

Changes in isometric quadriceps strength after the application of ultrasound-guided percutaneous neuromodulation. A case study

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Abstract

Background Ultrasound-guided percutaneous neuromodulation (US-guided PNM) is an invasive physiotherapy technique which is employed for neurofunctional improvement and treatment of pain. To date, no study has related this technique with muscle stimulation and dynamometry changes. Within the functional assessment tools, dynamometry tests were performed with devices which enable the calculation of variables related with isometric and isokinetic movement.

Aim To assess the changes in maximum isometric strength after the application of US-guided PNM.

Material and Methods A retrospective case study comprising 13 subjects (26 lower limbs) receiving US-guided PNM, with pre and post-intervention measurements.

The inclusion criteria comprised subjects without pain at the time of study, with coefficients of variation (COV) below 15% and in the process of improving loading work. We excluded subjects with pathology provoking pain at the time of the measurements and with contraindications for dynamometry or US-guided PNM. An isometric measurement was performed using the KINEO dynamometry system with 90° hip flexion and 45° knee extension, without strapping and with manual grips in lateral supports of the system. The lever arm was placed at 2 cm of the malleoli in the ventral aspect without strapping the ankle and a pre-intervention measurement was performed of the maximum isometric strength based on a mean of 3 repetitions (3 seconds' contraction and 6 seconds' relaxation). Subsequently, the US-guided PNM technique was performed on the femoral nerve, using the Physio Invasiva device and the PES modality (10 Hz frequency, 240 μs pulse width). Ten maximal and pain free stimulations were performed lasting 10 seconds each, with a 10 second rest between each contraction. After the intervention, a post intervention measurement was performed, in the same manner as the previous measurement.

Results In total, 13 volunteer subjects participated in the study, aged between 27 and 59 years, of which, 2 were women and 11 were men. After the application of US-guided PNM on the femoral nerve, changes were observed in the maximum mean isometric strength of the quadriceps, which increased from 26.75 kg in the pre-intervention mean with a standard deviation of 7.42 kg to 30.05 kg for the post-intervention mean,

Keywords

- ▶ neuromodulation
- ▶ percutaneous
- ▶ dynamometry
- ▶ femoral nerve
- ▶ isometric contraction

with a standard deviation of 9.23 kg. The results were statistically significant with $p < 0.000$.

Conclusion US-guided PNM applied to the femoral nerve is able to produce changes in maximum isometric strength measured using dynamometry.