

Early effects of corneal collagen cross-linking by iontophoresis in ex vivo human corneas.

Abstract

PURPOSE

The purpose was to investigate the early modifications induced by collagen cross-linking by iontophoresis of riboflavin (ionto-CXL) in ex vivo human corneas by evaluating different protocols of UVA irradiation.

METHODS

In this experimental study 46 ex vivo human corneas obtained from the Eye Bank of Mestre (Italy) were divided in different groups: six were utilized as control (CTL); eight were treated with ionto-CXL at 3 mW/cm(2) power for 30 min (I-3); eight were treated with ionto-CXL at 10 mW/cm(2) for 9 min (I-10); eight were treated with iontophoretic delivery of riboflavin only (I-0); eight were treated with the standard CXL at 3 mW/cm(2) for 30 min (S-3); and eight were treated with CXL at 10 mW/cm(2) for 9 min (S-10). All samples were evaluated by haematoxylin-eosin staining and immunohistochemical analysis using different markers (Connexin 43, CD34, Collagen I, TUNEL assay). Western blot analysis, utilizing Bax and Ki67 primary antibodies, for detection of keratocyte apoptosis and proliferation, respectively, was also performed.

RESULTS

No endothelial damage was evidenced in the treated groups. In I-10 corneas the epithelial layers were not always well-preserved. Anterior stroma showed an uneven distribution and numerical reduction of keratocytes as well as increased apoptosis; a reduced subepithelial interweaving of collagen I fibers was observed. In S-3 and S-10 the changes induced by treatments were similar to I-10. I-3 and I-0 showed no significant changes with respect to the control group.

CONCLUSIONS

In the ionto-CXL at 10 mW/cm(2) group occurred the main morphological and biomolecular changes. This experimental study suggests that iontophoresis can be considered a non-invasive potential delivery tool for riboflavin penetration in corneal stroma during CXL.

Links

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