

The Brachial Plexus Provocation Test

Description

The Brachial Plexus Provocation Test (BPPT) (or Upper Limb Tension Test) is used by clinicians to assess mechanical sensitivity of peripheral nerve tissue in the upper quadrant. The BPPT as developed by Elvey (1979) is performed in the following sequence: *gentle shoulder depression, glenohumeral abduction to 90° and external rotation in the coronal plane, forearm supination and wrist and finger extension*. Elbow extension to pain threshold is then performed manually by the clinician. The BPPT biases the median nerve, and variations using different movements may bias the ulnar or radial branches of the brachial plexus (Butler 1991)

A positive response is indicated by reproduction of the patient's pain which often correlates with reduced range of movement measured at the elbow suggested to be related to the onset of protective muscle activity (Hall et al 1999). Asymptomatic subjects also report varying levels of pain with the BPPT (Kenneally 1985), which should alert clinicians to the importance of bilateral comparison where possible. Although a bilateral loss of elbow extension occurs in some individuals with whiplash and may indicate central hyperexcitability as opposed to nerve tissue mechanosensitivity (Sterling & Pedler 2008).

Commentary

The benefit of a quick, practical and repeatable test of neural mechanosensitivity is clear, as it helps to guide the diagnosis, assessment and treatment of disorders such as carpal tunnel syndrome (CTS) (Coppieters et al 2006), cervical radiculopathy (Wainner et al 2003) and whiplash associated disorders (Sterling & Pedler 2008). However, the BPPT has at times come under scrutiny from reviewers. It attempts to quantify findings in the multi-factorial area of neural provocation, and it does so across the most intricate and mobile biomechanical chain in the human body. Anatomical studies support the validity of BPPT to move and/or tension nerve tissues of the upper quadrant. However, due to its complex, multi-joint nature, the BPPT can also cause the deformation of a number of other structures such as arteries, fascia and meningeal tissues (Walsh 2005). Studies have examined the specificity of the BPPT, and its use in the diagnosis of suspected neuropathic conditions (eg, cervical radiculopathy (Rubenstein et al 2007)). These results generally suggest the BPPT has *low* specificity and high sensitivity for conditions with neurogenic association; however, one must remember that it is a test for neural mechanosensitivity along the *entire* peripheral nerve and nerve trunk. Therefore, while the BPPT may not be able to diagnose specifically a condition such as CTS or cervical radiculopathy, a negative BPPT may be used to help rule it out. This said, if neurogenic pain is thought to be the dominant feature of a painful condition, signs of mechanosensitivity should also be identified across other aspects of the patient's assessment, for example active and passive range of movement and nerve trunk palpation (Hall et al 1999).

Recent data from individuals with whiplash indicate that the BPPT may also provide useful indication of the presence of

The test should take only a few minutes to perform and should be conducted by clinicians with knowledge of upper limb neurodynamics, precautions and contraindications to neural testing. Application of the BPPT without care may result in exacerbation of patients' symptoms (Walsh 2005).

Reliability and validity: Inter- and intra-tester reliability studies support a high intraclass correlation for the BPPT in both the clinical and laboratory setting (asymptomatic subjects ICC ≥ 0.95 ; patient population ICC ≥ 0.98) (Coppieters et al 2002). Coppieters et al (2002) suggest that 7.5° difference in measured elbow ROM is significant to show improvement or decline in the clinical setting. The anatomical validity of the BPPT is supported by cadaver studies that demonstrated movement and/or tension in the brachial plexus and peripheral nerves of the upper limb during the test (Kleinrensink et al 2000). Sensitivity of the BPPT is generally accepted as high with mixed results in the literature regarding its specificity, due to the possibility of other multi-joint tissues being provoked during the test (Walsh 2005, Rubenstein et al 2007). Caution is therefore advised in the interpretation of BPPT due to accompanying non-neural structures that may be provoked during the test. Sensitising manoeuvres, eg contralateral cervical side flexion, may differentiate between neural and non-neural components (Coppieters et al 2002).

central hyperexcitability. In this case the clinician would observe a bilateral loss of elbow extension in association with moderate reports of pain when testing is taken to pain threshold only (Sterling & Pedler 2008).

In summary, the BPPT is a valuable and valid clinical test of neural mechanosensitivity in the upper limb. For best practice, every effort should be made to standardise its clinical use. When using the BPPT for diagnosis, the clinician should be aware of possible false positives and other physical signs or objective measures that may influence its result.

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