

Effect of the frequency of neuromuscular electric stimulation of the leg on femoral arterial blood flow. (Article in French)

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Place of origin Belgium

Background In a previous work (1993) the authors have demonstrated that TENS applied to the human leg muscles increases largely the arterial femoral blood flow and that this elevated flow remains stable during the stimulation.

Objective To investigate the influence of the frequency of the stimulation on the level of hyperaemia in the femoral artery.

Tested products Compex 2-channel stimulator

In vivo laboratory study on 7 healthy volunteers (7 male, 1 female, mean age 26,9).

NMES is applied to the internal and external branches of the politeal sciatic nerve in order to stimulate all muscles of leg & foot.

The following hemodynamic variables are assessed at rest and during each stimulation episode:

- Study design & methods
- Heart rate
  - Systolic arterial blood pressure
  - Diastolic arterial blood pressure
  - Mean arterial pressure
  - Arterial debit (l/min)
  - Pulsatility index
  - Peripheral vascular restistance

The stimulus is yielded by a Compex stimulator for 7 minutes with frequencies in random order between 3 and 15 Hz. The intensity of the current (mean: 31 mA) is set up at such a level to increase blood flow by at least 100% at 5 Hz.

The femoral arterial flow velocity and the pulsatility index are assessed during the last minute of the stimulation by a duplex ultrasound method.

The peripheral vascular resistance is calculated on the base of the femoral blood flow and the mean arterial pressure.

- Results
- The authors observed a linear increase of the blood flow with increasing frequencies of stimulation (181% of the rest value at 3 Hz and 276% at 9 Hz). The hyperaemia tend to a plateau between 7 and 9 Hz, with a trend to drop for further frequencies. These higher frequencies were not comfortable and some subject did not tolerate.
  - The pulsatility index and the vascular resistance drop dramatically with the lower frequency (3Hz) and remain at this low level during further stimulation.
  - The arterial pressure elevates during the stimulation at 13 and 15 Hz.
  - Stimulation does not affect heart rate.

Conclusion

The transcutaneous NMES of the leg muscles leads to an important hyperaemia which can be modulated by the selection of the frequency. The range of 5 to 7 Hz seems optimal for potential clinical applications.

Key message

Optimal femoral blood flow enhancement with NMES at frequencies in the range of 5 to 7 Hz.