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FREQUENCY OF CONGENITAL DYSCHROMATOPSIAS IN MALE POPULATION OF THE SPLIT-DALMATIAN COUNTY IN CROATIA

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A population of 9974 healthy male subjects (aged 15-45 years) was screened for congenital dyschromatopsia. The study group consisted of subjects applying for a driving licence in the Split-Dalmatian County between 1996 and 1999. The aim was to establish colour vision deficiency (dichromats) and borderline deficiencies (anomalous trichromats) in candidates through complete ophthalmologic examination including the Ishihara pseudoisocromatic plates, anomaloscope Nagel II, and Hue Lanthony colour test. The frequency of congenital dyschromatopsias was 8.48 %. This frequency includes 2.39 % dichromats (1.49 % protanops and 0.90 % deuteranopes) and 6.09 % anomalous trichromats (1.27 % protanomals, 4.20 % deuteranomals, 0.21 % extreme protanomals and 0.41 % extreme deuteranomals). It is important to recognise and classify dyschromatopsias according to type and severity in order to avoid misinterpretation of results and consequent unjustified limitations imposed on anomalous trichromats in the selection of a profession.

KEY WORDS: *anomalous trichromatism, colour vision, dichromatism, normal trichromatism*

The perception of colour is one of three most essential elements of vision, the other two being light and form. Colours are perceived from the first months of life, but the ability of fine colour distinction is acquired progressively through experience and, to some degree, through education (1, 2). Proper recognition and distinction of colours is developed in young age, and it declines with age and illness. Studies of colour vision have prompted several authors to a more intensive investigation of the occurrence of congenital dyschromatopsia within a nation or a race. The first extensive study in Croatia was undertaken by Peić (5) in 1976, followed by Cvetnić in 1999 (6).

Different diagnostic methods and tests used led to differences in results reported from different countries, but differences in the frequency of congenital dyschromatopsias between members of the same nation, race, culture and ethic group must also be acknowledged and investigated. Dyschromatopsias occur because of congenital or acquired disorder in receptors and/or in the transmitting mechanism of the visual system, and include:

- dichromatism (anopia - for one colour; protanopia - no perception of red; deuteranopia - no perception of green; and tritanopia - no perception of blue).
- anomalous trichromatism (impaired perception of one of the spectral colours; protanomaly - impaired perception of red, deuteranomaly - impaired perception of green; and tritanomaly - impaired perception of blue).
- transient forms (extreme anomalies in subjects who misread pseudoisochromatic plates, but have an abnormal quotient (AQ) of 0.7-1.4 on anomaloscope); and
- monochromatism or achromatopsia (no perception of colours).

The dichromats are aware of their limitation from their youth, and they generally show little interest in professions requiring good colour vision (transport and some industries).

Anomalous trichromats are usually identified in screening for professions requiring normal colour vision. This group requires detailed diagnosis and analysis.

The aim of this study was to determine the frequency of congenital dyschromatopsias in the male population of the Split-Dalmatian County.

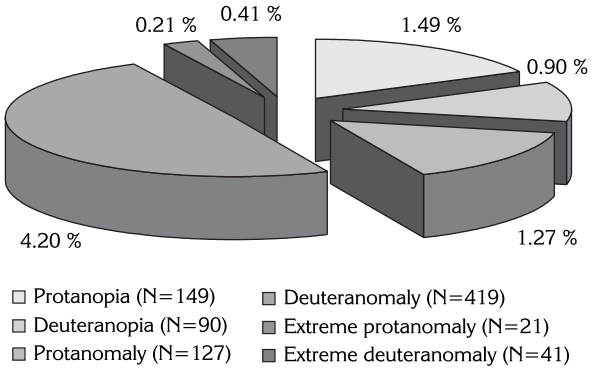

Figure 1 *Frequency (%) of congenital dyschromatopsias in 9974 male subjects from the Split-Dalmatian County. N is the number of subjects in the listed subgroups.*

SUBJECTS AND METHODS

The study group consisted of 9974 healthy male subjects (aged 15-45 years) who applied for a driving licence in the Split-Dalmatian County over the period 1996-1999. Epidemiological data were collected from occupational health services in Split and from the Department of Ophthalmology, Clinical Hospital Split. Colour vision was tested only in subjects who had normal findings after a complete ophthalmologic examination of vision, biomicroscopy of the anterior segment, measurement of the intraocular pressure and the inspection of the fundus. They were screened for dyschromatopsia using Ishihara pseudoisochromatic plates (Kanchara and Co., Tokyo, Japan, edition 1881 consisting of 24 plates) and further tests included anomaloscope Nagel II (Schmidt and Haensch, Berlin from 1977) and Hue Lanthony colour test (Frohnhauser from 1994, Unterhachingen).

RESULTS AND DISCUSSION

In the studied population of 9974 subjects, 91.52 % were trichromats, while congenital dyschromatopia was identified in 847 subjects, which amounts to a frequency of 8.48 %. This frequency includes 2.39 % dichromats and 6.09 % anomalous trichromats. A further division into identified subgroups is shown in Figure 1. No monochromats, tritanomals or tritanopes were identified in studied population.

The frequency of congenital dyschromatopsia varies between nations, races, ethnic groups, and sexes (6). Extensive European studies report 7.95 % dyschromatopsias in Greece, 8.9 % in France, 7.1 % in Belgium, 7.25 % in Great Britain, and 8-10 % in Norway (8-10). Outside Europe the trend seems to drop; 5.59 % in China, 3.9 % in Japan, 4.0 % among Jews, 3.71 % among African Americans, and only 1.0 % among Inuit people (11).

In an earlier study, the frequency of congenital dyschromatopias in inland Croatia was 8.95 % (5), which is close to the frequency reported in this paper for the Split-Dalmatian County. However, in this study a higher frequency of severe colour deficiencies was identified than in continental Croatia (12). Our data from coastal Croatia and from inland Croatia have frequencies only slightly above the European average, which is 8 %.

Each colour deficiency should be recognized as early in childhood as possible, and developmental difficulties of each individual overcome with professional assistance. Colour deficiency identified by occupational health physician should be further assessed by an ophthalmologist, who will determine its type and severity. This would give the population with dyschromatopsias an opportunity to get timely advice about the choice of profession. This particularly refers to individuals with extreme anomalies and pigment anomalies in whom correct diagnosis may mean an opportunity to pursue a desired career. Since normal colour vision is indispensable in many professions, it is necessary to use unique criteria for the evaluation of extreme and pigment anomalies and rely on diagnostic methods and tests that yield the most precise results for each colour anomaly.

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Sažetak

UČESTALOST UROĐENIH DISKROMATOPSIJA U MUŠKOJ POPULACIJI SPLITSKO-DALMATINSKE ŽUPANIJE

Ustanovljuje se postotak i učestalost urođenih diskromatopsija u Splitsko-dalmatinskoj županiji koje dosad nisu istraživane u županijama Hrvatske, na 9974 ispitanika, zdravih muškaraca, kandidata za vozače, u dobi od 15. do 45. godine starosti, a u vremenskom periodu od 1996.-1999. godine. Cilj je bio utvrditi zastupljenost težih oštećenja kolornog vida (dikromata) te lakših i graničnih poremećaja (anomalnih trikromata). Kolorni vid ispitivan je pseudoizokromatskim tablicama Ishihara u ordinaciji medicine rada, a zatim na Rodenstock ortoreter aparatu, anomaloskopu Nagel II i 40 Hue Lantony testom na Klinici za očne bolesti, KB Split, gdje je izvršen i kompletan oftalmološki pregled.
Obrađeni i dobiveni rezultati su prikazani grafički. Dobiveno je 8,48 % diskromatopsija, od čega 2,39 % dikromata (protanopa 1,49 %, deuteranopa 0,90 %) i 6,09 % anomalnih trikromata (protanomala 1,27 %, deuteranomala 4,20 %, ekstremnih protanomala 0,21 % i ekstremnih deuteranomala 0,41 %). Od važnosti je da nakon ispitivanja raspoznavanja boja u ordinaciji medicine rada, nađene diskromatopsije identificiramo po vrsti i jačini što je u domeni subspecijaliste oftalmologa kako ekstremni anomalni trikromati ne bi bili oštećeni u odabiru zanimanja krivom interpretacijom rezultata.

KLJUČNE RIJEČI: *anomalna trikromazija, dikromazija, diskromatopsije, kolorni vid, normalna trikromazija*

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