INTRODUCTION

Pulsed Acoustic Cellular Expression (PACE) is a novel technology based on the use of pulsed acoustic energy waves (specific shock waves) that has been clinically shown to produce a cellular expression response which may be used in a clinical practice. Extracorporeal Shock Wave Therapy (ESWT) was introduced for medical practice approximately 25 years ago for fragmentation of kidney stones. This technique has been successfully employed mostly in orthopedic diseases and several inflammatory tendon diseases. It has been proven that ESW therapy improves tissue regeneration and neangiogenesis.

Wound healing is a highly dynamic process and involves complex interactions of extracellular matrix molecules, soluble mediators, and various resident and infiltrating cells. The tissue ischemia affects restoration of circulation to damaged tissues and has direct effect on wound healing. The aim of this study is to evaluate whether PACE therapy induces the neovascularization and improves blood supply to the tissues.

MATERIALS AND METHODS

Cremaster muscle flap model (Figure 1) for direct intravital microcirculatory hemodynamics and leukocyte-endothelial interactions recordings:
1. Non-ischemic controls (n=12)
2. Ischemia control (Shrs) (n=12)
3. Pre-ischemic (Shrs) PACE treatment (n=12)
4. Post-ischemic (Shrs) PACE treatment (n=12)

Assessment methods:
1. Microcirculatory hemodynamics (capillary perfusion, leukocyte-endothelial activation - rolling, sticking and transmigrating leukocytes)
2. Immunohistochemistry
   - Leukocyte trafficking – adhesion molecules expression: E-selectin, ICAM-1, VCAM-1
   - Vasculogenesis: VEGF, von Willebrand factor (vWF)

RESULTS

Figure 4. Average Functional Capillary Density in Ischemia Reperfusion

Figure 5. Expression of cell adhesion molecules: ELAM-1, ICAM-1 and VCAM-1 in response to postischemic and preischemic PACE treatment.

Table 1. Correlation between pro-angiogenic factors and leukocyte behavior in ischemia-reperfusion injury.

CONCLUSIONS

- Pre-ischemic and post-ischemic PACE treatment down-regulated adhesion molecules expression and this correlated with reduction of sticking leukocytes at the microcirculatory level
- Post-ischemic PACE treatment induced expression of pro-angiogenic proteins (VEGF, vWF), which correlated with increased capillary density and confirmed potential for neangiogenesis
- Protective effect of PACE treatment was confirmed in muscle flaps submitted to ischemia – reperfusion injury