Perfusion monitoring in flaps with new technique - Laser Speckle Contrast Imaging

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Flaps are widely used in reconstructive surgery to cover defects following the removal of tumors, malformations, or trauma. An adequate blood perfusion to the flap is crucial for its survival. For decades it has been a great challenge to accurately measure the blood perfusion of flaps.

In the present thesis, a new non-invasive laser technique, Laser Speckle Contrast Imaging (LSCI) is used to measure blood perfusion in flaps. In the first study, we used a porcine model to investigate the blood perfusion along the length of the skin flaps. Also the impact of stretching and/or rotating the skin flaps were examined. In the second study, we used the same porcine model to study the blood perfusion on eyelid Hewes tarsoconjunctival flaps when stretched and/or rotated. The effect of repeated diathermy were also investigated.

The results from the first study showed that the blood perfusion decreased from the base to the tip of the skin flaps; being reduced to 60% at 20 mm, 37% at 30 mm, and 27% at 40 mm from the base. Stretching the flaps with a force of 3 N reduced perfusion to 45%, and 10 N to 29%. Rotating the flaps to 45° had no significant impact on blood perfusion, and a rotation to 90° reduced perfusion, 54%. When stretching with 3 N, the already 90° rotated flap, perfusion dropped to 26%.

The results from the second study showed that rotating the tarsoconjunctival flaps by 90° did not significantly affect perfusion, while further rotation to 180° reduced blood perfusion to 75% of baseline value. When the flaps were both rotated 90° and stretched with 5 N, the perfusion was reduced to 63%, and with 10 N to 36%. Successive applications of diathermy decreased blood perfusion to 56%, after being applied once and to 43%, 31%, and 15%, after the second, third and fourth applications.

In conclusions, blood perfusion decreases rapidly with distance from the base of skin flaps. Rotation combined with stretching reduced the blood perfusion, which should be avoided in long flaps. Also diathermy reduced the blood perfusion and should be carefully considered.
Publications

Original articles


II. Cu Ansson, Rafi Sheikh, Ulf Dahlstrand, Hult, J., Sandra Lindstedt Ingemansson & Malin Malmsjö, Blood perfusion in Hewes tarsoconjunctival flaps in pigs measured by laser speckle contrast imaging, 2018 dec, I : JPRAS Open. 18, s. 98-103