

# Benedictine Monastery on the Island of Rab Hides the Mystery of Sunlight Influence on Development of Macular Degeneration (AMD). Is a Harmful Sunlight, Risk Factor or Cause of Macular Degeneration?

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## ABSTRACT

*Benedictine Monastery of St. Andrew is probably the oldest existing Benedictine monastery in this area. According to hundreds of years of legend, it was founded in 1018 year. In clinical examination about the possibility of the macular degeneration occurrence in 15 Benedictine sisters, we found the age-related macular degeneration (AMD) in two cases only. In 13 other sisters aging 27, 60, 67 years, the fundus picture was like in a baby, vision, visual field and meridian thresholds were normal. What is the explanation for this phenomenon? Two sisters with AMD work and live as the farm workers, but the other sisters live in closed monastery with very low natural sunlight, approximately 300–500 lx. In conclusion, the earlier author's experimental and clinical works follow the consequence that without exposure of eyes to harmful higher doses of sunlight, it is not possible to develop AMD. The harmful cumulative dose of sunlight is not the risk factor, but the cause, including the inheritance, for AMD development.*

**Key words:** age related macular degeneration, sunlight exposure, cumulative effect, risk factor

## Introduction

The age-related macular degeneration (AMD) is the chronic, progressive eye disease, involving the all parts of the retinal tissue: retinal pigment epithelium, photoreceptors, ganglion cells and axons, in macula region and in peripheral retina too<sup>1–3</sup>. The AMD disease is caused in combination with genetics and the environmental factors<sup>3–9</sup>, the harmful sunlight especially<sup>1,4,5</sup>. AMD is today the leading cause of vision loss in the world, and the progression of this disease in the whole world takes our breath away. About 15 million people suffer from it in USA today, and the annual incidence reaches new two million cases, after 65 years of life especially. The more shocking thing is that the first signs of retinal lesions, in terms of the increased excitation threshold, could appear in people exposed to higher doses of sunlight for a longer time, even in the childhood<sup>1,5</sup>. Particular studies support

such claim, because in such regions with higher insolation, AMD appears in the earlier life age<sup>5</sup>. Just in these geographical regions with higher insolation, and the phenomenon of the increased excitation of retinal threshold, in children make the cumulative effect for the earlier AMD occurrence<sup>1,5</sup>. It has been proved in works with proteomics, where the light induced oxidation of photoreceptors creates the oxidant stress conditions, accumulating free radicals, leading to the oxidation of docosahexaenoate (DHA) and creating the increased concentration of carboxyethylpyrrole (CEP) in the retinal tissue. This concentration is significantly lower in the healthy retina<sup>7–11</sup>. The author proves in his earlier papers<sup>1–3,5</sup> that a higher sunlight and longer exposure unavoidably lead to AMD appearance, which develops in the earlier life age and with stronger progression. The important thing is



Fig. 1. The Benedictine Monastery of St. Andrew on the Island of Rab



Fig. 2. Window on the Monastery, as the only source of light giving comfortable 300–500 lx.

that AMD is not only the macular disease, but the whole retina and its periphery are attacked, and all the histological elements of the retina, as well<sup>1–3,10</sup>. One of the first papers proved this claim in 2006 year<sup>10</sup> in proteomics, while the first clinical paper proved it in 2007 year<sup>2</sup>.

The purpose of this paper is to make a contribution to the claim that without the influence of higher doses of sunlight (or some other source of optical radiation), together with the existing genetic factor the development of AMD is impossible.

## Materials and Methods

It is known from the earlier papers<sup>1–3,5</sup> that the Mediterranean region of the Island of Rab is exposed to higher doses of sunlight compared with the other areas of the Republic of Croatia and even a greater part of the Mediterranean. The idea has been as follows: if the sunlight is one of the unavoidable risk factors in the genesis of macular degeneration (AMD), then people who are practically not exposed to higher doses of the sunlight will not develop AMD, not even in the older life age, 65 to 70 years, for instance. The Benedictine Monastery of St. Andrew on the Island of Rab has been chosen for this experiment (Figure 1). What is important for this monastery? The sisters do not go out into the outside world and therefore they are not exposed to higher doses of sunlight. Their living space is cosy, illuminated by natural sunlight approximately 300–500 lx (Figures 2 and 3), or artificial light, to be distinguished from the inhabitants of the Island of Rab, when daily values, reach even more than 100,000 lx. during the summer months (Figure 4).

The additional interesting point is that two sisters leave the monastery for technical reasons and work on the farm, being more exposed to the influence of daily sunlight.

All the sisters underwent medical examinations: fundus oculi, vision with correction, visual field, isopteric and meridian thresholds.

## Results

In 13 sisters, who did not go out to the daylight, all the findings were normal. The fundus like as if in children, in spite of the fact that two of them suffered from diabetes. The remaining two sisters, aging 47 and 58 years developed the initial AMD with disturbances in the



Fig. 3. Sister and the inner sunlight illumination.

visual field, characteristic for AMD, caused by the sunlight<sup>1,3,5</sup>, being characterized by defect of contracted and invaginations of the internal and peripheral isopters.

## Discussion and Conclusion

The author proves in great number of papers<sup>1-3,5</sup> that AMD appears as earlier, with the expressed progression for the same life age, as the inhabitants are more exposed to the sunlight. The other essential factor is the protection, being inadequately applied even nowadays. About 90% of people are aware that higher sunbathing leads to the skin cancer and only 10% of them realize the same sunlight to be harmful for eyes. The advantage of the earlier author's paper lies in the fact that the author takes field measurements of sunlight characteristics. Except UV-B he regularly measures UV-A, total quantity of the sunlight-luminous flux, expressed in luxes, occupation and the time of residence and exposure to the sunlight. This clinical claim has its exact arguments, such as the measurement of the retinal excitation threshold in the macula and periphery, what is far more exact than visual expression or the fundus appearance only. Meridian thresholds measurement is more exact than OCT method (having greater value in wet form), because it gives the retinal excitation threshold values at the level of 20-30 photon quanta of the visible light spectrum<sup>1</sup>. Anyway, the proteomics also proves<sup>10,11</sup> that light induced oxidation in mitochondria in tissue of sensorial retina<sup>10-12</sup>, leads to the oxidant stress conditions, espe-



Fig. 4. View of the old town of Rab, where the Monastery is situated, during the summertime, when daily values reach even more than 100,000 lx.

cially in the outer segment of photoreceptors, increasing the carboxyethylpyrrole (CEP) concentration.

In conclusion, the AMD problem should be put up as a national health problem of the population. The children are to be primarily protected not only by glasses, but with medical filters with proper declaration and with required supplementation of vitamin A derivatives and antioxidants.

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**U BENEDIKTINSKOM SAMOSTANU NA OTOKU RABU KRIJE SE MISTERIJ, DA LI JE POJAČANO IZLAGANJE SUNČEVOJ SVJETLOSTI RIZIK ILI UZROK RAZVOJA MAKULARNE DEGENERACIJE (AMD)?**

## S A Ž E T A K

Autori se čitavim nizom godina bave proučavanjem djelovanja optičkog spektra, posebice sunčeve svjetlosti, na mogući raniji nastanak i progresiju makularne degeneracije (AMD). U svojim radovima i kliničkim epidemiološkim studijama, kao i na eksperimentalnim životinjama, dokazali su da pojačano izlaganje sunčevoj svjetlosti sigurno doprinosi

oštećenju retine. S obzirom na kumulativni efekt, autori su dokazali da već i u ranoj životnoj dobi i u djece dolazi do oštećenja retinalne osjetljivosti, povišenja praga podražaja, ako se duže izlažu sunčevoj svjetlosti bez zaštite. Po toj logici, autori su zaključili, ako je tome tako, onda u osoba koje su jako zaštićene od sunčeve svjetlosti, neće biti ni početnih znakova za AMD, bez obzira i na godine starosti! Iz tog razloga izabran je Benediktinski samostan na otoku Rabu, gdje su časne sestre praktički »zatvorene« od vanjskog svijeta i minimalno se izlažu sunčevoj svjetlosti. U samostanu živi 15 sestara, promatrano kroz određeni period vremena, od kojih 13 uopće ne izlaze u vanjski svijet, dok dvije obavljaju sve vanjske poslove, pa čak se i intenzivno bave poljoprivredom. Kod ovih 13 sestara koje nisu izložene sunčevoj svjetlosti, sve relevantne pretrage: visus, optički mediji, fundus, vidno polje, bili su potpuno uredni. Fundus je u sestara od 57 godina izgledao kao u dječjoj dobi, za razliku od sestara koje su intenzivno izložene sunčevoj svjetlosti, gdje se nalazi oštećenje u vidnom polju, tipično za AMD, te razvijena slika makularne degeneracije kao u poljoprivrednika sa otoka Raba. Autori zaključuju da nema pojave i progresije AMD bez ekstenzivnog izlaganja optičkom zračenju, posebice sunčevoj svjetlosti, te da sunčeva svjetlost predstavlja, pored genetskog faktora, uzrok, a ne rizik faktor za razvoj AMD. Iz tih razloga, autori se zalažu za prevenciju makularne degeneracije medicinskim filterima i suplementacijom A vitamina, njegovih prekursora i antioksidansa.