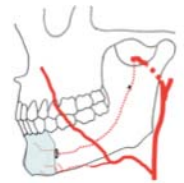


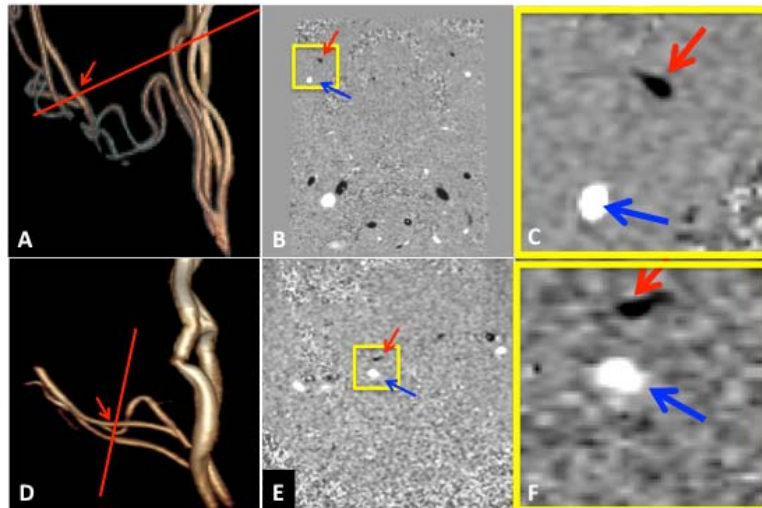
## Value of 2D Phase Contrast-MRI for investigation of facial hemodynamic: Preliminary result in a face allograft woman

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**Purpose:** The First human face allograft was made in 2005 [1]. Transplantation consisted in part of revascularisation of facial arteries and veins. Investigation of facial vessels is limited by Doppler-ultrasound and can't be used as quantitative tool to follow the outcome of transplanted patients. Little is known concerning quantitative facial hemodynamics. 2D Phase Contrast (PC)-MRI is a rapid, non invasive and reproducible tool, suitable for measuring arterial and venous blood flows during cardiac cycles even in small regions of interest [2-3-4]. This investigation aims to develop a dedicated PC-MRI protocol to assess facial arterial and venous flows.



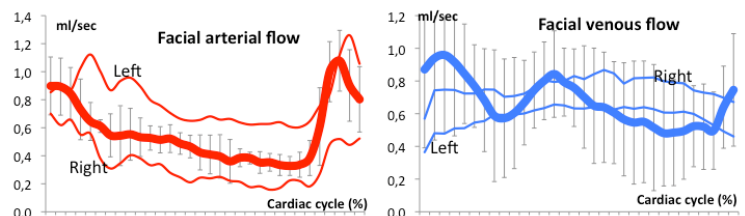
**Methods:** Seven control adults (mean age: 45±6 years) and one patient with a facial transplantation were scanned. The facial transplantation was carried on a 52 years old woman with a large lower face composite tissue defect, after exeresis of highflow



**Figure 1** shows reconstructed MR angiography (A,D) which was used to select 2D PC-MRI orientation to be perpendicular to the facial arteries (red arrow). in Images B and E we can see 1 of the 32 PC-MRI images in which arterial flow are represented in hypointensity (red arrows) whereas venous flow are represented hyperintense (blue arrows). Images C and F zoom the right vessels of the face. Images A,B,C are from a healthy subject and D,E,F from the transplanted patient.

arteriovenous malformation. The facial transplant was compounded by tissue of the lower face, with inferior part of maxillary bone (dental arch included), mandibular bone and tongue. In this woman, PCMRI was realized 1 month after surgery. All the subjects gave their consent and MRI was realized in accordance with ethical procedure of our university hospital. A conventional vascular cine PC-MRI (3T GE Healthcare, Milwaukee, WI) was used to quantify blood flows in the main artery and vein of the face on the right and left sides. An "in-hance" angiography sequence was used as a scout view to position the PC-MRI acquisition planes perpendicularly to the selected vessels (figure 1). Retrospective peripheral-gated cine PC-MRI was performed using 8 channel head coils and with 32 cardiac phases (FOV=18 cm<sup>2</sup>, slice-thickness 5 mm, matrix=256x256, vps=2, flip-angle=20°, BW=31.25 kHz, minTE, venc=40 cm/sec). Duration of the PC-MRI was around 3 minutes, depending on the cardiac frequency. Post processing of PCMRI was done using a dedicated flow software ([www.tidam.fr](http://www.tidam.fr)). Arterial and venous flow curves were reconstructed to assess both mean value and pulsatility of the flow across the cardiac cycle.

**Results :** Mean arterial and venous flow were reconstructed and are presented in figure 2. The post transplantation hemodynamic was functional in both venous and arterial vessels (figure 2) although we show a difference between right and left sides.



**Figure 2** represents facial arterial and venous flows in the transplanted patient, plotted to the results from the control population. Curve flows are represented in ml/sec across one mean cardiac cycle.

**Discussion, conclusion:** Since 2005 [1], 25 facial transplantations have been successfully performed. In most of them, microsurgical anastomosis of facial transplant was made on the facial artery. 2D PC-MRI is a rapid and quantitative tool useful for measuring arterial and venous flow of the face. Nevertheless the high variability of these preliminary results requires a larger control population to be explored before clinical application. Nevertheless PCMRI protocol has shown its ability to measure arterial and venous flows of the face. We have shown that arterial and venous flow of the face presented different shape in accordance as we can see in other organs. In this work PC-MRI highlights arterial and venous flow behavior in facial transplantation. Similar protocols could be used to better understand physiological hemodynamic of the face and to follow the patients outcome.

**References:** 1: Devauchelle B. et al. First human face allograft: early report. *Lancet*. 2006 2: Feinberg DA, Mark AS. Human brain motion and cerebrospinal fluid circulation demonstrated with MR velocity imaging *Radiology* 1987 3: Spilt A, et al. Reproducibility of total cerebral blood flow measurements using PCMRI. *J Magn Reson Imaging*. 2002. 4: Stoquart-Elsankari S, et al., A phase-contrast MRI study of physiologic cerebral venous flow. *J Cereb Blood Flow Metab*. 2009