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Color Duplex Sonography for the Monitoring of Vascularized Free Bone Flaps

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Introduction

For the postoperative management of microvascular free flaps the early detection of vascular complications is important. The clinical evaluation using reperfusion tests, inspection of the colour of the transplanted skin and bleeding after puncture is routinely performed (Fig.1). The clinical evaluation cannot be performed after free flap transfer without a skin island such as fibula, scapula or iliac crest bone flaps. Methods for the postoperative monitoring of revascularized free flaps such as scintigraphy, laser doppler flowmetry, MRI, angiography, measurements of pH and oxygen saturation levels and tissue temperature are not routinely performed due to being invasive, cost and time consuming and may be not reliable. Several of those methods also cannot be performed when the flap has no skin island. After microsurgery using free bone flaps without a skin island a postoperative monitoring may be difficult. When vascular complications are suspected revisional surgery may be performed unnecessarily. Colour duplex sonography for the postoperative monitoring of 12 free fibula grafts without a skin island is demonstrated.



Fig. 1a



Fig. 1b

In cases of vascular complications revisional surgery is indicated and should be performed immediately.

Fig.1a: Venous congestion of radial forearm flap detected clinically at postoperative day three.

Fig. 1b: Recovery of the flap after immediate revisional surgery was performed.

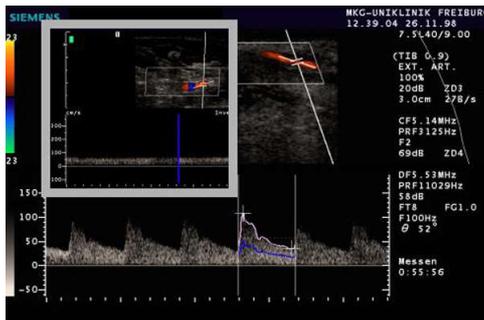


Fig. 2

Quantitative and qualitative monitoring of the perfusion of microvascular anastomoses using colour duplex and doppler sonography. Fig. 2: The arterial and venous blood flow (inlet) of the vascular pedicle is demonstrated.

Methods

The quantitative and qualitative monitoring of the perfusion of microvascular anastomoses and of the transplanted tissues using colour duplex sonography is presented (Fig.2). A 7.5 Mhz scanner (Elegra®, Siemens, Germany) for the postoperative monitoring of 12 free fibula flaps were used. The colour duplex sonography was performed daily starting at postoperative day one for ten days.

Results

The perfusion of the vascular pedicle and the transplanted tissues could be demonstrated in all fibula flaps using colour duplex sonography and the arterial and venous flow was identified by means of colour doppler sonography (Fig.2). The identification of the anastomoses was facilitated after intraoperative documentation of the location of the vascular pedicle and successful in all free flaps. In three cases postoperative complications next to fibula flaps such as abscess formation, wound dehiscence and wound healing disturbances after irradiation occurred (Fig. 4, 7). Vascular complications and failure of the flaps were suspected. Using colour duplex sonography undisturbed perfusion of the vascular pedicle and the transplanted tissue was verified (Fig. 5, 8). Revisional surgery was therefore not indicated and the complications were managed with local wound care (Fig. 6, 9). The free fibula flaps proved to be well integrated at time of removal of the osteosyntheses material after 6 months (Fig. 3, 10).

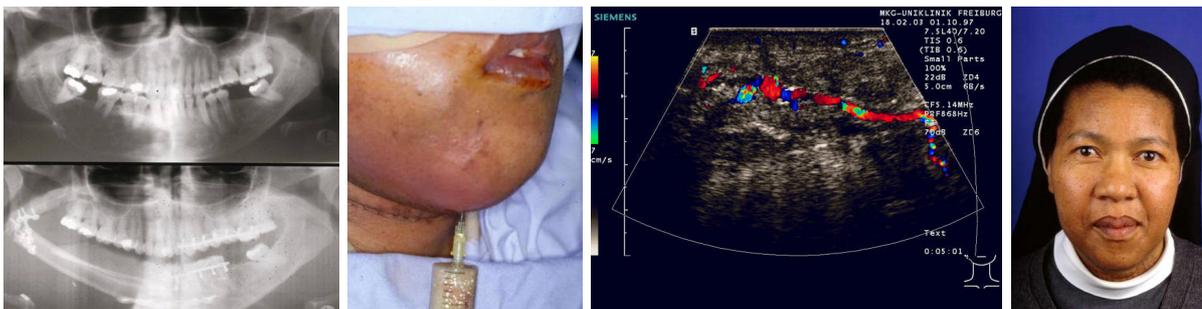


Fig. 3-6: Primary mandibular reconstruction using a fibula flap was performed after resection of an ameloblastoma. Preoperative and postoperative X-ray (Fig.3). At postoperative day ten an abscess had formed next to the free fibula flap (Fig.4). Good perfusion of the anastomosis and the flap was demonstrated using colour duplex sonography (Fig.5). Revisional surgery was not performed. Postoperative view of the patient (Fig.6).

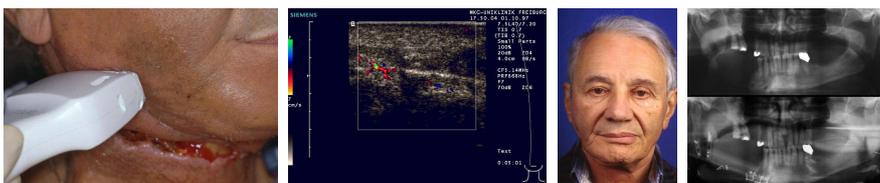


Fig. 7-10: Secondary mandibular reconstruction using a free fibula flap was performed 18 months after resection of squamos cell carcinoma and postoperative irradiation with 60 Gy. At postoperative day six a wound healing disturbance occurred and a vascular complication was suspected (Fig. 7). Normal perfusion of the anastomoses and of nutrient vessels entering the free bone flap (arrow) were demonstrated (Fig. 8). Revisional surgery was therefore not performed. Postoperative view of the patient (Fig. 9). Preoperative X-Ray after mandibular reconstruction (Fig. 10).

Conclusion

The colour duplex sonography for the monitoring of free bone flaps without skin islands proved to be a reliable method. The perfusion of the vascular pedicle of all free 12 fibula flaps were demonstrated. Colour duplex sonography is a non-invasive and inexpensive method and can be performed immediately when needed. A close follow-up for the postoperative monitoring is possible. The management of free bone flaps when vascular complications are suspected can be facilitated using colour duplex sonography.

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Poster Faksimile:



COLOR DUPLEX SONOGRAPHY FOR THE MONITORING OF VASCULARIZED FREE BONE FLAPS

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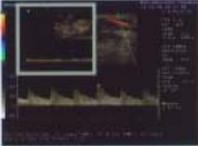
Introduction:
 For the postoperative management of microvascular free flaps the early detection of vascular complications is important. The clinical evaluation using reperfusion tests, inspection of the colour of the transplanted skin and bleeding after puncture is routinely performed (Fig.1). The clinical evaluation cannot be performed after free flap transfer without a skin island such as fibula, scapula or iliac crest bone flaps. Methods for the postoperative monitoring of revascularized free flaps such as scintigraphy, laser doppler flowmetry, MRI, angiography, measurements of pH and oxygen saturation levels and tissue temperature are not routinely performed due to being invasive, cost and time consuming and may be not reliable. Several of those methods also cannot be performed when the flap has no skin island. After microsurgery using free bone flaps without a skin island a postoperative monitoring may be difficult. When vascular complications are suspected revisional surgery may be performed unnecessarily. Colour duplex sonography for the postoperative monitoring of 12 free fibula grafts without a skin island is demonstrated.

Fig.1a **Fig.1b**




Left: Cases of vascular complications revisional surgery is indicated and should be performed immediately.
 Fig.1a: Visual inspection of a free fibula flap distally immediately at postoperative day three.
 Fig.1b: Recovery of the flap after immediate revisional surgery was performed.

Right: Quantitative and qualitative monitoring of the perfusion of microvascular anastomoses using colour duplex and doppler sonography. Fig.2: The arterial and venous blood flow (color) of the vascular pedicle is demonstrated.



Methods: The quantitative and qualitative monitoring of the perfusion of microvascular anastomoses and of the transplanted tissues using colour duplex sonography is presented (Fig.2). A 7.5 Mhz scanner (Elegra®, Siemens, Germany) for the postoperative monitoring of 12 free fibula flaps were used. The colour duplex sonography was performed daily starting at postoperative day one for ten days.

Results: The perfusion of the vascular pedicle and the transplanted tissues could be demonstrated in all fibula flaps using colour duplex sonography and the arterial and venous flow was identified by means of colour doppler sonography (Fig.2). The identification of the anastomoses was facilitated after intraoperative documentation of the location of the vascular pedicle and successful in all free flaps. In three cases postoperative complications next to fibula flaps such as abscess formation, wound dehiscence and wound healing disturbances after irradiation occurred (Fig. 4, 7). Vascular complications and failure of the flaps were suspected. Using colour duplex sonography undisturbed perfusion of the vascular pedicle and the transplanted tissue was verified (Fig. 5, 8). Revisional surgery was therefore not indicated and the complications were managed with local wound care (Fig. 6, 9). The free fibula flaps proved to be well integrated at time of removal of the osteosyntheses material after 6 months (Fig. 3, 10).

Fig.3

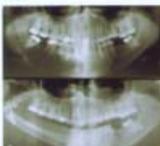


Fig.4



Fig.5

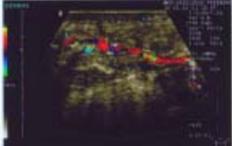


Fig.6



Fig. 3-4: Primary mandibular reconstruction using a fibula flap was performed after resection of an ameloblastoma. Postoperative and postoperative 3-mo (Fig. 3). At postoperative day 10 an abscess had formed next to the free fibula flap (Fig. 4). Good perfusion of the anastomosis and the flap was demonstrated using colour duplex sonography (Fig. 5). Revisional surgery was not performed. Postoperative view of the patient (Fig. 6).

Fig.7



Fig.8

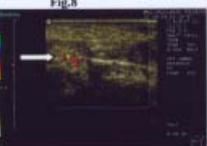


Fig.9



Fig.10



Fig. 7-10: Secondary mandibular reconstruction using a free fibula flap was performed 18 months after resection of squamous cell carcinoma and postoperative evolution with MRCT. At postoperative day 10 a wound healing disturbance occurred and a vascular complication was suspected (Fig. 7). Normal perfusion of the anastomosis and of nutrient vessels entering the free bone flap (arrow) were demonstrated (Fig. 8). Revisional surgery was therefore not performed. Postoperative view of the patient (Fig. 9). Postoperative and postoperative 5-mo after mandibular reconstruction (Fig. 10).

Conclusion: The colour duplex sonography for the monitoring of free bone flaps without skin islands proved to be a reliable method. The perfusion of the vascular pedicle of all free 12 fibula flaps were demonstrated. Colour duplex sonography is a non-invasive and inexpensive method and can be performed immediately when needed. A close follow-up for the postoperative monitoring is possible. The management of free bone flaps when vascular complications are suspected can be facilitated using colour duplex sonography.