

## Somatosensory Evoked Potentials Part III: The Lumbar Spine and Lower Extremity

Most work with lower body SSEPs has been in the study of lumbar radiculopathy. Somatosensory Evoked Potentials (SSEP), can evaluate the dynamic neurophysiological function of large sensory afferent fiber conduction through the peripheral nerves and the dorsal column up to the somatosensory cortex. SSEPs are complementary to traditional nerve conduction and EMG studies. SSEPs can help verify a conduction abnormality along the neuroaxis by stimulating a peripheral nerve and measuring the time it takes to get to the contralateral cortex of the skull (latency). An ipsilateral time delay in latency compared to published normal values, the unaffected extremity or an absent wave form or peak indicate a neurophathological process which must be correlated with other electrodiagnostic tests, imaging tests, lab tests, and the clinical findings. When evaluating for lumbar radiculopathy the posterior tibial nerve, and the peroneal nerve are mixed nerves commonly tested. These nerves contain fibers from multiple neurologic and root origin, and can be tested as normal despite the existence of a monoradiculopathy due to a masking or watering down effect from the remaining unaffected root levels. This has been documented in the literature in studies by Katifi et al., Aminoff et al., and others.

A study by Feinsod et al., found in a series of patients with prolapsed discs, that all patients studied had abnormal peroneal nerve SSEPs. Dermatome Somatosensory Evoked Potentials (DSSEP) have emerged as a sensitive and specific adjunct to SSEP electrodiagnostic testing. In a study by Katifi et al., and Sedgewick, DSSEPs correctly identified the level of root compression in 19 of 21 patients with surgically confirmed lesions. Walk et al., made similar findings in their study, and found SSEP to be a sensitive and specific tool in the electrodiagnosis of lumbosacral radiculopathy, and recommended its utility in addition to conventional EMG when equivocal. Dermatome studies help improve specificity in documenting sensory nerve dysfunction since the electrode stimulates the "signature area" of a dermatome (i.e., the lateral foot for S1). DSSEP has also been shown to be efficacious in the electrodiagnosis of spinal stenosis in studies by Snowden et al., and Owen et al.

In studies by Pop, Slimp, Chiappa, Eisen, Aminoff, Delisa, and others, normal values were determined for lumbar dermatomes and segmental nerves. A significant correlation was found between body height and length and absolute latencies. Other variables which must be accounted for include temperature, obesity, CNS and metabolic disorders. Criteria for abnormality can include:

1. absent wave forms
2. absolute latency delays greater than 2.5-3.0 standard deviations from normal
3. side to side latency differences greater than 3.0 milliseconds
4. abnormal amplitude ratio of wave forms in excess of 4.1

Like most things in life and science there are contrasting views with respect to the diagnostic utility of SSEP and DSSEP. Aminoff et al., and Rodriguez et al. have published papers stating that SSEP/DSSEP have limited value in the diagnosis of radiculopathy. However, most papers in the literature have been favorable to SSEP as a sensitive method of electrodiagnosis in cases of lumbar radiculopathy. In a recent review article by Swenson in the JNMS, he states that some of the disparity in the reports of sensitivity is due to selecting the cut-off of normal (i.e., 2.5 versus 3.0 standard deviations).

SSEPs have also been suggested as useful by Synek in the diagnosis of piriformis syndrome, and meralgia parasthetica. Other studies have also documented the utility of SSEP in lower extremity entrapment neuropathies of the sural nerve. SSEPs have been shown to be valuable dynamic treatment assessment tools of both surgical care and chiropractic care of radiculopathy, disc herniations, spinal stenosis, and the vertebral subluxation complex.

### Conclusion

SSEP/DSSEPs are a valuable part of the electrodiagnostic examination and provide data regarding sensory function and dysfunction. When imaging studies aren't clear, SSEP/DSSEP may add meaningful information to the patient's diagnosis and prognosis to help improve clinical management.

References available by request.

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