Abstract: Shockwave (SW) application has been shown to limit flap necrosis. However, the underlying microhemodynamic mechanisms remain unclear. Therefore, the objective of this study was to analyze the effect of SW application on a microcirculatory level. We treated 12 C57BL/6 mice with local SW application (500 shockwave impulses at 0.15 mJ/mm²) either 24 h before (preconditioning [PRE]) or 30 min after (postconditioning [POST]) flap elevation. Animals with an untreated flap (CON) or without a flap served as controls. We applied dorsal skinfold chambers to the animals and performed epifluorescence microscopy over a 10-d period to assess microcirculatory parameters (arteriolar diameter, red blood cell velocity, blood flow, functional capillary density, and intercapillary distance) as well as inflammation, apoptotic cell death, and necrosis. SW application significantly decreased tissue necrosis independently of the application time point (PRE: 29% ± 7%; POST: 25% ± 7% versus CON: 47% ± 2%; day 10, P < 0.05). Arteriolar diameter, red blood cell velocity, and blood flow were not statistically significantly different among the 3 flap groups. However, SW (PRE and POST) resulted in an early and persistent increase in functional capillary density and consequently decreased intercapillary distance compared with CON and the group...
without a flap (P< 0.05). Also, SW resulted in a significantly decreased inflammatory response (P< 0.05) and induced an angiogenic response, as indicated by new functional microvessel formation observed 5 d after therapy. Local SW application improved tissue survival by recruitment of sleeping capillaries within the non ischemic tissue and maintenance of capillary perfusion within the critically perfused tissue after induction of ischemia, which was independent of the application time point. Neoangiogenesis occurred beyond the ischemic tolerance of the tissue, and therefore does not seem to contribute to improved tissue survival.