Theoretical Considerations for Chronic Pain Rehabilitation

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[Lotze M, Moseley GL. Theoretical considerations for chronic pain rehabilitation. *Phys Ther*. 2015;95:1316–1320.]

Published Ahead of Print: April 16, 2015
Accepted: April 2, 2015
Submitted: December 21, 2014

Conventional rehabilitation of patients with chronic pain is often not successful and is frustrating for the treatment team. However, theoretical developments and substantial advances in our understanding of the neurological aspects of chronic pain are changing these experiences. Modern theoretical models of pain consider pain to be a perceptual inference that reflects a "best guess" that protective action is required. This article argues that keen observation and open and respectful clinician-patient and scientist-clinician relationships have been critical for the emergence of effective rehabilitation approaches and will be critical for further improvements. The role in modern pain rehabilitation of reconceptualizing the pain itself—by "Explaining Pain," careful and intentional observation of the person in pain, and the strategic and constant communication of safety—is emphasized. It also is suggested that better understanding of the neural mechanisms underpinning chronic pain has directly informed the development of new therapeutic approaches, which are being further refined and tested. Conventional pain treatment (where the clinician strives to find the pain-relieving medication or exercise) or pain management (where the clinician helps the patient to manage life despite unabating pain) is being replaced by pain rehabilitation, where a truly biopsychosocial approach allows clinicians to provide patients with the knowledge, understanding, and skills to reduce both their pain and disability. A brief overview is provided of the key aspects of modern pain rehabilitation and the considerations that should lead our interaction with patients with chronic pain.

Chronic pain exerts a massive burden on society.[1] The landmark work of Fordyce[2] triggered a shift away from the idea of pain treatments toward the idea of "management," whereby clinicians—and, therefore, patients—aim to optimize quality of life despite unabating pain. Here, we outline the theoretical and practical considerations that underpin the re-emergence of pain rehabilitation and present examples of how scientific discoveries are being transformed into effective rehabilitation approaches. By so doing, we hope to not only help rehabilitation practitioners but also increase interaction between scientists and clinicians on the approaches and understanding of chronic pain. Scientists pursue answers to questions, but it is the clinicians, and the patients themselves, who identify the questions that need answering. Similarly, by engaging frankly and humbly with scientists, clinicians can draw on a very large community of people with the energy, skills, and resources to provide unbiased answers to their questions.

Old Lessons Ring True

The substantial increase in our appreciation of the complexity of pain biology has led to the emergence of a common implication: to first and foremost *observe.* Clinically, *observation* refers to careful appraisal of patients and their situation (ie, to ask questions and to listen carefully to the responses). To really listen is to focus your attention on the patients, on what the patients say (and, indeed, on what they do not say) and how they say it—not just the words they use, but the entire behavioral package (ie, their manner, their posture, their ease of articulation, their expression, and the attributions they provide for their pain). Recognition that every aspect of this behavioral package reflects activation of neural representations compels us to integrate those things into our clinical reasoning. In a truly biopsychosocial framework of pain, the things we say, do, think, and hear are all potential modulators of pain itself and may all be suitable targets for rehabilitation (for a review, see Butler and Moseley[3]). Clearly, then, the relationship we develop with the patient in pain is critical.

This critical relationship that exists between the clinician and the patient also is reflected in, and can direct and inform, that between the clinician and the scientist. Indeed, careful observation of the person in pain requires scientists to honor Darwin's advice to most carefully note those observations that *do not* support our current perspectives.[4] Noting rather than disregarding such observations has opened up new fields of investigation in chronic pain rehabilitation. For example, that some patients are made worse by simply imagining movements of a painful limb[5,6] or that some patients declare they have a swollen limb that is, in fact, not swollen[7] presumably went unnoted for some time but has now been investigated with empirical methods, and new treatments have been generated as a result. What, then, should clinicians be observing? We think the answer to this question has been radically changed as a result of recent theoretical and neuroscientific developments in our field.

Pain as a Conscious Motivator to Protect Our Body

It should be remembered, as we grapple with the complexity of pain and its sometimes tenuous relationship with tissue damage, that pain exists only in our own consciousness. Pain might be considered a perceptual inference—a "best guess" that protective action is required. Not surprisingly, then, although pain is universally attributed to some mix of brain activity, exactly how the feeling emerges as a result of the brain activity remains part of what Chalmers called "the hard problem."[8] We avoid this problem clinically by focusing on causal and associative relationships we see and theoretical models, or "thinking stories" that we use to understand those relationships.

Pain is clearly related to both external (exogenous) and internal (endogenous) stimuli. These relationships are modulated by other sensory inputs and cognitive, emotional, and social factors that can be broadly encompassed by the concept of "context." This sometimes extraordinary modulatory power (compare, for example, the pain evoked by identical cold stimuli in the presence of either a blue or red light[9]) is not unique to pain. Scientists investigate such modulations in far less emotionally charged conscious experiences (eg, vision). An overly simplistic understanding of vision would suggest that what we see is an accurate representation of the imprint of the pattern of light that is hitting the retina. However, one realizes this is not the case when one considers common visual illusions, where cues about the size of everyday objects, the patterns of light and shadow, and color cues—all informing about context—can fundamentally change what we see.

Think about the Necker cube experiments,[10] experiments on color recognition using mondrians,[11] and the McGurk illusion.[12] Each of these tells us that perception, including but not limited to pain, reflects the brain's best guess as to what behavioral response is appropriate and what conscious experience will invoke it.[13]

Very important discoveries from the study of nociception continue to

move forward our pursuit for better pharmacological pain therapies. However, the theoretical perspective of pain as a perceptual inference based on both nociceptive and non-nociceptive information has re-ignited the pain rehabilitation field. That nociception is neither sufficient nor necessary for pain[14] and that pain is an experience that urges us to *do something* to protect a body part[15] are not new ideas, but the potential influence of their recent endorsement cannot be overstated. The loosening grip of the structural-pathology model, in which pain was considered a readout of nociceptive input and a measure of tissue damage, has triggered this shift in our approach. It is an important shift because, as long as chronic pain was considered analogous to chronic nociception, only treatments that reduce nociception would make any sense. It is perhaps not surprising that the clinical impact of treatments for chronic pain that are based on this structural-pathology model has been underwhelming to say the least.

Clinical Implications

This idea of pain as a perceptual inference that urges protective action infers that pain will be modulated by anything that weights the inference toward protection. That is, any input—exogenous, endogenous, cognitive, social, or contextual—that provides "credible evidence of danger" to body tissue, as well as the current state of the organism,[3] will increase the likelihood and intensity of pain. We can observe the patient through this lens of danger versus safety. What credible evidence is there of danger or safety? During the interview and the physical assessment, are there cues that alert the keenly observant clinician to modulations of perceived danger? Assessment expands from evaluation of tissue integrity and mechanical performance to evaluation of anything that implies danger or safety. Such an approach is captured in self-assessment and therapeutic tools such as the Protectometer.[3]

One exciting aspect of the advances in pain-related knowledge is that changing the meaning of pain—changing how an individual in pain makes sense of their own pain—should change pain itself.[3] The therapeutic approach that directly targets this aspect, which has come to be known as "Explaining Pain," refers to a range of educational interventions that aim to change someone's understanding of what pain actually is. Although "pain education" has been a part of cognitive-behavioral management programs for decades, that education was limited to the *application* of the science rather than the science itself—for example, teaching patients that pain does not equal harm; that you should move despite pain; and that pain is unavoidable, but suffering is optional.[16]

Explaining Pain covers the science itself. That is, it aims to provide an understanding of the biological rationale for doing those things. Explaining Pain is an approach to management rather than a specific set of procedures or techniques (and, critically, an approach that dovetails with cognitive-behavioral techniques). The core objective of Explaining Pain is to shift one's conceptualization of pain from that of a marker of tissue damage or pathology to that of a marker of the perceived need to protect body tissue. Explaining Pain has thus far taken several different formats—from intensive one-on-one, small-group, tutorial-type sessions to large-group seminars lasting up to 3 hours.[17,18] The approach has been adapted according to preference and economics, and the material has been condensed[19,20] or incorporated into booklets[21] or storybooks.[22] Systematic reviews concluded that Explaining Pain is probably effective for reducing pain and disability in people with a range of chronic pain states.[23,24]

The Dark Side of Plasticity

The implications of these developments extend beyond Explaining Pain. There is now a large body of literature on the differences in central nervous system function between people with chronic pain and healthy controls. These differences are thought to reflect, in part, "maladaptive neuroplasticity."[25] Put simply, the longer you have pain, the better your system gets at producing it; pain becomes triggered more easily (allodynia), and previously painful events become more painful (hyperalgesia). Chronic pain also is associated with abnormal intracortical inhibitory mechanisms[26] whereby body-related neural representations become less precise, an abnormality thought to be important in some of the multiple system dysfunctions that are seen in people with chronic pain.[27] That this increased sensitivity and decreased precision may contribute to the problem of pathological pain has generated promising new approaches to rehabilitation.

Retraining the Brain: Graded Motor Imagery

Graded motor imagery (GMI) begins with implicit motor imagery, where the patient views images of body parts (eg, hands) and makes a judgment about whether the body part that is displayed belongs to the left or the right side of the body. Graded motor imagery then progresses to explicit motor imagery, where the patient actively imagines adopting the posture shown in the image and then progresses to mirror box training.[28] It has now been more than 10 years since the first randomized controlled trials of GMI were published. Although GMI was developed with a clear biological rationale based on

established properties of neural activation with implicit and explicit motor imagery,[29] data are now available for more than 450 patients who have completed the GMI protocol, about 20% of them having participated in randomized controlled trials.

Those data reveal some very interesting patterns. For example, the degree to which patients participate appears to be very important; results clearly drop when participants drop beneath 7 training sessions a day, each for several minutes. This is a clear limitation of the approach because that training load is substantial and the patient needs to remain very motivated. The patient might be motivated by feedback and increasing demand of the training process. The clinician can control the training time and development online so he or she can take action when participation is decreasing. The role of the clinician is rather as a coach than as an empathic doctor who is expected to relieve the patient's pain.[2] Therefore, classical clinical role models do not apply here, and cognitive and behavioral principles are important. Indeed, although the available published and audit data are building a positive picture, the clinician-patient relationship is likely to be critical. For example, some clinical centers report much better outcomes than others, even though all are ostensibly doing the same thing, and the consistency of the conceptual paradigms among the treatment team seems to be important. The power of "message coherence" should not be underestimated.

Using the Clinician-Patient Relationship as Rehabilitation

There has been some important work on the complex patient-therapist interaction on the topic of chronic pain.[30,31] The focus on pain as a threatening event or trust in the restorative capacity of the body is also a matter of observing how other people react to pain.[32] Whether pain should provide a focus of assessment has been contentious since Fordyce's pioneering work.[2] That attending to pain might increase pain itself is also a sensible argument, with some experimental support.[33] However, the patient in pain is concerned most obviously about his or her pain and what it means, so to ignore it in treatment will only make sense if the patient understands the protective action model of pain. How, then, can we find the balance between honoring the patient's pain and suffering and integrating it with a rehabilitation process aimed at promoting function? We would contend that the unifying principle is to always be cognizant of providing evidence of safety. General aspects of interaction, such as being friendly and spending time concentrating on the patient's needs, provide evidence of safety. Demonstrating that you are informed, explaining pain, and explaining the rehabilitation approach in simple words also provide evidence of safety. Bearing in mind that much of our clinical practice involves reassurance[34] and education, it would seem critical to ensure they are cornerstones of clinical training.[35]

Very relevant to this issue is the re-emergence of the patient narrative as a potential driver of rehabilitation and facilitator of conceptual and behavioral change. The idea that first-person accounts of pain have a role across the pain sciences—from the experimental laboratory[36] to the clinic[16] and to society at large[37]—is not necessarily new, but their re-emergence as bona-fide contributions to the field could very well open up new and novel methods to enhance the clinician-patient relationship as a therapeutic tool.

Should Pain Be Avoided in Rehabilitation?

That pain is not indicative of damage implies that intervention does not need to avoid pain altogether. Training should be time contingent or load contingent, not pain contingent. When pain increases during or after therapy, the patient can be reminded that this is not a symptom of damage but a protective strategy of an overly protective system. We have found that a balance is required between empathy and "holding the line" that adaptation, back to normal, will not occur without loading the system. Many principles of behavioral therapy are integral here as well—reminding patients that they are responsible for their body and for rehabilitation; encouraging patients to focus attention on healthy aspects of the body; integrating homework and occupational aspects for daily living; assisting patients in identifying sources of safety; learning and implementing coping skills and strategies to relieve pain— ultimately giving the patients the resources to master their own situation, to set attainable goals, and to learn the principles of slow and steady progression, all on the platform of a modern understanding of their pain.

Conclusion

We have proposed that current theoretical models of pain, and better understanding of increased sensitivity and decreased intracortical inhibition, compel us to approach pain rehabilitation, and its research, from the perspective of credible evidence of danger and safety. The clinician needs to be a keen observer and an empathic but assertive coach, ultimately providing patients with the skills to master their situation. The knowledge and evidence advocate a key role of Explaining Pain and highlight exciting developments in the application of modern pain science to the generation of new treatments.

Both authors provided concept/idea/project design and writing.

Dr Moseley receives author royalties for coauthored books that are relevant to some of the material in this article. Dr Lotze receives author royalities for editing a neurorehabilitation journal.

Dr Moseley's research was supported by a Principal Research Fellowship from the National Health and Medical Research Council, ID 1061279.

DOI: 10.2522/ptj.20140581

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