Melanin determination using optimised inverse Monte Carlo for skin - light interaction

ABSTRACT

Abnormality of melanin production causes skin pigmentation disorders. Many simulation models of light interaction with human skin have been reported. The most accurate skin model is based on Monte Carlo approach. An inverse model is used to derive optical properties of skin by fitting the spectral reflectance obtained from the model of light interaction to the actual spectral reflectance obtained from empirical data. Currently there is no an inverse Monte Carlo model which is designed to analyse skin chromophores especially melanin type and its concentration. In this paper, a development of an inverse Monte Carlo model to analyse skin pigmentation model is presented. The inverse model is first validated with 37 spectral reflectance data obtained from normal participants. An observational clinical study involving 11 melasma patients is then conducted. As expected, result shows that the concentrations of eumelanin and pheomelanin of all melasma lesions are higher than concentration of eumelanin and pheomelanin of normal skin, resulting in higher light photon absorption. It can be inferred that the developed inverse model is able to determine relative concentrations of eumelanin and pheomelanin.