

Medical Perspective: Macular Degeneration (AMD) and Human Sight in the Future

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ABSTRACT

The author concisely presents the results of his 30-year investigations about the harmful influence of the higher sun radiation on the eyes. The investigations were carried out among the population of the Island of Rab, situated in the northern part of the Adriatic sea. This geographical region has been characterized by higher doses of the global sun radiation compared with the remaining part of the Republic of Croatia, and partly with the rest of the Mediterranean. The author proved it by his own measurements of UV-B, UV-A and the global sun radiation. The number of the diseased from the macular degeneration (AMD), cataract and precancerous pterygium has been significantly increased in those inhabitants being more exposed to the sun radiation. Investigating the retinal threshold, of the macula and peripherally – meridian thresholds, even the children more exposed to the sun radiation without protection, are established to have the increased excitation threshold of the retina, making later the basis and risk factor for the earlier AMD development. The author also points out that the periphery of retina and the macula are damaged in AMD. Later stages of macular degeneration transfer to the clinical form of the optic nerve atrophy. The author pathohistologically proved that the whole retina has been degeneratively involved in AMD, not only the photoreceptors and the retinal pigment. Therefore, the author pleads for the idea of children protection from the higher sun radiation to become a national problem of each country, and the coordination must be with the World Health Organization (WHO).

Key words: age related macular degeneration, sunlight exposure, risk factor, children

Introduction

Human vision in the functional sense – HOMO SAPIENS HEIDELBERGENSIS is about 700,000 years old, while the organ of vision has phylogenetically earlier heritage in the genetic predetermination morphology and primary perception of light. For the sake of comparison, domestic cat – FELIX DOMESTICA, FELIDAE family, is about 70 million years old. Why is this comparison important? The sunlight developed visual organ in the functional sense of perception and transformation of light energy of photon quantum in any species. If you compare human visual organ and domestic cat you'll realize that cat has anatomically well defined conditions for the entry of the particular light quantity in case of higher daylight or in minimal night illumination. This adaptation is much weaker in human beings, e.g. the human pupilla has a minimal surface of 3 mm², being only 0.5 mm² in cat. Maximal human mydriasis amounts 48 mm² at low night illumination or in the darkness, being

even 180 mm² in cat. If these surfaces have been explained by the flux of coming light, the differences are enormous. Second, the cat never stares at light and her head is bowed down because of the use of smell. While doing so, the light coming horizontally and from the above, stimulates the lower part of the retina – tapetum lucidum, especially sensitive about small light quantities at night. Unfortunately, a human being has no such protection, mainly spending his life by daylight or the artificial light, which could be even more harmful.

One essential thing has to be pointed out, e.g. the man and all his great science must comprehend that his species is only one biological creation in phylogenesis of all the other species, and his »life span« is definite. A man will never experience a cat's fate. Regardless of the cephalization coefficient, his biological ontogenetic – phylogenetic predetermination, genetically cognizable in

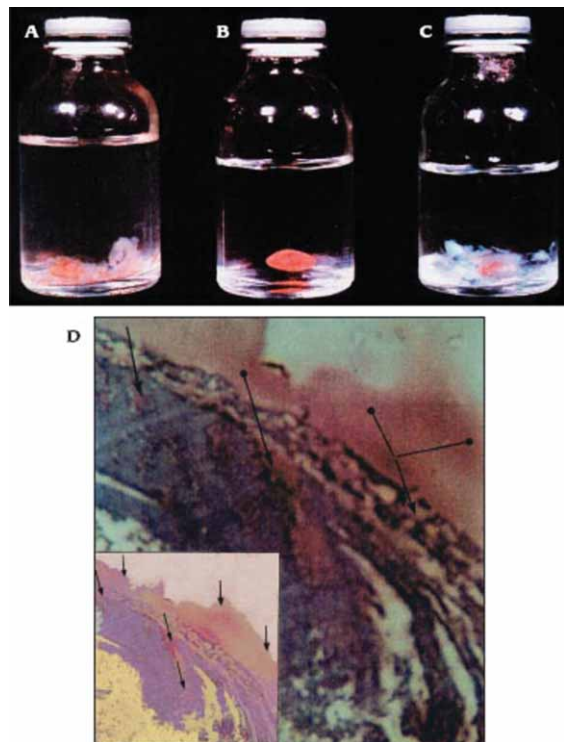


Fig. 1. Intracapsular extracted lenses – fixed in 4% formaldehyde: A), C) extracted lenses with complications during operating procedure; B) normal aspect of the lens after intracapsular extraction; D) penetration of transformed and degenerative vitreous through the lens capsule.

pro and paragenesis, make him vulnerable in relation to the environment.

One of the important environmental factors is the sunlight¹⁻³ which represents the source of life on the Earth, not only for the man, but for the others, as well. The light »created« the life, but how long and how to survive unfortunately depends on man partly only. But, during his small part in a short time of the human survival on the Earth, the man must considerably take account of his subordination to the nature of the sunlight and use it for healthiness and protect himself of possible harmfulness.

Material and Methods

In his long-standing work during a 30-year period¹⁻⁴ the author examined harmful effects of longer exposure to the sunlight in the inhabitants of the Island of Rab in the Republic of Croatia, climatically belonging to the Mediterranean region. He personally measured UV-B, UV-A and global sun radiation, and calculated the flux values of the sun radiation in the retina using the Lambert's cosine law ($E=I \cos \alpha/R^2$) and concluded that the area of the Island of Rab has been mostly exposed to the global sun radiation in comparison with the other parts of Croatia and the surrounding Mediterranean

area. In numerous epidemiological studies and examining the inhabitants of this region he found out particular diseases such as: pseudoexfoliation of lens capsul and glaucoma capsulare, pterygium with precancerosis, actinic cataract (Figure 1) and macular degeneration (AMD). His most recent papers from 2010 year proved the AMD to be the most directly connected with higher sun radiation of the retina. The initial signs of damage after longer exposure to the sunlight could appear even in children, as a cumulative effect, increasing the meridian threshold of the retino-cortical pathway. The quantitative perimetry proved that the peripheral changes were the same as those in the macula. This has been proved by papers from genomics and proteomics⁵⁻⁸, where in the AMD, retina, under the influence of optical radiation, the concentration of carboxyethylpyrrole (CEP) is increased as the product of light induced oxidation of photoreceptors. The last author's epidemiological study in the Benedictine monastery proves that there is no the occurrence and development of AMD without the influence of higher doses of the sunlight. He proved with his patent in collaboration with »Essilor«, the medical filter with light transmission at the level of 565–570 nm in combination with photosensitive filter to have the best protection, in children especially. It belongs to the domain of proved efficacy – chromotherapy.

Discussion and Conclusion

The sunlight which created a visual organ in all the species, besides its elementary role of life survival on the Earth, especially stressed optical radiation (»nonionizing«), has the harmful effects. Of many existing species, the Homo sapiens is very endangered because of too high doses of sun radiation, and therefore he must elaborate precisely determined protection system, for the skin and eyes especially, starting from the earliest childhood in view of proved harmful cumulative effect of the sunlight energy. It has been proved that the appearance and development of AMD is mostly caused by higher doses and the cumulative effect of the sun radiation. The sunlight, except its genetical predetermination, can be claimed as the essential cause of the occurrence and progression of AMD, earlier comprehended as one of the secondary environmental risk factors. Therefore, the author pleads for the protection of AMD even in the earliest childhood (by education and visual protection with medical filters and with proper declaration), like in Australia (in spite of their higher sun radiation), because of the cumulative effect. This must become a national problem of each country, to elaborate a Declaration of sight protection, from the higher doses of sun radiation especially, on a level of the Ministry of Health in each particular country and the World Health Organization (WHO).

Finally, the author suggests in a view of etiopathogenesis of AMD and semantically to name the Age-related Macular Degeneration – AMD as: The Age-related Retino-macular Degeneration – Actinic (ARMD-A).

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MEDICINSKA SAGLEDAVANJA: MAKULARNA DEGENERACIJA (AMD) I VID ČOVJEKA U BUDUĆNOSTI

SAŽETAK

Autor daje pregledni sažetak o uzrocima nastanka i razvoja makularne degeneracije (AMD), kao jednog od vodećih uzroka slabog vida u čitavom svijetu. Ističe se da je predugo izlaganje sunčevu svijetlu i optičkoj radijaciji, jedan od osnovnih uzroka nastanka i razvoja AMD. Autor predlaže da se taj zdravstveni problem podigne na nivo Ministarstva zdravstva svake pojedine Zemlje, u suradnji sa Svjetskom zdravstvenom organizacijom (WHO). Posebno se naglašava neophodnost zaštite u djece, posebnim medicinskim filterima u području transmisije zeleno-žutog područja (565–570 nm), jer u to rano dječje doba započinje kumulativni efekt sunčeve radijacije kao osnova, pored genetskog, za budući razvoj AMD.