Genetic and psychophysical evaluation of color vision in a large pedigree of Leber's Hereditary Optical Neuropathy of the 11778/ND4 mtDNA mutation.

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Leber's Hereditary Optical Neuropathy (LHON) is a maternally inherited disease that may lead to acute loss of central vision predominantly affecting young males. In a large Brazilian family, 49% of asymptomatic carriers of LHON exhibited color vision abnormalities. The purpose of this study is to determine the correlation between the psychophysical and genetic features of the color vision in the affected and asymptomatic carriers of the 11778/ND4 mitochondrial mutation (mtDNA) LHON. Twenty three asymptomatic (12 female and 11 male) and six affected (1 female and 5 male) carriers of the LHON had their color vision evaluated psychophysically and genetically. Color discrimination thresholds were measured using the Cambridge Color Test (Cambridge Research Systems, Ltd) along the protan, deutan and tritan axes. A genetic screen using real time quantitative polymerase chain reaction was used to estimate the relative number of L and M cone opsin genes in the X chromosome array. Of the six affected LHON patients, four male carriers had deutan opsin gene arrays and the other two subjects had normal arrays. All showed losses in color vision with deutan thresholds worse than protan and tritan. Of the 23 asymptomatic LHON carriers, 12 had arrays with normal proportion of L opsin genes but they were deficient in the color vision test. The thresholds were higher than normal for the protan (131.4±58.56), deutan (112.9±35.6) and tritan (146.8±59.4) axes. Five subjects were normal in both genetic and psychophysical evaluations. Six asymptomatic LHON carriers had reductions in the color discrimination and more than one L gene in the X chromosome array. We have two main conclusions: that there is a hereditary color vision deficiency in the Brazilian 11778/ND4 – LHON pedigree characterized as deutan defect and the asymptomatic LHON carriers with normal proportion of L opsin genes have color vision deficiency probably caused by the neuropathologic mechanism of the LHON disease.

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