Mechanical stimulations and facial skin rejuvenation: a randomized simple-blind study with biopsies

Philippe HUMBERT1
, Adeline JEUDY\ Férial FANIAN\ Marek HAFTEK2
lResearch and Studies Center on the Integument (CERT), Department of Dermatology, Clinical Investigation Center (CIC BT506), Besançon University Hospital; INSERM UMR1098, FED4234 mCT, University of Franche-Comté, Besançon, France
2Laboratory for Dermatological Research EA4169 "Normal and Pathological Functions of the Skin Barrier", Université Lyon 1, Lyon, France.

Introduction: Loss of mechanical tension appears to be the major factor underlying decreased collagen synthesis in aged skin. Numerous in vitro studies have shown the impact of mechanical forces on fibroblasts through mechano-transduction which consists in the conversion of mechanicals signals into biochemical responses. Such responses are characterized by the modulation of expression of the genes co ding for extracellular matrix components (collagens, elastin,...) and also for degradation enzymes (MMPs) and their inhibitors (TIMPs) (2-5). For the first time, a new medical device providing a mechanical stimulation of the cutaneous and sub-cutaneous tissue, has been used in a simple blinded controlled and randomized study in order to evaluate i) functional modifications induced in fibroblasts and ii) improvement of the appearance of aging skin after a series of treatments.
Material and Methods: 30 subjects, 20 women and 10 men (aged between 36 and 50 years), with clinical signs of skin loosening on the lower part of the face, were randomly assigned to undergo a treatment on hemi-face. After a total of 24 sessions with LPG Mechano-stimulation device, biopsies were performed on the treated side and the contra-lateral control area for *in vitro* assessments (dosage of hyaluronic acid, elastin, type-I collagen, MMP9; retraction of dermis equivalent with isolated fibroblasts) and electron microscopy (n=10). Furthermore, before / after evaluations of all treated patients included clinical quotation, biometrological assessments and patient's self-assessment questionnaire.
Results: *In vitro* assessments showed increase in hyaluronic acid (+80.2%), elastin (+45.6%), type 1 collagen (+7.8%) and MMP9 (+115.4%) content along with an improvement of the migratory capacity of the fibroblasts. Electron microscopy evaluations confirmed a clear dermal remodeling in relation with both the improvement of fibroblast activity and the inhibition of collagen degradation. Additionally, clinical evaluations showed a significant improvement of various signs associated with skin aging (wrinkles, finelines, heterogeneity of the complexion, puffiness, tear-trough) and the standardized photographies showed an improvement of the skin ptosis. **Conclusion**: Mechano-stimulation is a non invasive, non aggressive and safe technique delivered at different frequencies which can significantly improve skin trophicity. The results observed with objective measurements, i.e *in vitro* assessments and electron microscopy confirm the firming and restructuring effect of the procedure. Considering its efficacy on aging skin, the global satisfaction of the subjects and excellent tolerance, this device can be proposed for facial skin rejuvenation.

Bibliography:

1. V ARANI J, DAME MK, RITTIE L, FLIGIEL SE, KANG S, FISHER GJ, VOORHEES Jl Decreased collagen production in chronologically aged skin: roles of age-dependent alteration in fibroblast function and defective mechanical stimulation. Am J Pathol. 2006 Jun; 168(6):1861.
2. EASTWOOD M, McGROUTHER DA, BROWN RA, Fibroblasts responses to mechanical forces, Proc Inst Mech Eng 1998 ; 212 (2) : 85-92
3. CHIQUET M, Regulation of extracellular matrix gene expression by mechanical stress Matrix Biol 1999 oct; 18(5) : 417-26
4. HARRIS AK, STOPAK D, WILD P, Fibroblast traction as a mechanism for collagen morphogenesis. Nature 1981 ; 290(5803) : 249-51.
5. KESSLER D., DETHLEFSEN S., HAASE L, PLOMANN M., HIRCHE F., KRIEG T., ECKES B. Fibroblasts in mechanically stressed collagen lattices assume a "synthetic" phenotype. J Biol Chem 2001 September; 276 (39) : 36575-85.