Pulsed heat shock to enhance collagen production of human dermal fibroblasts

in vitro

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Introduction

One of the aspects of interest of aging skin is that it has a degenerated collagen matrix. To regenerate this matrix, fibroblasts need to be stimulated to produce new collagen.

In this study, the effects of pulsed heat shocks of different temperatures on the expression of procollagen 1, procollagen 3, hsp27, hsp47, and hsp70 of human dermal fibroblasts in vitro, is investigated.

Materials & Methods

The heat shocks were applied by rinsing the cells twice for ± 2 seconds with heated PBS. Two different temperatures, 45°C and 60°C, were used for the heat shocks. The same protocol was followed using the reference temperature of 37 ºC.

Growth rate and viability were obtained at six different time points (t = 0, 3, 5, 8, 10, 12 days). Metabolic activity at the different temperatures was measured directly after the heat shocks. Quantative PCR was performed at six different time points (t = 5, 15, 35, 65, 95 min) after the heat shock to determine expression levels relative to the reference temperature.

Results

The 60°C heat shock results in a significantly lower growth rate. However, the viability is in line with the control group. It also shows that the cells at 90°C heat shock diminish in growth rate and lose their viability (figure 3).

Discussion

These data indicate that different processes occur after the heat shocks at the different temperatures. However, the increased expression of both procollagen 3 and hsp47 suggests stimulation of the human dermal fibroblasts as a reaction to the heat shocks. This implies that in the living dermis heat shocks induce regeneration of the collagen network.