

An Amended Method for Assessment of Hypertrophic Scars Viscoelastic Parameters

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Abstract : Recording of viscoelastic strain-vs-time curves with the aid of the suction method and a follow-up analysis, resulting into evaluation of standard viscoelastic parameters, is a significant technique for non-invasive contact diagnostics of mechanical properties of skin and assessment of its conditions, particularly in acute burns, hypertrophic scarring (the most common complication of burn trauma) and reconstructive surgery. For elimination of the skin thickness contribution, usable viscoelastic parameters deduced from the strain-vs-time curves are restricted to the relative ones (i.e. those expressed as a ratio of two dimensional parameters), like grosselasticity, net-elasticity, biological elasticity or Qu's area parameters, in literature and practice conventionally referred to as R2, R5, R6, R7, Q1, Q2, and Q3. With the exception of parameters R2 and Q1, the remaining ones substantially depend on the position of inflection point separating the elastic linear and viscoelastic segments of the strain-vs-time curve. The standard algorithm implemented in commercially available devices relies heavily on the experimental fact that the inflection time comes about 0.1 sec after the suction switch-on/off, which depreciates credibility of parameters thus obtained. Although the Qu's US 7,556,605 patent suggests a method of improving the precision of the inflection determination, there is still room for nonnegligible improving. In this contribution, a novel method of inflection point determination utilizing the advantageous properties of the Savitzky-Golay filtering is presented. The method allows computation of derivatives of smoothed strain-vs-time curve, more exact location of inflection and consequently more reliable values of aforementioned viscoelastic parameters. An improved applicability of the five inflection-dependent relative viscoelastic parameters is demonstrated by recasting a former study under the new method, and by comparing its results with those provided by the methods that have been used so far.

Keywords : Savitzky-Golay filter, scarring, skin, viscoelasticity

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