

# Apple Cart

a core concepts musculoskeletal health group newsletter

## Chronic Pain: Altered Pain Processing Mechanisms And Central Sensitization

It is estimated that 10-20% of the general population is affected by chronic pain. Studies regarding chronic widespread pain in the US and the UK have suggested that around 10-11% have permanent symptoms whereas chronic regional pain was estimated to occur in 20-25% of the population<sup>4</sup> with women are 1.5 times more likely to be affected than men<sup>4</sup>.

Chronic pain is not always caused by a nociceptive stimulus, tissue damage or an inflammatory process and is more often related to altered pain processing mechanism and central sensitization<sup>11</sup>. Investigations like MRI, X-ray or blood tests are often negative. These negative results is frustrating for many patients as their pain remains. This can lead to misunderstandings between patients and health care providers, family members or friends as the patient's symptoms are not consistent with the results.

Experiencing "unexplained" pain and being questioned from outside if the pain is real causes extra stress and contributes to increased pain levels. Additionally it can lead to fear avoidance behaviors, anxiety, increased stress levels, mental and physical disabilities<sup>6-8</sup>. It can diminish performance at work and private life and, in general reduce activity levels and the quality of life. There is a wide range of chronic pain conditions such as fibromyalgia, chronic fatigue syndrome, chronic regional pain syndrome, osteoarthritis, musculoskeletal disorders, headaches,

visceral and neuropathic pain. Many symptoms of these conditions overlap complicating the process of finding the right diagnoses and appropriate treatment approach.

Fortunately within the last years intense research has led to a better understanding of chronic pain, pain processing mechanisms and central sensitization and hence to new approaches in the management of chronic pain.

### Pain processing and central sensitization

The physiology of pain is very complex and there are many factors involved which can influence pain processing and pain perception. The International Association for the Study of Pain (IASP) defined pain as *"an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage"*; whereas chronic pain is defined as *"pain that persists after tissue healing time or longer than 3-6 month after the onset of pain"*<sup>1,8</sup>. Moseley<sup>10</sup> stated that the biology of pain is never straight forward and mentioned four key points which are important for the understanding of acute and persistent pain. He stated that<sup>10</sup>:

1. Pain does not provide a measure of the state of the tissues
2. Pain is modulated by many factors from across somatic, psy-

chological and social domains

3. The relationship between pain and the state of the tissues becomes less predictable as pain persists.
4. Pain can be conceptualized as a conscious correlate of the implicit perception that tissue is in danger.

In most acute pain states, pain originates from an increased nociceptor activity reflecting the presence of a peripheral damaging stimulus<sup>7</sup>. After injury/tissue damage inflammatory mediators such as glutamate, substance P, calcitonin gene related peptide are released causing an increased sensitivity (primary hyperalgesia) in the area of tissue damage and the surrounding of the uninjured skin (secondary hyperalgesia)<sup>8</sup>. In some cases of injury, nociceptors can keep on firing and cause hypersensitivity in the dorsal horn. This can lead to an increased sensitivity of low-threshold mechanoreceptors which causes an increased pain response to mechanical, thermal and chemical stimuli. Even small movements and touch (allodynia) can become painful<sup>3,7,8</sup>. Prolonged nociceptor activity can cause alterations in the spinal cord and in higher centers in the brain leading to an increased sensitivity of pain modulating neurons. These changes can amplify incoming peripheral stimuli to that extent that even in-noxious stimuli become sufficient enough to cause pain. Instead of being peripheral driven, the pain becomes "centralized"<sup>3,7,8,10</sup>.

Central sensitization is *"an augmentation of responsiveness of central pain-signaling neurons to input from low-threshold*

*mechanoreceptors*"<sup>9</sup>. The spinal cord acts as a "magnifier" or "distorter" of the tissue reality. In this stage the information the brain receives from the dorsal horn is not accurate anymore and does not reflect the actual or real state of the tissues<sup>3</sup>. Furthermore morphological changes in the brain<sup>2</sup> and alterations in the proprioceptive representation of the painful body part in primary sensory cortex can occur and may compromise and distort motor control<sup>10</sup>.

Under these circumstances perceived pain looks like it is an illusion since it is caused by a sensation that is equal in the quality to a real noxious stimulus, but occurs in the absence of any tissue damage or a nociceptive stimulus<sup>3,7,10</sup>. Or simply said pain persists although the time for normal tissue healing has long passed and there is no obvious sign (or issue in the tissue) which explains the patient's pain. For these patients the pain is real, just that it is not activated by noxious stimuli<sup>3</sup>. As indicated by the IASP's definition of pain, the pain response can be very different for everybody since it is modulated by somatic, social and psychological factors<sup>10</sup>. Hence the oversensitive system can respond with pain from harmless internal or external stimuli such as visceral processes and normal audio, visual or tactile simulations. Even thoughts and emotions have the potential to influence the pain response in a positive and negative manner<sup>3,7,8,10</sup>. It is important to know that during the pain experience many parts of the brain are activated simultaneously and that there is not just one pain center in the brain as commonly assumed<sup>3</sup>.

In summary pain and chronic pain is a very complex process which involves many body systems and brain regions. It is important for a clinician to know the complexity of pain processing mechanisms to address them appropriately in their treatment approach.

## Management

There are many treatment options available but there is limited evidence regarding long term efficacy for a specific approach for chronic pain patients<sup>6</sup>. The biopsychosocial model

plays an important role in the treatment of chronic pain. It emphasizes on the interaction between biological, psychological and social factors and indicates that the management should not only be directed towards physiological, pathological or anatomical changes in the body<sup>5</sup>.

Treatment in a multidisciplinary setting including disciplines such as physicians, psychologists, physiotherapists and occupational therapists seems to show consistently better outcomes in chronic pain patients<sup>6</sup>. There is evidence that psychological factors and good interpersonal relationships between clinicians and patients directly affect the outcome of treatment<sup>6</sup>.

Patient education is essential in chronic pain management and helps the patient to understand his pain<sup>3</sup>. Knowing that pain is not equal harm or injury reduces the perception of threat, anxiety and fear of movement<sup>3</sup>. It can alter beliefs and attitudes, promotes positive thinking and encourages the patient to become more active which helps to re-establishes the motor representation in the brain<sup>3,7,8</sup>. Overall the management should aim to improve quality of life and focus on<sup>3,6,8,11</sup>:

- Patient education
- Reduction of anxiety negative beliefs and attitudes
- Increase optimism
- Improve coping strategies
- Increase activity levels
- Decrease nociceptive input

Depending on the condition the treatment may differ but generally the following treatment approaches showed positive results in chronic pain management. Some of them are<sup>3,6,8,11</sup>:

- Cognitive behavioral therapy
- Pharmacological treatment
- Aerobic exercises and hydrotherapy (pool exercises)
- Patient education
- Mirror therapy
- Relaxation strategies

In conclusion, the pain experience of every patient is subjective and unique. Finding the appropriate treatment is challenging and may differ from case to

case. Good communication between the patient and the clinician and among the medical professions is of great importance and a key factor to achieve positive outcomes. The management of chronic pain should be in accordance to the biopsychosocial-model considering biological, psychological and social factors. Treatment should address the patients' needs to reduce pain, increase function and decrease negative thoughts and beliefs. The main goal is to improve the quality of life.

## References

1. Apkarian, VA, Baliki, MN & Geha, PY 2009, 'Towards a theory of chronic pain', *Progress in Neurobiology*, vol. 87, pp. 81-97.
2. Apkarian, AV, Hashmi, JA & Baliki, MN 2011, 'Pain and the brain: Specificity and plasticity of the brain in clinical chronic pain', *Pain*, vol. 152, pp. S49- S64.
3. Butler, DS & Moseley, GL 2003, *Explain Pain*, Noigroup Publications, Adelaide, Australia.
4. Clauw, DJ & Crafford, LJ 2003, 'Chronic widespread pain and fibromyalgia: what we know, and what we need to know', *Best Practise & Research Clinical Rheumatology*, vol. 17, no. 4, pp. 685-701.
5. Gatchel, RJ, Peng, YB, Peters, ML, Fuchs, PN & Turk, DC 2007, 'The Biopsychosocial Approach to Chronic Pain: Scientific Advances and Future Directions', *Psychological Bulletin*, vol. 133, no. 4, pp. 581-624.
6. International Association for the Study of Pain 2011, *Pain Clinical Updates*, vol. XIX, Issue 2, January 2011.
7. Nijs J & Van Houdenhove, B 2009, 'From acute musculoskeletal pain to chronic widespread pain and fibromyalgia: Application of pain neurophysiology in manual therapy practice', *Manual Therapy*, vol. 14, pp. 3-12.
8. McMahon, S & Koltzenburg, M 2005, *Wall and Melzack's Textbook of Pain*, 5th Edition online version, Elsevier Churchill Livingstone.
9. Meyer RA, Campbell JN, Raja SN. Peripheral neural mechanisms of nociception. In: Wall PD, Melzack R, editors. *Textbook of pain*. 3rd ed. Edinburgh: Churchill Livingstone; 1995. p.13-44.
10. Moseley, GL 2007, 'Reconceptualising pain according to modern pain science', *Physical Therapy Reviews*, vol. 12, pp. 169-178.
11. Woolf, CJ 2010, 'Central sensitization: Implications for the diagnosis and treatment of pain', *Pain*, doi:10.1016/j.pain.2010.09.030.

MICA (P) 158/10/2010

*This newsletter is produced by Core Concepts - Musculoskeletal Health.*

*We can be reached at*

*T: 6226 3632 or*

*E: enquiry@coreconcepts.com.sg*

*W: www.coreconcepts.com.sg*

