



# Applications of biofeedback for patients with chronic pain

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Biofeedback represents a multifaceted tool for the treatment of patients with chronic pain. In addition to several well-documented applications for directly addressing physical symptoms, biofeedback represents an effective way to address stress and other psychosocial variables associated with pain. Strategies for incorporating biofeedback into treatment and using biofeedback as a tool to develop a broader biopsychosocial approach to patients with chronic pain will be briefly discussed and illustrated with hypothetical patient examples.

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## Vignette: “splinting” muscle activity associated with cervical pain

### Presenting diagnosis

Chronic cervical pain.

### History and medical information

This 45-year-old female homemaker had been in four automobile accidents over 15 years. She had cervical-area pain and headache with no radicular symptoms that began after one of the first accidents and had worsened over time. After the first two accidents, her symptoms had disappeared with conventional physical therapy treatment. She had spasms of her neck muscles and headaches averaging two per week since the third accident. She believed that her posture was worsening. In addition, she had become very irritable and this was having a negative effect on her relationship with her husband. Her cervical spine x-rays and

MRI were negative for pathology, but did show signs of decreased joint spaces. A diagnostic EMG showed no abnormalities.

The patient complained of soreness in the cervical paraspinal muscles, occurring more on the right side than the left and felt “tight” and “grabbing.” She reported that her pain ranged in intensity from a 2 of 10 to an 8 of 10. She said her pain occasionally could increase to a 9. Her pain seemed to be worsened by driving more than 2.5 hours, bending, being in static positions for more than 15 to 20 minutes, and reaching overhead. Her pain was somewhat reduced by using a tens unit, moving, being in a warm pool, stretching, and laying flat. She believed that her pain was also worsened by stress. The tension headaches involved a “band”-like feeling around her head and occurred three to four times per week. She reported that her symptoms were more severe than before, and she was “unable to get any relief.” However, she stated that she had learned to “live with” the neck discomfort and had experienced very little change in her activity level.

### Evaluation

Tightness in the upper trapezius musculature was present, with more tightness on the right side. Soreness was

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present in the upper and lower trapezius, posterior cervical, and scaleni "trigger points." Evaluation of spinal range of motion showed hyperextension of the cervical spine and hypoextension of the thoracic spine. She had limitation of 50% in motions of left lateral flexion and rotation to the right. She had a 33% decrease in lateral flexion to the left, and a 25% decrease in forward flexion. At the end points in ranges of motion in all directions, the patient described soreness at the right neck "trigger points" and a shooting-type sensation into her right shoulder. Muscle testing showed strength within normal limits.

### Goals of therapy

1. To limit pain and allow for increased range of motion
2. To increase active pain-free range of motion
3. To provide prevention techniques for home care through use of muscle awareness training and relaxation techniques
4. To strengthen thoracic extensors, neck flexors, and other support musculature

### Treatment

For the first week, the patient met with her physical therapist over three sessions to develop strategies for pain reduction and to reduce muscle spasm. This included use of ice massage, active stretching, and ultrasound to temporarily "release" the muscles. Transcutaneous electrical nerve stimulation (TENS) and iontophoresis with dexamethasone sodium phosphate were used to suppress pain further. The purpose of these techniques was to allow the patient to relax her muscles without increased pain.

In the second week, pain reduction modalities continued, but were followed by generalized relaxation techniques. Relaxation included diaphragmatic breathing to reduce the patient's "neck breathing." Further assessment of muscle tension suggested increased tightness and inability to release tension quickly in the right upper trapezius and neck accessory breathing muscles.

After the patient could significantly relax her muscle activity to a low level unassisted by the therapist, she was started on a neck awareness exercise with five sessions of sEMG biofeedback over 2 weeks. With those exercises, she learned to release her neck muscles while in different positions (neutral, lateral flexion, and cervical rotation). She also learned to recognize and decrease bilateral cocontraction of the upper trapezius muscles during cervical rotation. She learned to release the involved muscles and demonstrated consistent control as shown by the sEMG. She then progressed to practicing the control during functional activity exercises twice per week over 3 weeks. The activity involved reciprocal upper trapezius contraction and relaxation, and then strengthening of the thoracic extension while relaxing the upper trapezius muscles.

The patient was now reporting that she was no longer experiencing headaches, and the intensity of her cervical

pain was ranging from 1 to 3 of 10. She had some increases in pain during long drives of more than 1 hour in duration, but was generally able to avoid significant "flare-ups" of her pain by using some of the relaxation and stretching exercises every 30 minutes or so during long trips.

The therapist reviewed general and specific relaxation with sEMG biofeedback at 2 and 4 weeks after treatment, and again at 6 months. Follow-up at 1 year showed continued mild range (0-3 of 10) cervical pain, with periods of no pain lasting up to 2 days. There was a decrease in headache frequency to three headaches per year, 95% of full range of motion of the cervical spine, and increased thoracic range of motion. The patient continued to be aware of and attentive to her posture, and when she noticed increasing neck muscle tension, she was able to correct herself before developing symptoms.

Biofeedback therapy appeared to have helped this patient's awareness of: (1) a maladaptive posture; (2) corrective positioning by use of her muscles; and (3) times when increasing muscle tension could lead to symptoms. She could avoid flare-ups of her pain that previously had led to her seeking medical care. This case illustrates the use of a multidisciplinary approach, the need for checking multiple factors that may contribute to symptoms, and the use of biofeedback in managing chronic pain.

### Discussion: applications of biofeedback for patients with chronic pain

Biofeedback can be a valuable tool in the treatment of chronic pain. In addition to being an effective method for directly addressing physiological processes that cause chronic pain symptoms, biofeedback facilitates psychological interventions that aid the chronic pain patient in developing greater skills for coping and improved functioning.

Biofeedback, particularly when used as an adjunct to other therapeutic interventions, has been shown to be an effective treatment for reducing or eliminating symptoms of several pain-related conditions, including low back pain,<sup>1-3</sup> headaches,<sup>4-7</sup> temporomandibular disorders,<sup>8-13</sup> Raynaud's phenomenon,<sup>14-16</sup> fibromyalgia,<sup>17-19</sup> irritable bowel syndrome,<sup>20,21</sup> and repetitive strain injuries.<sup>22-24</sup> It would be beyond the scope of the present article to discuss the effectiveness of each of these applications of biofeedback. Instead, the focus here will be to describe the general processes by which biofeedback is used to improve functioning in patients with chronic pain.

As defined by Schwartz and Schwartz,<sup>25</sup> the objectives of applied biofeedback are "to help persons develop greater awareness of, confidence in, and an increase in voluntary control over their physiological processes that are otherwise outside awareness and/or under less voluntary control, by first controlling the external signal, and then by using cognitions, sensations, or other cues to prevent, stop, or reduce symptoms." Biofeedback training refers to a process of

measuring and transforming physiological information into visual and/or audio signals that are presented (ie, “fed back”) to the patient to facilitate improvement in the patient’s ability to detect and modify the physiological variable of interest. The physiological variables that are typically monitored in biofeedback therapy include heart rate, heart rate variability, respiration, electrodermal response, muscle tension, and peripheral skin temperature. Whereas the field of biofeedback includes several distinct applications, the most common aims in biofeedback are to train the patient to reduce the tension and/or autonomic arousal that underlie or exacerbate the presenting disease or its symptoms. For example, a patient with chronic neck and shoulder pain might use a visual display of surface electromyography of the upper trapezius to learn to detect and reduce tension in the muscle, thereby controlling or eliminating the source of their pain.

Pain is a complex phenomenon that is influenced by psychological and social variables as much, if not more so, than it is by sensory and physiological variables.<sup>26-28</sup> Two important factors that have been identified as important contributors to coping with pain include self-efficacy and perceived control.<sup>3,29-31</sup> Biofeedback provides a way for patients with pain to experience control over their bodies by learning to manipulate autonomic activity or muscle tension, thus increasing self-efficacy and creating discrepancy with self-defeating helplessness beliefs. One example is a patient with chronic low back pain who learns to alter his response to an acute pain episode, and rather than becoming more tense and irritable, relaxes his muscles and his mind with deep breathing.

Patients with pain may not readily recognize the potential role of psychological variables in their experience of pain, and may respond quite negatively when this is suggested by the treating physician. Often, patients with pain are more willing to discuss their pain-related experiences, opinions, and expectations than psychosocial factors, which they may view as irrelevant to their pain. Helping patients develop an understanding of the connections between these factors early in the intervention is imperative, as treatment will undoubtedly fail if the patient does not find the philosophy, intervention methods, and goals of treatment personally relevant.<sup>32</sup> Because a referral for treatment with biofeedback may not carry the same stigma as a referral for psychotherapy, perhaps because it is perceived as more technological, the patient may be more likely to comply with the recommendation. Once engaged in treatment, biofeedback helps patients make the connection between their physical sensations and psychological processes, and can often lead to increased willingness to engage in psychological interventions that might previously be met with resistance. In this way, biofeedback can serve as a crucial gateway to incorporating important psychosocial interventions into treatment that might otherwise be dismissed. Consider the patient who was injured at his job as a construction laborer and has struggled with ongoing back pain for over a year. After many diagnostic tests, examinations,

and treatment with multiple providers, the pain symptoms are unresolved and are perceived to have worsened. It would not be unlikely that such a patient has received contradictory medical advice or differing opinions about diagnosis. A referral to a psychologist at this point in treatment is likely to be met with skepticism and even anger, as many patients perceive this as a suggestion that their pain symptoms are being faked or exaggerated. A referral to a psychologist who practices biofeedback may not be received with the same resistance, most likely due to a perception that biofeedback is more a treatment of the body rather than the mind, although it most often is a treatment of both.

Feelings of helplessness, hopelessness, and depression often arise in patients with chronic pain because they must cope not only with the stress produced by the pain itself, but also the frustration of being unable to find relief from their pain.<sup>33</sup> Biofeedback provides a way for the patient with chronic pain to understand, and alter, the physiological effects of stress. As the patient develops this understanding of the physiological processes associated with stress, the skilled practitioner can also open a therapeutic avenue into the cognitive and behavioral components that trigger or perpetuate ineffective or unhealthy stress responses. The aim of this strategy is to improve the patient’s coping strategies and lead to improved functioning, regardless of the presence of pain symptoms. To illustrate, consider a patient with chronic back pain that persists following spinal fusion surgery. Although a successful business manager with no history of psychopathology, her ongoing difficulties in managing her pain increasingly tax her previously effective strategies for coping with stress. Where she previously spent time analyzing problems and devising solutions, she now spends a great deal of time thinking about her pain and planning her daily activities around it. In addition, she no longer participates in regular exercise because she finds it leads to increased pain. As a result, her relationships at work and at home have begun to deteriorate, leading to more stress, and she reports symptoms of anxiety and depression that appear to be increasing over time. Biofeedback could be used with this patient to develop her skills at identifying signs of increasing stress-related arousal, such as shallow breathing or muscle tension, and to develop skills, such as relaxation or meditation, to decrease her fight-or-flight response, or improve her ability to maintain focused attention and calmly approach problems. The application of biofeedback would likely lead to a discussion of her cognitive and behavioral approaches to stress, such as her conflict resolution skills used with coworkers and family members, thereby opening the door for psychological intervention.

To summarize, in addition to directly addressing pain symptoms themselves, biofeedback is also a very useful tool in addressing psychosocial factors that contribute to pain and to the decreased physical, social, and occupational functioning that results from chronic pain.

A listing of biofeedback providers can be obtained by contacting:

- The Association for Applied Psychophysiology and Biofeedback (AAPB), 10200 W 44th Ave #304, Wheat Ridge, CO 80033. Telephone: (303) 422-8436. Online: <http://www.aapb.org>
- The Biofeedback Certification Institute of America (BCIA), 10200 W. 44th Ave, Ste 310, Wheat Ridge, CO 80033-2840. Telephone: (303) 420-2902 or (866) 908-8713. Online: <http://www.bcia.org>

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