

Tissue Blood Supply after Transplantation of a pedicled Flap- Microcirculation two Days and one Week after Surgery and Flap Conditioning

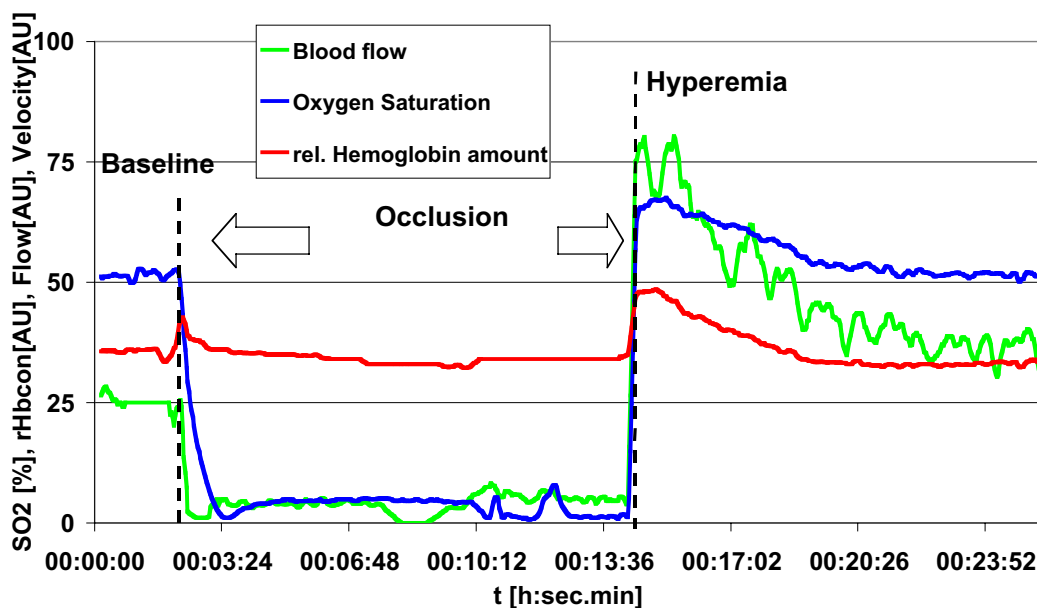
Viability of tissue of a transplanted flap requires sufficient perfusion and supply with oxygen¹. In pedicled flaps blood in- and outflow to and from the recipient site is therefore sustained by the vessels of the donor site until new vessels grow into the flap. By flap conditioning (pinching off the blood inflow from the donor site) stimuli are set, that accelerate growth of new vessels from the donor side. If the flap tolerates the occlusion of the pedicle for 2 hours, it is disconnected (mostly after 3 weeks). Then blood supply only takes place through the newly grown vessels of the recipient site.

In the shown case² a big defect of the soft part of the hand was covered by a pedicled groin flap. A few days after surgery flap training was started. At the 2. and 9. day of flap conditioning the blood flow, oxygen saturation and hemoglobin amount were measured by the O₂CO₂GEN TO SEE probe before, during and after occlusion of the flap pedicle

Tissue neovascularisation two days after transplantation

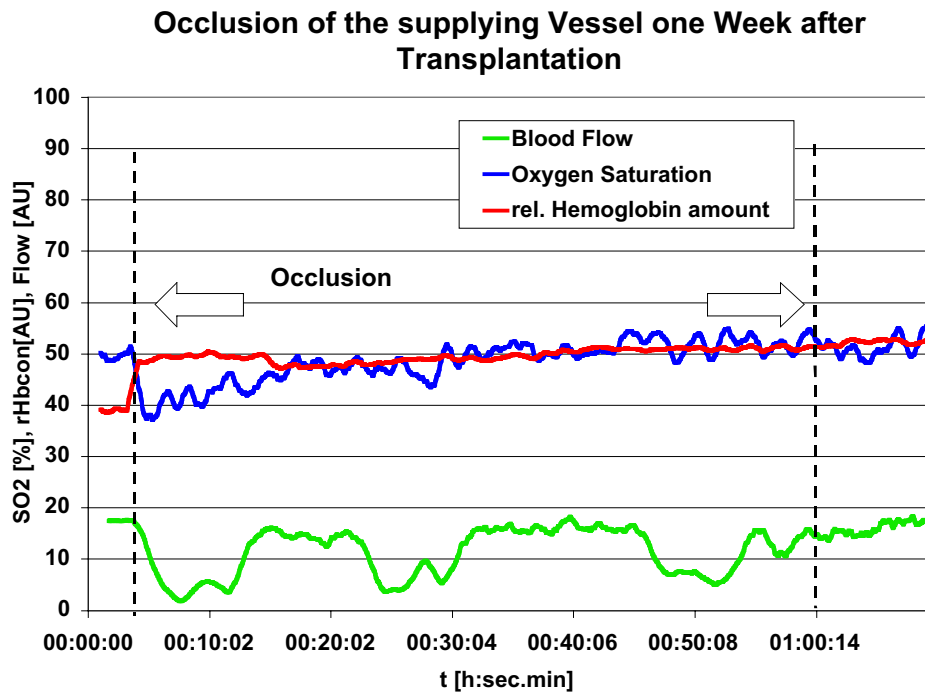
After two days **oxygen saturation, blood flow and hemoglobin amount** decreases clearly during occlusion of the supplying vessel. During occlusion an increase of hemoglobin amount occurs, caused by a **venous congestion** of the faster occlusion of the vein. After the occlusion there is **reactive hyperemia**, that lasts for 5 minutes until values return to baseline. During reactive hyperemia particularly blood flow increases highly above baseline values. Vessel dilatation and venous filling can be observed by local hemoglobin amount

Tissue Supply during Occlusion of the supplying Vessel, 2 days after Transplantation



Tissue neovascularisation one week after transplantation

One week after transplantation perfusion is almost stable after occlusion of the abdominal vessel. **Oxygen saturation only decreases by a few percent.** The small increase of hemoglobin amount indicates a small **outflow** problem, during occlusion of abdominal vessels.



The small increase of all parameters during measurement period indicates a **warming** of the hand, that can be explained by the blanket, with which the hand was covered during the whole measurement.

Interestingly there are high variations of the blood flow during occlusion for relative long time periods (about 5 minutes). During those strong decreases pulsation of the blood flow could be observed the whole time. As this decrease of perfusion has almost no influence on oxygen saturation, there is a change in oxygen uptake of the measured tissue. This can be caused by a change of metabolism of the cells, which speed and strength would be unusual, or by a **redistribution** of the blood from nutritive vessels to e.g. shunt vessels.

With O2C blood supply and important hemodynamic conditions of transplanted tissues can be characterized by determination of the parameters of microcirculation oxygen saturation, blood flow and hemoglobin amount. The diagnosis of flap hemodynamic conditions includes **discrimination of undersupply by arterial or venous occlusion, decrease of oxygen uptake by decreased metabolism or shunt perfusion and successful neovascularization.**

¹ Pittet B, Chang P, Cederna P, Cohen MB, Blair WF, Cram AE: The role of neovascularization in the survival of an arterialized venous flap. *Plast Reconstr Surg* 1996 Mar;97(3):621-9

² at Prof. Dr. Lanz, Hospital of hand surgery, Hospital for heart and vessel surgery GmbH, Bad Neustadt.