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QUANTITATIVE CLINICAL ASSESSMENT OF THE BURN SCAR

Robert A. Redden, Alan W. Eberhardt, Donald R. Smith*, Stan G. Walker‡, Dale S. Feldman, Department of Biomedical Engineering, University of Alabama at Birmingham; *Birmingham Surgical PC; ‡Department of Acute Physical Therapy, UAB Outpatient Burn Clinic

The long-term healing of skin grafts is often characterized by an abnormal, hypertrophic response. Hypertrophic scars (HSc) are cosmetically unappealing and functionally disabling due to the increased stiffness of the tissue. The clinical assessment of scars is limited, however, due to the lack of an accurate, objective, quantitative technique for measuring tissue stiffness and function. We evaluated a device that quantitatively measures biomechanical properties of skin. These measures would allow for accurate comparisons of various treatments and a better understanding of normal and abnormal wound healing.

The Biomedical Tissue Characterization System (BTC-2000, SRLI Technologies, Nashville, TN) is a clinical device for the quantitative *in vivo* evaluation of skin. The system applies a controlled, ramped vacuum (0 to 150 mmHg) to the tissue and measures the resulting deformation. We tested HSc and contralateral unburned sites, for within-patient controls, in skin grafted burn patients (n=17). At each site, circular areas of 1.0cm and 2.5cm diameter were tested and curves of applied load vs. tissue deformation were generated.

From the load-deformation curves, five mechanical parameters were calculated: slope of the early 'toe' region (from 0-30 mmHg applied load), slope of the 'linear' region (from 120-150 mmHg applied load), area under the curve, total deformation, and immediate elastic recoil after vacuum release. To establish clinical relevance, the derived parameters were correlated with the pliability score from the Vancouver Scar Scale (VSSP), a widely used clinical rating scale. The VSSP is an integer scale from 0 (normal) to 5 (contracture) in which an increased score represents decreased pliability.

With the 1.0cm diameter test area, three mechanical parameters were identified that best distinguished scars from normal skin and most strongly correlated with the VSSP. The scar tissue exhibited a greater toe slope, indicating increased tissue stiffness compared to normal skin, a decreased area under the toe region of the curve, indicating lower energy absorption, and less total deformation ($p<0.005$). All values correlated strongly with the VSSP ($p<0.001$). The 2.5cm diameter test area results were less conclusive.

The BTC-2000 proved to be a viable clinical device for the assessment of skin graft scars. The BTC results are objective and quantitative and provide a higher order of accuracy and statistical power than traditional clinical rating. The toe region of the load-deformation curves shows the most significant contrast between normal tissue and scars. The biochemical relevance is yet to be elucidated, but may relate to reduced elastic fiber concentration, altered collagen orientation, and the abnormal extracellular matrix found in HSc. These measures could be used to enhance the understanding of scar formation and biochemistry, compare treatments, and help identify small potentially pathological changes undetectable by imprecise clinical scales.