

## Isolated Contraction of Deep Lumbar Paraspinal Muscle with Magnetic Nerve Root Stimulation: A Pilot Study

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**Abstract :** Objective: The aim of this study was to evaluate the changes of lumbar deep muscle thickness and cross-sectional area using ultrasonography with magnetic stimulation. Methods: To evaluate the changes of lumbar deep muscle by using magnetic stimulation, 12 healthy volunteers (39.6±10.0 yrs) without low back pain during 3 months participated in this study. All the participants were checked with X-ray and electrophysiologic study to confirm that they had no problems with their back. Magnetic stimulation was done on the L5 and S1 root with figure-eight coil as previous study. To confirm the proper motor root stimulation, the surface electrode was put on the tibialis anterior (L5) and abductor hallucis muscles (S1) and the hot spots of magnetic stimulation were found with 50% of maximal magnetic stimulation and determined the stimulation threshold lowering the magnetic intensity by 5%. Ultrasonography was used to assess the changes of L5 and S1 lumbar multifidus (superficial and deep) cross-sectional area and thickness with maximal magnetic stimulation. Cross-sectional area (CSA) and thickness was evaluated with image acquisition program, ImageJ software (National Institute of Health, USA). Wilcoxon signed-rank was used to compare outcomes between before and after stimulations. Results: The mean minimal threshold was 29.6±3.8% of maximal stimulation intensity. With minimal magnetic stimulation, thickness of L5 and S1 deep multifidus (DM) were increased from 1.25±0.20, 1.42±0.23 cm to 1.40±0.27, 1.56±0.34 cm, respectively (P=0.005, P=0.003). CSA of L5 and S1 DM were also increased from 2.26±0.18, 1.40±0.26 cm<sup>2</sup> to 2.37±0.18, 1.56±0.34 cm<sup>2</sup>, respectively (P=0.002, P=0.002). However, thickness of L5 and S1 superficial multifidus (SM) were not changed from 1.92±0.21, 2.04±0.20 cm to 1.91±0.33, 1.96±0.33 cm (P=0.211, P=0.199) and CSA of L5 and S1 were also not changed from 4.29±0.53, 5.48±0.32 cm<sup>2</sup> to 4.42±0.42, 5.64±0.38 cm<sup>2</sup>. With maximal magnetic stimulation, thickness of L5, S1 of DM and SM were increased (L5 DM, 1.29±0.26, 1.46±0.27 cm, P=0.028; L5 SM, 2.01±0.42, 2.24±0.39 cm, P=0.005; S1 DM, 1.29±0.19, 1.67±0.29 P=0.002; S1 SM, 1.90±0.36, 2.30±0.36, P=0.002). CSA of L5, S1 of DM and SM were also increased (all P values were 0.002). Conclusions: Deep lumbar muscles could be stimulated with lumbar motor root magnetic stimulation. With minimal stimulation, thickness and CSA of lumbosacral deep multifidus were increased in this study. Further studies are needed to confirm whether the similar results in chronic low back pain patients are represented. Lumbar magnetic stimulation might have strengthening effect of deep lumbar muscles with no discomfort.

**Keywords :** magnetic stimulation, lumbar multifidus, strengthening, ultrasonography

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