Ultraviolet Light A (UVA) Photoactivation of Riboflavin as a Potential Therapy for Infectious Keratitis

av

Karim Makdoumi

Akademisk avhandling

Avhandling för Medicine doktorsexamen i Medicinsk vetenskap med inriktning mot kirurgi, som enligt beslut av rektor kommer attförvaras offentligt fredag den 16 december 2011 kl. 09.15, Wilandersalen, Universitetssjukhuset i Örebro

Opponent: Professor Jesper Østergaard Hjortdal, Århus Universitetshospital, Århus, Danmark

Örebro universitet
Hälsoakademin

701 82 ÖREBRO
Abstract


Collagen Crosslinking (CXL) is a treatment based on the photosensitization of riboflavin (vitamin B2), using ultraviolet light (UVA). It is implemented as an alternative to transplantation in keratoconus and corneal ectasia. The same mechanism is utilized in transfusion medicine, to reduce the risks for infectious transmission associated with the procedure. Infectious keratitis is a condition that is coupled with risks for the development of serious complications and subsequent visual impairment or even blindness. As the spread of antibiotic resistant bacteria signifies that real hazard and concern that corneal infection in the future could be a severely difficult condition to treat, the need for new therapeutics seems evident.

The aim of this thesis was to study the photoactivation of riboflavin and to elucidate several key factors involved in the antimicrobial action of the phenomenon as well as to study the clinical effect of CXL in infectious keratitis.

The experimental papers investigated the antimicrobial effect tested on three different bacterial strains, commonly found as causative microorganisms in keratitis, as well as Acanthamoeba castellanii, in fluid solutions. The purpose was to establish if UVA alone eliminated microbes or whether the outcome was mediated by the combined action with riboflavin and if so, try to specify the quantity required for achieving the effect. A clear bactericidal effect was seen in all tested strains, with results strongly indicating an interaction between the vitamin and ultraviolet light. Regarding Acanthamoeba however, growth inhibition was induced by ultraviolet light solitarily, with no additional effect from riboflavin.

The clinical response of riboflavin photoactivation, employed as CXL was observed in 7 severe cases of infectious keratitis, which all responded to therapy. A clinical non-randomized pilot study of UVA-riboflavin interaction as the primary therapy for bacterial keratitis resulted in curing of 14 out of 16 ulcers without the use of antibiotics.

In conclusion, the use of UVA photoactivation of riboflavin as an infectious photodynamic therapy seems to be a promising tool for integration as an adjuvant treatment in infectious keratitis.

Keywords: riboflavin; ultraviolet; light; UV; UVA; keratitis; melting; bacteria; acanthamoeba; photoactivation; photosensitization

Karim Makdoumi, Hälsoakademien
Örebro University, SE-701 82 Örebro, Sweden, karim.makdoumi@orebroll.se