**Transcutaneous lumbar spinal cord stimulation for studies of sensory-motor integration mechanisms.**

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Electrical stimulation of the human lumbosacral posterior roots is used to evoke spinal reflexes and to neuromodulate altered sensori-motor function following spinal cord injury. The posterior roots can be depolarized by epidural as well as recently also transcutaneous electrical stimulation. Here, we present the non-invasive intervention of the spinal network and reflex pathway. The posterior root reflexes (PRR) result from depolarization of the Ia afferent fibers which subsequently activates the monosynaptic motor fibers innervating the lower limb muscles. Such PRR are elicited by transcutaneous spinal cord stimulation utilizing skin electrodes placed on the back at the level of the T11-T12 spinous processes and large electrodes at the lower abdomen. Single pulses delivered from such site can consistently activate L2-S2 posterior root fibers bilaterally and thus evoke PRR in various lower limb muscles simultaneously. By varying the rostrocaudal position of the back electrodes (T11-T12 spinous processes +/– 4 cm), a more dominant stimulation of either the upper or the lumbar spinal cord segments can be achieved, as reflected in the activation thresholds of the PRR elicited in the L2-L4 innervated quadriceps vs. the L5-S2 innervated triceps surae. Transcutaneous spinal cord stimulation to elicit PRRs is a comprehensive assessment method for human motor control studies.

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|  | Figure: Methodology of transcutaneous spinal cord stimulation. |