Abstract

Laser welding of ocular tissue is an alternative technique or adjunct to conventional suturing in ophthalmic surgery. It is based on the photothermal interaction of laser light with the main components of the extracellular matrix of the connective tissues. The advantages of the welding procedure with respect to standard suturing and stapling are reduced operation times, lesser inflammation, faster healing and increased ability to induce tissue regeneration. The aim of this study is to evaluate, by means of light (LM) and scanning electron microscopy (SEM) analyses, the structural modifications induced in laser-treated corneal stroma. We use laser-activated nanocomposites (colloidal gold nanorods and chitosan-gold nanorod gel) and indocyanine green dye as near-infrared chromophores to mediate functional photothermal effects in the corneal stroma. Then, by application of an 810-nm diode laser radiation (80mW, 16.7 W/cm^2) coupled with exogenous chromophores, we achieved local denaturation of the endogenous collagen filaments. The thermal damage is confined within close proximity in a radial distance from the irradiated area, while surrounding areas maintained native structure of stromal collagen fibres. Based on microscopic characterization of the collagen modifications; we can conclude that chitosan-gold nanorod gel is able to induce similar photothermal effects as of organic dyes. If laser parameters be optimised, nanochromophores can be a powerful alternative to organic dyes in surgical applications, including in ophthalmology.

Key words: Gold nanorods, laser-activated nanocomposites, photothermal effect, cornea, diode laser.