8. Monitoring of flaps by measurement of intracapillary haemoglobin oxygenation with EMPHO II: experimental and clinical study.

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OBJECTIVE: To find out whether measurements of intracapillary haemoglobin oxygenation made with the non-invasive Erlangen microlightguide spectrophotometer (EMPHO II) provided accurate data about the oxygen supply as well as the blood flow to free flaps in rats and humans. DESIGN:
Experimental, and prospective open clinical study. SETTING: University hospital, Germany. ANIMALS and SUBJECTS: Thirty male Wistar rats and 20 patients who underwent microsurgical transplant of free flaps (radial forearm, n = 8; osteocutaneous fibula, n = 7; and myocutaneous from the lateral thigh, n = 5). INTERVENTIONS: Measurement of the haemoglobin oxygenation of the skin before, during, and after transfer of the flap. MAIN OUTCOME MEASURES: Reproducibility and mean curves for haemoglobin oxygenation and haemoglobin concentration. RESULTS: All values were reproducible, and there were only slight fluctuations. Uninjured skin in rats (baseline value) oxygenation of the total haemoglobin concentration ranged from 15% to 45% (mean 23%). After the flaps were raised there was a slight increase (to a mean of 37%), probably as a result of reactive hyperaemia. There was a rapid decrease within a few minutes of arterial occlusion, and residual oxygenation of up to 20% after perfusion stopped. The flap was totally deoxygenated after 1 h. Venous occlusion caused a similar pattern and all flaps were deoxygenated by 30 min. In the clinical study ligation of the vascular pedicle caused a massive reduction in values but after anastomosis there was significantly higher haemoglobin oxygenation (P = 0.05) and this continued to increase postoperatively. There were no complications and oxygenation gradually and continuously decreased from the base of the flap to the periphery. CONCLUSION: The non-invasive EMPHO II provides reliable and easily assessable data about the circulation and supply of oxygen to a transplanted free flap.

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