Recent Advances In The Assessment Of Low Back Pain

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The focus of this paper is a) low back pain, b) the muscles of the low back and c) how recent advances in understanding their activity has changed the way the treatment is conducted. Excluding sudden trauma, for purposes of this paper four systems are viewed as causing low back pain. These are a) facet joints, b) nerves (impinged), c) disks (bulging or herniated) and d) muscles. While dysfunction in any of these systems can cause back pain, research suggests that muscle spasm (trigger points – Travell & Simons, 1983, 1992) accounts for the majority of the pain.

The study of muscle activity is conducted through the use of surface electromyography techniques (SEMG). Starting with the pioneering works of Basmajian (1985) muscle activity of the low back has been examined extensively with often-conflicting results drawn. Pullman (2000) leading a team of researchers from the American Academy of Neurology concluded that SEMG techniques were not accurate in diagnosing low back pain. However they concluded that there was enough evidence to warrant the use of SEMG in kinesological studies of low back pain. The techniques of assessment put forth in this paper meet these latter criteria.

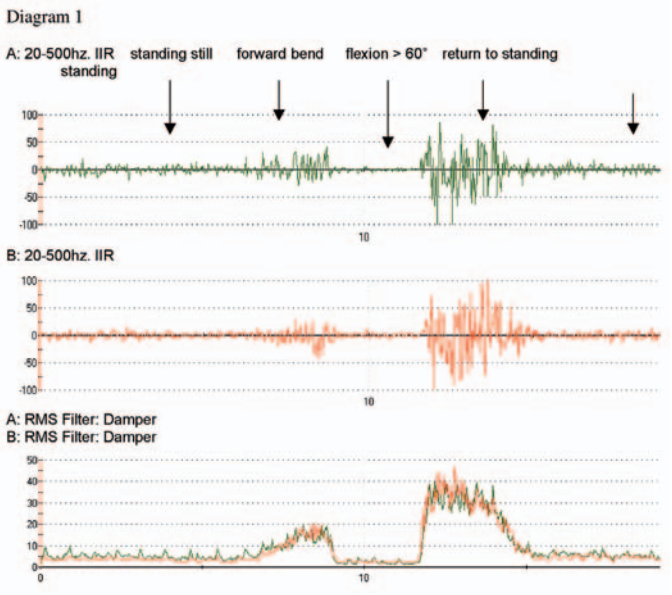
In 1991 Sihvonen studied the test-retest reliability of the SEMG signal in non-pain subjects examining the lumbar paraspinals. By having them perform flexion and return to upright positions he showed this procedure to have extremely high reliability in flexion (r = .92) and returning to the upright position (r = .97). These articles (amongst others) form the basis for the assessment procedures that follows.

Assessment Procedure

The assessment procedure employed is performed in the standing position. Electrodes are placed over the lumbar paraspinals at approximately L1 – 3 following standard procedures (Sherman 2003). The feet are placed shoulder width apart. The subject is then asked to bend forward as far as is comfortable, pause and return to the upright position and stand still. This is repeated 3 times. The results are stored on computer and printed for the subject to see. These results are then utilized to direct treatment and provide feedback as to the subject's progress.

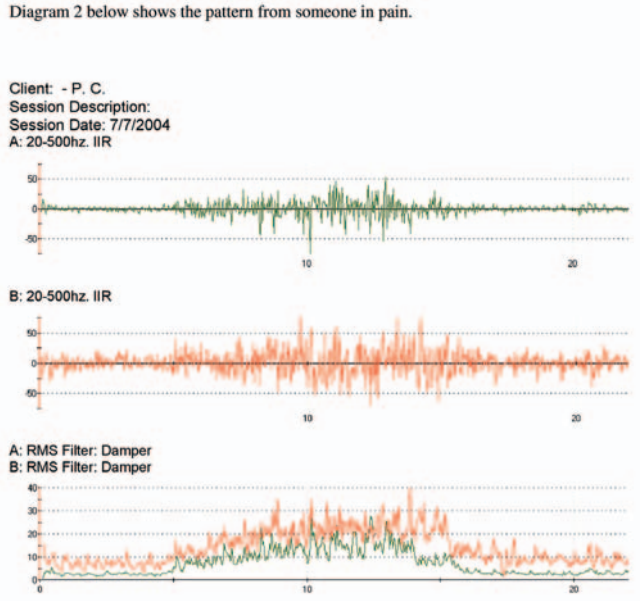
Diagram 1 below shows a pain free subject's pattern. (Note there is just one repetition of the movement shown here.) The top tracing (green color) shows the activity (raw signal) of the left lumbar paraspinal muscles. The second tracing (red color) shows the activity (raw signal) of the right lumbar paraspinals, while the bottom tracing shows an integrated signal with the 2 tracings overlaid. This formula applies to all the tracings seen below.

Diagram 1



A review of this tracing shows just one bend and a return to the upright position with decreased activity between (a return to baseline) the movements. These results are consistent with those from Sihvonen. What is evident from this tracing is a) in the upright position the activity of the lumbar paraspinals is low, b) during movement in the sagittal plane the activity of the paraspinals is equal from side to side, c) the muscle activity in the lumbar paraspinals goes quiet after flexion before returning to the upright (the ligaments and tendons take over the load causing the muscles

Diagram 2 below shows the pattern from someone in pain.



to go quiet after 60 degrees), d) the activity to return to the upright position is greater than that needed for flexion and e) the muscles return to baseline upon standing upright.

Due to the reliability of this pattern it is considered to be the criteria to which training is conducted. This pattern is also considered to be more reliable than the pain report as often the pain will disappear before the normal pattern appears. Clinical experience is that stopping treatment before the SEMG pattern normalizes results in a return of symptoms within a couple of weeks. Conversely our clinical experience is that once the SEMG tracings normalize the pain does not return even in 5 year follow up studies.

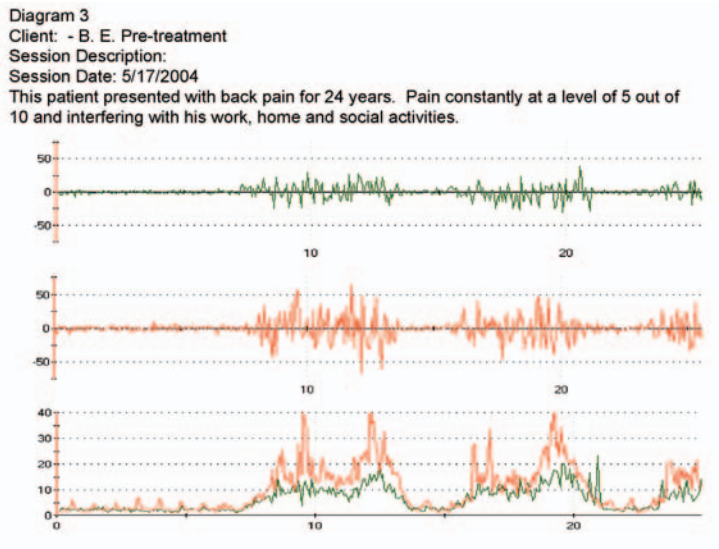
Review of these tracings shows quite a deviance from the pain free tracing. First the lumbar paraspinals are not quiet during standing. The right side is quite elevated. Second during movement in the sagittal plane there is an imbalance of activity during both aspects of the movement. Third there is no clearly defined shutoff of the muscles after flexion. Fourth there remains increased activity on the right side after movement, which is slightly higher than before movement.

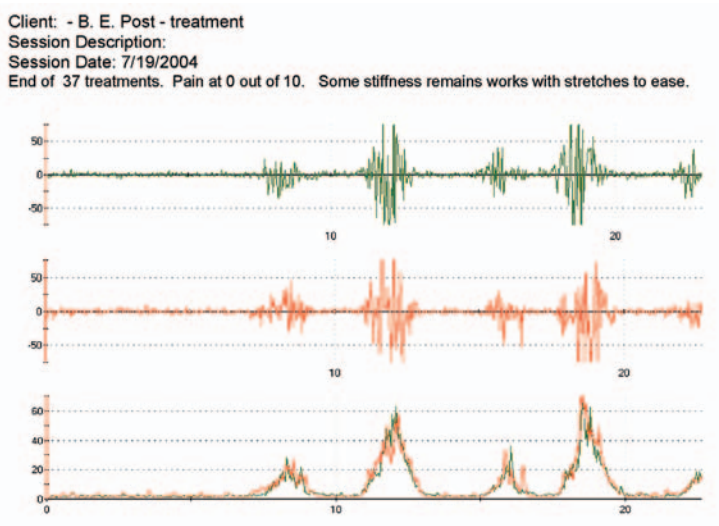
What Does This Mean?

The information that follows is based entirely upon the authors' experiences with these procedures and the successful outcomes (elimination of pain and restoration of function) these protocols have produced. While they believe there is a sound physiological basis for the statements that follow the discussion is not considered to be all-inclusive.

1. The elevation of the muscle activity in standing before movement appears to reflect the activity of the hamstrings and/or iliopsoas. A trigger point in these muscles is thought to reduce the length of these muscles pulling the pelvis out of alignment causing the paraspinals to oppose this force. Stretching the hamstrings and/or iliopsoas reduces this activity as seen in the changes diagramed below.
2. The elevation during movement appears to reflect hyperactivity of the right side similar to that during standing. Years of clinical work suggest that there is a different cause of this imbalance than for standing. The imbalance can be corrected by stretching to the high side. It is believed that the low side reading reflects activity (a trigger point) in the quadratus lumborum. This trigger point inhibits the activity of the ipsilateral paraspinals producing this pattern. Thus stretching to the high side stretches the trigger point underlying the paraspinals returning the pattern to symmetry.
3. There are a number of factors, which may cause the muscles to remain active beyond the 60 degrees in flexion. Which one is dominant is not presently known. Some of the possible causes include disk protrusion(s), nerve impingement, reflexive protective spasm. Despite this limitation treatment as seen below changes this pattern.
4. Baseline activity represents the same forces as outlined in point #1. Often this activity is increased from the first tracing.

Diagram 3 below shows a client before and after treatment. The treatment protocol was directed by the SEMG tracings and involved stretching in flexion, extension, and lateral flexion twice as often to the right side. Details of the machine and stretching protocols are outside of the focus of this paper but are available from the authors.





Conclusion

There are a number of contra-indications for the use of these techniques. These include a) lumbar fusion less than 6 months old, b) metastatic cancer, c) severe osteoarthritis or osteoporosis with over 45% bone loss, d) herniated disk, e) compression fracture within one year, f) aortic aneurism, g) hemiplegia, h) cognitive dysfunction and i) uncontrolled medical disorder. While this list appears to be extensive, it accounts for very little of the population that experiences low back pain.

The assessment procedure as outlined above provides objective data that can be gathered in a systematic and reliable manner. It appears to reflect the kinesological aspects of low back pain. Using this information treatment can be organized in a reliable manner with results objectively documented. (Call for References.)