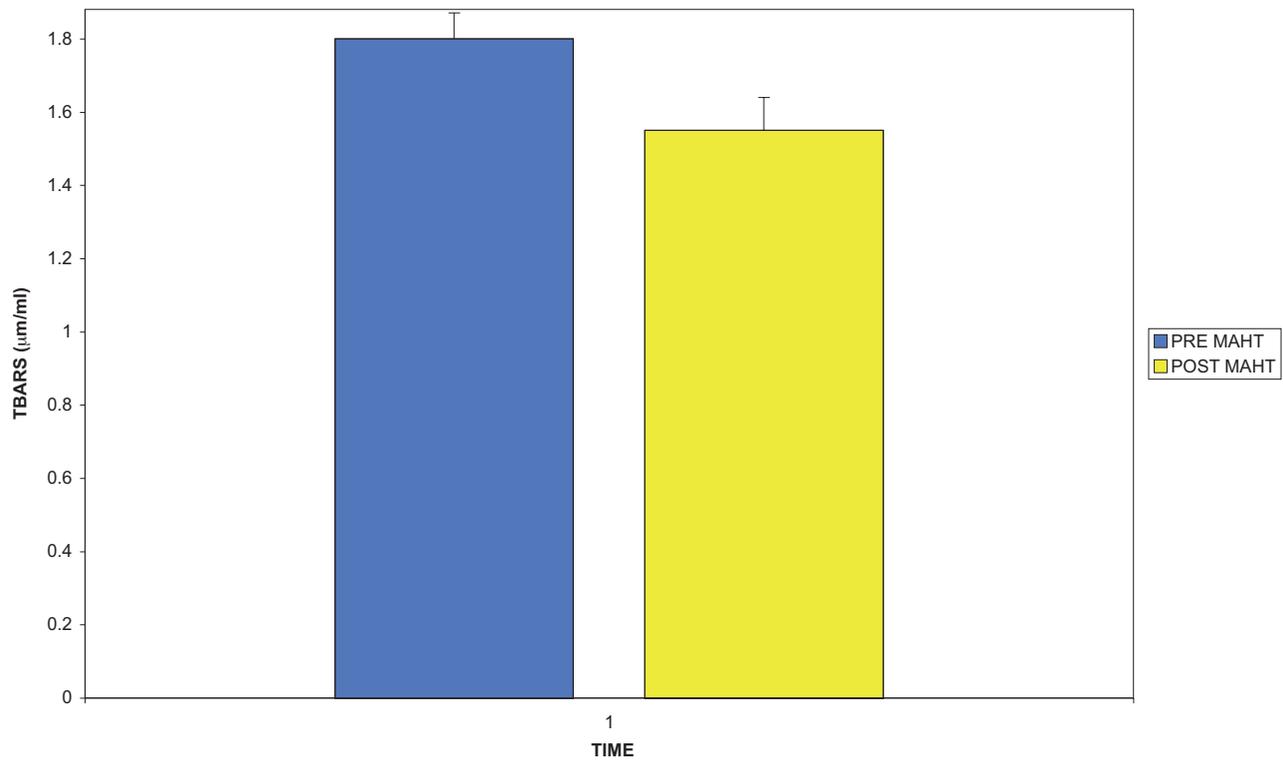


Figure 4 Comparison between values of TBARS before and after the cycle of major ozonated autohaemotherapy (pre MAHT – post MAHT) in AMD patients:  $p$  not significant.

## Statistics

The comparisons between groups before and after MAHT were done using Student's test for paired data. Values with  $p < 0.05$  were considered significant.

## Results

Results are summarised in figures 1- 4. Figures 1 and 2 show a significant difference between basal values of protein SH groups and malondialdehyde in controls with respect to AMD patients. Figures 3 and 4 depict the changes in protein SH groups and TBARS before and after MAHT: the SH protein rose significantly at the end of the treatment cycle, whereas the increase in TBARS was not significant given the wide interindividual variability of plasma malondialdehyde which in any case decreased at the end of MAHT.

## Discussion

Age-related macular degeneration is universally considered a disease of chronic oxidative stress in which the retina is the main target of free radicals. This study disclosed a clear-cut drop in plasma thiols and an increase in malondialdehyde before the start of MAHT with respect to control values. This

difference only reached statistical significance for plasma thiols due to the wide interindividual variability of TBARS.

This basic difference suggests that the antioxidant titre of each individual should be measured before ozone therapy as a presumed value of oxidative indices cannot be used.

The lack of an effective official medical protocol for the treatment of AMD justifies attempts to use MAHT to treat age-related macular degeneration. Our results showed an improvement in quality of life in almost all patients following MAHT, a particularly encouraging outcome since AMD is a highly disabling disease.

The biochemical mechanisms underlying the success of MAHT are probably linked to an increase in endogenous antioxidants and a decreased production of reactive oxygen species (ROS), as confirmed by our measurements of plasma thiols and malondialdehyde before and after MAHT. Alongside the change in the redox balance, MAHT and other ozone therapies change the biological response by interacting with other systems including the immune, inflammatory and blood coagulations systems<sup>5,6</sup>.

The lack of side-effects and its relative simplicity make major ozonated autohaemotherapy a valid alternative treatment for AMD patients. Further studies are required to assess possible alternative treatment protocols in terms of ozone concentration and treatment duration.

## References

- 1 Bressler NM, Bressler SB, Stuart LF: Age related macular degeneration. *Surv Ophtalmol* 32: 375-413, 1988.
- 2 Adler R: Mechanism of photoreceptor death in retinal degenerations. *Arch Ophtalmol* 114: 79-83, 1996.
- 3 West S, Vitale S et Al: Are antioxidants or supplements protective for age related macular degeneration? *Arch Ophtalmol* 112: 222-227, 1994.
- 4 Esterbauer H: Estimation of peroxidative damage. A critical review. *Pathol Biol* 44: 25-28, 1996.
- 5 Bocci V: Does ozone therapy normalise the cellular redox balance? *Med Hypotheses*: 150-154, 1996.
- 6 Borrelli E, Bocci V: L'esposizione quasi totale del corpo all'O<sub>2</sub>-O<sub>3</sub> come metodica non invasiva. In: Bocci V. *Ossigeno-ozonoterapia*, Casa Editrice Ambrosiana: 143-151, 2000.

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