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Online oxygen measurements in ex vivo perfused muscle tissue in a porcine model using dynamic quenching methods

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Abstract:

Introduction Transplantation of autologous free tissue flaps is the best applicable technique for treating large and complex tissue defects and still has one major failure criterion. Tissue – and in particular muscle tissue – is strongly sensitive to ischemia, thus after a critical period of oxygen depletion the risk of a partial or total flap loss is high. *Materials and methods* For that reason a miniaturized ex vivo perfusion system has been developed, that supplies the tissue during operational delays. The purpose of this study was to determine the oxygenation levels during such a perfusion using different perfusates and therefore to objectify if a complementary oxygenation unit is required to improve perfusion quality. The oxygen levels of the tissue, as well of the perfusate, were measured by using minimal invasive optical oxygen sensors that are based on dynamic quenching. The ex vivo perfused tissue was the porcine rectus abdominis muscle. *Results* Results show, that during perfusion with heparinized crystalloid fluid (Jonosteril®) and heparinized autologous whole blood, additional oxygenation of the perfusion reactor led to different ex vivo oxygen tissue saturations, which can be detected by dynamic quenching. *Conclusion* Dynamic quenching methods are a promising and valuable technique to perform online oxygen measurements in ex vivo perfused muscle tissue in a porcine model.

Key-words: Free flap tissue transplantation, ischemia, hypoxia, extracorporeal perfusion, porcine tissue, optical oxygen sensor, dynamic quenching