**EFFECTIVE 2/15/2013**

# Cigna Medical Coverage Policy

**Effective Date** ..... **2/15/2013**
**Next Review Date**……..**9/15/2013**
**Coverage Policy Number** ..... **0166**

**Subject** **Biofeedback**

**Table of Contents**


Coverage Policy ..... 1
General Background ..... 2
Coding/Billing Information ..... 13
References ..... 16


**Hyperlink to Related Coverage Policies**

Attention-Deficit/Hyperactivity Disorder (ADHD): Assessment and Treatment
Autism Spectrum Disorders/Pervasive Developmental Disorders: Assessment and Treatment
Complementary and Alternative Medicine
Extracorporeal Electromagnetic Stimulation for Urinary Incontinence
Hyperhidrosis Treatments
Injectable Bulking Agents for Urinary Conditions and Fecal Incontinence
Invasive Treatments for Urinary Incontinence
Physical Therapy
Sacral Nerve Stimulation for Urinary Voiding Dysfunction and Fecal Incontinence

***INSTRUCTIONS FOR USE***

*The following Coverage Policy applies to health benefit plans administered by Cigna companies including plans formerly administered by Great-West Healthcare, which is now a part of Cigna. Coverage Policies are intended to provide guidance in interpreting certain* ***standard*** *Cigna benefit plans. Please note, the terms of a customer's particular benefit plan document [Group Service Agreement, Evidence of Coverage, Certificate of Coverage, Summary Plan Description (SPD) or similar plan document] may differ significantly from the standard benefit plans upon which these Coverage Policies are based. For example, a customer's benefit plan document may contain a specific exclusion related to a topic addressed in a Coverage Policy. In the event of a conflict, a customer's benefit plan document* ***always supercedes*** *the information in the Coverage Policies. In the absence of a controlling federal or state coverage mandate, benefits are ultimately determined by the terms of the applicable benefit plan document. Coverage determinations in each specific instance require consideration of 1) the terms of the applicable benefit plan document in effect on the date of service; 2) any applicable laws/regulations; 3) any relevant collateral source materials including Coverage Policies and; 4) the specific facts of the particular situation. Coverage Policies relate exclusively to the administration of health benefit plans. Coverage Policies are not recommendations for treatment and should never be used as treatment guidelines. In certain markets, delegated vendor guidelines may be used to support medical necessity and other coverage determinations. Proprietary information of Cigna. Copyright ©2013 Cigna*

## Coverage Policy

**Biofeedback and biofeedback devices are specifically excluded under many benefit plans. In addition, biofeedback and biofeedback devices are considered behavioral training and education/training in nature, and such services are specifically excluded under many benefit plans. Please refer to the applicable benefit plan document to determine benefit availability and the terms, conditions and limitations of coverage.**

**If coverage is available for biofeedback, the following conditions of coverage apply.**

**Cigna covers biofeedback by a licensed healthcare professional as medically necessary for ANY of the following conditions:**

- constipation (adults only)
- stress, urgency, mixed, or overflow urinary incontinence when there is failure of other nonpharmacologic treatment (e.g., bladder training and/or pelvic floor muscle training [PFMT]) (children and adults)
- migraine and tension headaches (children and adults)

**Cigna does not cover biofeedback for any other indication because it is considered experimental, investigational or unproven.**

**Cigna does not cover EITHER of the following because each is considered experimental, investigational or unproven.**

- electroencephalography (EEG) biofeedback or neurofeedback
- in-home biofeedback devices

---

**General Background**

Biofeedback is a therapeutic process that electronically monitors bodily functions, such as breathing, heart rate, blood pressure, skin temperature and muscle tension, which are fed back to the individual by means of sounds, lights or electronic gauges. It emphasizes relaxation and stress-reducing techniques. Most proponents believe that by using these techniques, individuals can learn to control a variety of physiological responses formerly thought to be completely involuntary and thereby, help manage anxiety and pain commonly associated with stress reactions (Holroyd, et al., 2003; Karmody, 2003; Kiresuk, et al., 2005). According to the National Center for Complementary and Alternative Medicine (NCCAM), biofeedback is considered an alternative medicine technique under the mind-body category of complementary and alternative medicine (CAM) practices (NCCAM, 2012).

There are several different types of biofeedback. The biofeedback modality selected for therapy depends on the condition to be treated. EMG biofeedback measures muscle tension and is proposed for the treatment of chronic muscle stiffness, injury and pain (e.g., neck and back pain); headaches, asthma, incontinence; and intestinal symptoms. Thermal or temperature biofeedback measures skin temperature and is proposed for the treatment of circulatory disorders, such as headaches, hypertension, and Raynaud's phenomenon. Galvanic skin response (GSR) biofeedback, also called electrodermal response (EDR), electrodermal activity (EDA), skin conductance response (SCR) or skin conductance level (SCL) biofeedback, measures electrical conductance in the skin associated with sweat gland activity and perspiration. GSR is proposed for the treatment of anxiety disorders and phobias

Another form of biofeedback is electroencephalogram (EEG) biofeedback, also called neurofeedback or neurotherapy, which measures alpha (associated with relaxation and meditation) and theta (associated with focused attention) brainwave activity. It is proposed to counterbalance genetic and environmental tendencies by learning to alter brain wave patterns. EEG biofeedback has been proposed for the treatment of multiple conditions including insomnia, attention deficit hyperactivity disorder (ADHD), dyslexia, anxiety disorders, autism spectrum disorders, epilepsy, addictions, tinnitus, brain injury, depression, learning disabilities, pervasive developmental delay//mental retardation, fibromyalgia, dyslexia. However, the evidence in the published peer-reviewed scientific literature does not support the efficacy of EEG biofeedback.

Although there are numerous biofeedback devices available for home use, biofeedback should be performed by a trained professional in a clinical setting. Examples of home devices include: StressEraser® (Helicor, Inc., New York, NY) for mind and body relaxation; BrainMaster (BrainMaster Technologies, Inc., Oakwood Village, OH) EEG biofeedback device; GSR/Temp2X™ (Biofeedback Instrument Corp., New York, NY) temperature biofeedback system; and RESPeRate (Intercure Ltd., Lod, Israel) which uses therapeutic paced breathing to lower blood pressure.

Evidence in the published peer-reviewed literature and professional societies supports biofeedback for the treatment of constipation, urinary incontinence, and migraine and tension headaches.

**U.S. Food and Drug Administration (FDA)**

The FDA classifies biofeedback medical devices as 510(k), Class II, special controls, medical devices, subject to certain limitations, and they are exempt from the premarket notification requirements. The FDA defines a biofeedback device as “an instrument that provides a visual or auditory signal corresponding to the status of one or more of a patient's physiological parameters (e.g., brain alpha wave activity, muscle activity, skin temperature, etc.) so that the patient can control voluntarily these physiological parameters” (FDA, 2007). There are numerous biofeedback devices available from multiple manufacturers.

**Constipation**
Constipation is defined as three or fewer bowel movements a week often accompanied by hard, dry stool and pain. Although constipation can be associated with more serious disease, many times it is a feature of a colorectal motility disorder such as pelvic floor dysfunction (also known as pelvic floor dyssynergia, anismus or outlet obstruction) where there is a normal or slightly slowed colonic transit and a prolonged storage of residue in the rectum.

The evidence in the published peer-reviewed scientific literature supports the use of biofeedback for the treatment of constipation in adults. Significant improvements in constipation with biofeedback have been reported in systematic reviews, meta-analysis and randomized controlled trials (Enck, et al., 2009; Koh, et al., 2008; Heyman, et al., 2007; Rao, et al., 2007; Chiarioni, et al., 2006; Heyman, et al., 2003).

Biofeedback for the treatment of constipation in children is not well established and has not been proven to add additional benefit to established conventional therapy (Brazzelli, et al. 2006; Brazzelli, et al. 2004).

In their 2010 guideline on the management of constipation in children and young adults, the National Institute for Health and Clinical Excellence (NICE) (United Kingdom), stated that biofeedback should not be used for ongoing treatment in children and young people with idiopathic constipation. Meta-analysis showed no improvement in outcomes when conventional treatment (e.g., use of laxatives, advice on a high-fiber diet, attempting defecation after meals) was compared to conventional treatment plus biofeedback.

In practice guidelines on the management of constipation, the American Society of Colon and Rectal Surgeons (ASCRS) (2007) recommended biofeedback as a treatment option for patients with slow-transit constipation associated with symptomatic pelvic floor dyssynergia. Success rates range from 35–90% with sustained results reported for up to 24 months.

**Urinary Incontinence (UI)**
UI is an involuntary leakage of urine caused by a variety of conditions that directly or indirectly affect bladder control. Incontinence may manifest as near-constant dribbling or as intermittent voiding with or without awareness of the need to void. Post-void dribbling is common. The amount of leakage varies with the type of incontinence and may be small to large amounts. The types of urinary incontinence include stress, urge, mixed, overflow and functional. The inability of the bladder to hold urine during activities that increase abdominal pressure (e.g., exercise, coughing, sneezing, laughing) is called stress incontinence; a sudden, involuntary loss of urine for no apparent reason accompanied by a strong sense to void is called urge incontinence; and a combination of stress and urge incontinence is called mixed incontinence. Overflow incontinence involves an over distention of the bladder causing the bladder to never empty completely, and functional, or environmental, incontinence is leakage of urine due to the individual’s inability to get to the bathroom in time due to mental or physical difficulties (e.g., Alzheimer’s disease, arthritis). Pelvic floor muscle training is an established treatment modality for urinary incontinence. Bladder training, changes in fluid intake, pharmacotherapy and surgical intervention may also be indicated based on the type of incontinence. Biofeedback is an established treatment modality for children and adults with stress, urge, mixed or overflow urinary incontinence that is unresponsive to other nonpharmacologic modalities such as bladder training and/or pelvic floor muscle training. Biofeedback may enhance awareness of body functions and assist the individual in learning muscle strengthening pelvic floor exercises (Holroyd-Leduc, et al., 2008; Shamliyan, et al., 2008). There are several proposed methods of biofeedback which may be employed for the treatment of urinary incontinence including: vaginal cones, perineometers and electromyographic (EMG) systems (Payne, 2007).

The published peer-reviewed scientific literature includes systematic reviews, randomized controlled trials, and case series that have reported an improvement in urinary incontinence for up to two years following biofeedback (Fitz, et al., 2012; Herderschee, et al., 2011; Desantis, et al., 2011; Porena, et al., 2000; Burgio, et al., 2002;

Herbison, et al., 2002; Hunter, et al., 2004; Yabci, et al., 2005; Dannecker, et al., 2005; Burgio, et al., 2006; Klijn, et al., 2006).

The Agency for Healthcare Research and Quality (AHRQ) conducted a systematic review on the diagnosis and nonsurgical treatment of urinary incontinence (UI) in adult women. The focus of the review was women with stress UI associated with sphincter function and urgency UI which is often associated with overactive bladder. The review included pharmacotherapy and nonsurgical management (e.g., pelvic floor muscle training, biofeedback, intravaginal electrical stimulation). Randomized controlled trials which included mostly mixed incontinence showed that nonpharmacological treatments were better than no active treatment. Regarding biofeedback, AHRQ key findings stated that performing pelvic floor muscle training (PFMT) with biofeedback improved UI. AHRQ noted that women experienced improvement in UI with PFMT with and without biofeedback.

The 2010 American Urological Society's (AUS) guidelines on the management of children with vesicoureteral reflux and bladder/bowel dysfunction (BBD) stated that there was insufficient evidence to recommend a specific treatment but biofeedback is one possible treatment option for children more than age five years. AUS described BBD as abnormal lower urinary tract symptoms of storage and/or emptying which include lower urinary tract conditions such as overactive bladder and urge incontinence, voiding postponement, underactive bladder, and voiding dysfunction, and may also include abnormal bowel patterns including constipation and encopresis.

In their guideline on the management of urinary incontinence in women, NICE (Oct 2006) stated that "perineometry or pelvic floor electromyography as biofeedback should not be used as a routine part of pelvic floor muscle training", but that "biofeedback should be considered in women who cannot actively contract pelvic floor muscles in order to aid motivation and adherence to therapy".

**Headaches**
A migraine is a type of headache that is usually localized to one area of the head and may be accompanied by nausea, vomiting, light sensitivity and visual disturbances. A tension headache involves pain in the head, scalp or neck, with muscle tightness in the affected area. A migraine may also be present with a tension headache (i.e., mixed tension migraine) and has features of both tension headache and migraine. In addition to migraine and tension headaches, chronic (i.e., occurring on more days than not for a three month period or longer) or recurrent headaches may occur secondary to multiple conditions, such as medication usage, infectious process, brain tumor, caffeine withdrawal, sleep deprivation, trauma and psychogenic disorders. In these conditions, the treatment is aimed at the underlying cause, and biofeedback is typically not indicated (Huffman and Sakonju, 2005; Gladstein, 2006; McConaghy, 2007).

Biofeedback is a standard treatment option for migraine and tension headaches. Systematic reviews and randomized controlled trials have reported that biofeedback is effective in reducing the severity and frequency of these headaches in adults and children (Vasudeva, et al., 2003; Eccleston, et al., 2004; Kaushik, et al., 2005; Nestoriuc and Martin 2007). After conducting a meta-analysis of 55 randomized controlled trials, including 1718 patients assigned to biofeedback and 511 patients assigned to controls, Nestoriuc and Martin (2007) stated that biofeedback "can be recommended as an evidence-based behavioral treatment option for the prevention of migraine."

Guidelines by the National Headache Foundation (NHF) listed biofeedback as a treatment option for the evaluation and management of migraine headaches. The NHF stated that non-pharmacologic adjuncts used for the treatment of migraine including biofeedback may be effective and eliminate the need for pharmacologic interventions (Landy, et al., 2004; Mauskop, 2004). Thermal and EMG biofeedback have been shown to be effective in the prevention and relief of migraine headaches (Farmer, et. al., 2004). Biofeedback has also been proposed as a migraine treatment option for children over age ten years (Pearlman, 2004).

**Other Conditions**
Biofeedback has been proposed as a treatment modality for numerous other conditions including: alcohol and drug abuse, anxiety disorders, asthma, attention deficit hyperactivity disorders (ADHD), autism spectrum disorders, cancer pain and symptoms, cardiovascular disease, cerebral palsy, chronic back pain, chronic prostatitis, cystic fibrosis, epilepsy, fecal incontinence, fibromyalgia, functional dyspepsia, heart failure, hypertension, hyperhidrosis, knee osteoarthritis, labor pain, pervasive developmental disorders, posttraumatic stress disorder (PTSD), Raynaud's syndrome, recurrent urinary tract infection, reflex sympathetic dystrophy or

complex regional pain syndrome, rheumatoid arthritis, stroke, temporomandibular disorders, tinnitus, type 2 diabetes mellitus, upper limb pain, vulvodynia and whiplash. However, the evidence in the published peer-reviewed scientific literature does not support the efficacy of biofeedback for the treatment of these conditions. Overall, there is a lack of randomized controlled trials using sufficient sample sizes, comparing biofeedback to established therapeutic modalities (e.g., pharmacotherapy, behavior therapy) with long-term follow-ups. Patient selection criteria for biofeedback for these conditions have not been established and reported sustained benefit past the treatment period are lacking (McKee and Moravec, 2010; Yilmaz, et al., 2010; Glasscoe and Quittner, 2008; McGinnis, et al., 2005).

**Cancer:** Patients undergoing oncologic therapy experience persistent pain, fatigue, anxiety and side effects from chemotherapy. In additional to pharmacotherapy, biofeedback has been proposed as an adjunct treatment modality for this patient population. However, there is insufficient evidence in the published peer-reviewed literature to support biofeedback for the management of cancer. There have been a limited number of studies with small patient populations (n=12-81), short-term follow-ups (e.g., 3 months) and in some studies, lack of a control group. Most studies were conducted prior to 2000. Biofeedback has not been shown to be effective in reducing cancer pain or chemotherapy side effects. One study reported that relaxation training was more effective than biofeedback (Cooke, et al., 2011; Brunnhuber, et al., 2008).

In reference to the management of cancer pain, the National Cancer Institute (NCI) (2012) stated that alternative therapies (e.g., biofeedback) may be used in conjunction with pain medication in an effort to control pain. NCI states that even though some of these “methods have not been tested in cancer pain studies,” they may help to relieve pain, stress and anxiety therefore, improving the patient’s quality of life. NCI noted that if a patient was interested in trying biofeedback, they “must see a licensed biofeedback technician”.

The American Cancer Society (2010) stated biofeedback under the supervision of a licensed biofeedback technician is a non-medical treatment that may be used for the treatment of cancer pain. Non-medical treatment are “widely used” to help manage cancer pain and is typically used with other pain-relief methods.

In their Cancer-Related Fatigue guideline, the National Comprehensive Cancer Network® (NCCN®) (2011) stated that behavioral techniques including biofeedback are beneficial in improving fatigue among breast cancer patients.

**Chronic Back Pain:** Biofeedback has been proposed as a treatment modality for chronic back pain to help relieve the tension in the back muscles and alleviate pain. Henschke et al. (2010) conducted a systematic review of 30 randomized controlled trials (RCTs) that investigated behavioral treatment (e.g., biofeedback) for low back pain. There was low quality evidence (three RCTs; n=64) that EMG biofeedback was more effective than waiting list or progressive relaxation (one RCT; n=24).

Ostelo et al. (2005) conducted a systematic review of the literature to determine if behavioral treatments (including biofeedback) for nonspecific chronic low back pain (CLBP) were more effective than other treatments compared to waiting-list controls (WLC). Twenty-one randomized controlled trials met inclusion criteria. CLBP was defined as back pain that persisted for 12 weeks or more. Studies of individuals with CLBP caused by pathological entities including infection, neoplasm, fracture, osteoporosis and rheumatoid arthritis (RA) were excluded. The investigators reported that there is moderate evidence (three studies, n=88) that there is no significant difference between EMG biofeedback and WLC on behavioral outcomes in the short term. There is conflicting evidence (two studies, n=60) on the effectiveness of EMG biofeedback versus WLC on general functional status. There is limited evidence (one study, n=28) of EMG biofeedback for a small short-term positive effect on back-specific functional status. Cognitive behavioral treatment (CBT) was compared to EMG biofeedback in one study (n=28), which found no differences in the groups for pain or any behavioral outcome measures either in the short or long term. A combination of CBT and EMG biofeedback compared to WLC (four studies, n=134) found strong evidence for a short-term, positive effect on pain intensity, but no differences on behavioral outcomes or general functional status in the short term compared to WLC. The investigators concluded that combined CBT and EMG biofeedback and progressive relaxation therapy alone are effective for short-term pain reduction in patients with CLBP; however, more research is needed to determine what types of behavioral interventions are most effective for pain relief and which patients would benefit most from a specific type of behavioral treatment. The investigators stated no determination could be made from this review as to whether patients should be referred to behavioral treatment programs or to active conservative treatment programs.

The American Society of Anesthesiologist Task Force on Chronic Pain Management and the American Society of Regional Anesthesia and Pain Medicine (2010) stated that psychological treatment including biofeedback "may be used as part of a multimodal strategy for low back pain and for other chronic pain conditions".

The 2011 guidelines for acute and chronic low back pain published by the Work Loss Data Institute have biofeedback listed as a treatment modality that they do not recommend.

**Epilepsy:** In an effort to reduce abnormal brain waves and seizure frequency, biofeedback has been proposed for the treatment of epilepsy. Ramaratnam et al. (2008) conducted a meta-analysis of psychological treatments, including biofeedback, for epilepsy. Randomized and quasi-randomized studies were analyzed. Outcomes included quality of life and seizure frequency. Of the two trials including relaxation and behavioral therapy, one reported positive results by decreasing anxiety and enhancing adjustment. Another study of galvanic skin response reported reduction in seizure activity. A study using EEG biofeedback improved cognitive and motor functions in subjects with the greatest seizure reduction. The studies were deficient in methodology and, due to the limited number of studies, the evidence wasn't considered reliable.

In their clinical guideline for diagnosing and managing epilepsy in children and adults, NICE (2012) stated that psychological interventions, including biofeedback, may be used as an adjuvant therapy to anti-epileptic drugs (AED) to improve quality of life in adults who are not receiving optimal benefit from AED and in children and young people with drug-resistant focal epilepsy. They go on to state that psychological interventions have not proven to affect seizure frequency and are not an alternative to pharmacological treatment.

**Fecal Incontinence**
Fecal incontinence is the inability to control bowel movements and may involve leakage of stool. Causes of fecal incontinence include severe constipation, chronic diarrhea, overuse of laxatives, damage to the anal sphincter muscles or nerves, anal surgical procedures, spinal cord injury and stroke. Treatment includes changes in dietary habits, pelvic floor muscle exercises and pharmacotherapy. Biofeedback as been proposed for the treatment of fecal incontinence, but results from systematic reviews and randomized controlled trials report that biofeedback does not improve this condition.

Brazzelli et al. (2011) conducted a systematic review of randomized and quasi-randomized controlled trials to assess the effectiveness of behavior and/or cognitive interventions, including biofeedback, for the treatment of children with fecal incontinence. Twenty-one trials (n=1371) met inclusion criteria. Follow-ups ranged from 4–24 months with two trials reporting no follow-up following cessation of treatment. Combined results of nine trials showed higher rates of persistent symptoms of fecal incontinence for up to 12 months when biofeedback was added to conventional treatment (e.g., laxatives, toilet training, dietary advice, behavior modification). Based on this data, the authors concluded that there was "no evidence" that biofeedback training added any benefit to conventional therapy for the management of functional fecal incontinence nor was there enough data to assess the effectiveness of biofeedback for the management of organic fecal incontinence in children.

Norton and Cody (2012) conducted a systematic review of randomized and quasi-randomized controlled trial to evaluate biofeedback and/or anal sphincter exercises for the treatment of fecal incontinence in adults. Twenty-one studies (n=1525) met inclusion criteria. Two biofeedback studies reported follow-ups at nine months and five studies reported follow-ups at one year, but most studies reported no follow-up following cessation of treatment. The authors stated that they found no evidence that biofeedback provided any benefit over any other treatment (e.g., dietary modification, bulking agents, pelvic floor exercises). Evidence on patient selection criteria is lacking. Overall, the limited number of studies with methodological weaknesses, including incomplete outcome data, did not allow for definitive assessment of the role of biofeedback in the treatment of adults with fecal incontinence.

In a 2006 systematic review, Brazzelli et al. evaluated randomized and quasi-randomized trials of behavioral and cognitive intervention for the treatment of constipation in children. Eighteen trials including 1168 children met inclusion criteria, but the studies were small with variable interventions and outcomes. Success rates varied as well. The authors concluded that there was no evidence to support that biofeedback added any benefit to conventional treatment in children with functional fecal incontinence, nor was there evidence to assess the effects of biofeedback for the treatment of organic fecal incontinence.

In their guideline on the management of fecal incontinence, NICE (2007) stated that adults who have persistent fecal incontinence after initial management should be considered for special continence services including biofeedback. Due to the limited evidence, biofeedback is not recommended as a first line therapy.

The American Society of Colon and Rectal Surgeons (ASCRS) (2007) stated that biofeedback could be used as an initial treatment of fecal incontinence in motivated patients with some voluntary sphincter contraction. ASCRS noted that the benefits are variable and standard care (e.g. advice and education) alone has been shown to be as effective as biofeedback therapy.

**Fibromyalgia:** Biofeedback has been proposed for the treatment of fibromyalgia in an effort to facilitate and train an individual in maintaining a state of relaxation and decreased pain. In a randomized controlled trial, Babu et al. (2007) compared EMG biofeedback (n=15) to sham (n=15) and reported a significant decrease in pain and the number of tender points in the treatment group. However, there were no significant differences in the fibromyalgia impact questionnaire, or the six-minute walk test. Both groups experienced a significant decrease in FIQ and visual analogue scale but the decreases were greater in the biofeedback group.

**Functional Dyspepsia (FD):** Because low vagal tone may be a mediating mechanism by which psychological factors induce dyspepsia in FD, it has been hypothesized that biofeedback may be a helpful treatment modality by enhancing vagal tone, leading to improvement in parasympathetic activity and drinking capacity. In a randomized controlled trial (n=40) patients were allocated to investigation, information, and biofeedback with breathing exercises or to investigation and information only. Drinking capacity and quality of life significantly improved (p=0.02, p=0.01, respectively) following biofeedback, but an improvement in baseline vagal tone was not noted (Hjelland, et al., 2007).

**Hypertension:** Because of its potential to decrease stress and enhance relaxation, biofeedback has been proposed for the treatment of hypertension. Greenhalgh et al. (2009) conducted a systematic review to determine the clinical benefits and long-term effects of biofeedback for the treatment of essential hypertension in adults. Forty-one studies, including 36 randomized controlled trials (n=1660), met inclusion criteria. Twenty-one trials used biofeedback only and 15 trials used biofeedback with other treatment modalities. No meta-analysis was completed due to the poor reporting quality of the studies and the large degree of heterogeneity of treatments and comparators. Overall, the trials included small patient populations, no follow-up or follow-up less than 12 months. Other limitations of the studies included the variation in interventions, inconsistencies in measurement of outcomes, and the conflicting and variable results. No consistent short- or long-term benefits in the control of hypertension were seen when biofeedback was compared to pharmacotherapy, sham biofeedback, no intervention or other behavioral therapies (e.g., relaxation, hypnosis, meditation, stress education).

Nakao et al. (2003) conducted a meta-analysis of 22 randomized controlled studies of essential hypertensive patients (n=905). Biofeedback intervention resulted in blood pressure reductions that were greater by 7.3 millimeters (mm) of mercury (Hg) systolic and 5.8 mmHg diastolic compared to nonintervention controls (such as clinical visits or self-monitoring of blood pressure). Compared to sham or nonspecific behavioral intervention controls, the net reductions in systolic and diastolic blood pressures by biofeedback intervention were 3.9 mmHg and 3.5 mmHg, respectively. Reviewers were unable to determine whether biofeedback itself had an antihypertensive effect beyond the general relaxation response because biofeedback was only found to be superior to sham or nonspecific behavioral intervention when combined with other relaxation techniques. The investigators concluded that large, randomized controlled trials are needed to determine whether biofeedback itself has an antihypertensive effect beyond the general relaxation response.

Yucha et al. (2001) conducted a meta-analysis of 23 randomized controlled studies to determine the effectiveness of biofeedback in the treatment of stages I and II essential hypertension. Biofeedback therapy included different biofeedback modalities and elements of cognitive behavior therapy and relaxation training. The active control groups included treatments known to reduce blood pressure such as relaxation training, cognitive therapy and home blood pressure monitoring. The inactive control groups included waiting-list control, clinic blood pressure monitoring and sham biofeedback. The investigators concluded that both biofeedback and active control treatments resulted in a reduction in systolic blood pressure (SBP) and diastolic blood pressure (DBP), but only biofeedback showed a significantly greater reduction in both SBP (6.7 mm Hg) and DBP (4.8 mm Hg) when compared to inactive control treatments. The authors noted that statistical significance was achieved only in comparison with the inactive control groups. They also noted the difficulty in determining the

effectiveness of specific biofeedback modalities because of the small number of studies using each modality. Some studies tested one treatment at a time, while others used combined treatments, and complete data were not reported in many studies. The authors concluded that biofeedback as a treatment for stage I and II hypertension in healthy adults could be considered before the initiation of pharmacological treatments and as adjunctive therapy to standard pharmacological treatment.

**Labor Pain:** Barragán et al. (2011) conducted a systematic review of randomized controlled trials to evaluate the efficacy of biofeedback in the management of labor pain. Four trials (n=186) met inclusion criteria and primarily used EMG biofeedback. There were no significant differences between biofeedback and the control groups in terms of assisted vaginal birth, caesarean section, augmentation of labor and the use of pharmacological pain relief. Some studies reported that EMG biofeedback may have had some positive effects early in labor, but as labor progressed there was a need for additional pharmacological analgesia.

**Knee Conditions:** Wasielewski et al. (2011) conducted a systematic review of eight randomized controlled trials (n=319 subjects) to evaluate the effectiveness of electromyographic biofeedback (EMGB) of the quadriceps femoris muscle for the treatment of knee conditions. Diagnosis included patellofemoral pain syndrome (two trials; n=86), anterior cruciate ligament reconstruction (two trials; n=52), arthroscopic surgery (two trials; n=91) or osteoarthritis (two trials; n=90). EMGB appeared to benefit short-term postsurgical pain or quadriceps strength in three out of the four postsurgical investigations but was reported ineffective for chronic knee conditions including patellofemoral pain and osteoarthritis. Limitations of the studies included small heterogeneous patient populations, variability in interventions and outcomes, and poor methodology. The authors stated that the results should be viewed with caution due to the limited data and poor studies.

**Raynaud's Syndrome:** Proponents of biofeedback for Raynaud's state that using thermal biofeedback to produce vasodilation may help relieve the severity and frequency of attacks. Malenfant et al. (2009) conducted a systematic review and meta-analysis of randomized controlled trials on complementary and alternative medicine, including biofeedback (n=5 studies), for the treatment of Raynaud's phenomenon. The outcomes of the biofeedback studies (n=15–155) favored sham therapy over biofeedback ($p<0.02$). There were no significant differences in frequency or duration or severity of Raynaud's attacks. The authors concluded that biofeedback is not an effective therapeutic intervention for the treatment of Raynaud's.

The National Institute of Arthritis and Musculoskeletal Diseases (NIAMS) (2009) stated that while biofeedback is used for the treatment of a Raynaud's attack, formal studies have suggested that it is not helpful.

**Recurrent Urinary Tract Infection:** Minardi et al. (2010) conducted a randomized controlled trial to evaluate the efficacy of uroflowmetry biofeedback and pelvic floor relaxation biofeedback in women (n=86) with more than a three-year history of recurrent urinary tract infections (UTI) (i.e., three or more symptomatic episodes per year) and dysfunctional voiding. The authors defined dysfunctional voiding as an abnormally learned spectrum of voiding behavior in neurologically normal individuals. The women were randomized to one of four groups: group 1 (n=24), uroflowmetry biofeedback; group 2 (n=21), biofeedback training of the pelvic floor muscles; group 3 (n=20), uroflowmetry biofeedback combined with biofeedback training of the pelvic floor muscles; and group 4 (n=21), no treatment. Patients also received antibiotics during the study when indicated. At the three-, six- and 12-month follow-ups there were significant improvements ($p<0.05$, each), which remained stable, in all of the following outcome measures: storage and emptying symptoms, mean flow rate, flow time, voiding and volume; overall voiding pattern; post-void residual urine; mean opening detrusor pressure and detrusor pressure at maximum flow; and the prevalence of UTI. No significant improvements were seen in the untreated group. At 24 months in the treated groups, the storage and emptying symptoms and voiding patterns were similar to baseline values in 55% of patients, and the incidence of UTIs was similar in 45% of patients. The authors noted that this was the first study of pelvic floor therapy for the treatment of recurrent UTIs in women. Limitations of the study include the small patient population, short-term follow-up and the number of patients lost to follow-up (142 were originally enrolled).

**Rheumatoid Arthritis (RA):** Biofeedback has been proposed for the treatment of RA to help alleviate tension, stress, anxiety, insomnia and other symptoms that may cause acute flair-ups and/or enhance arthritic pain. Astin et al. (2002) conducted a systematic review of the literature to investigate the effect of psychological interventions (including biofeedback) on patients with RA. Outcome measures included functional ability, pain, tender joints, psychological status and coping ability. Twenty-five randomized controlled trials of 1676 patients met inclusion criteria. Because separate results by type of intervention (i.e., relaxation, biofeedback, CBT) were

not identified, the authors could not report which psychological interventions or combinations of interventions were most effective and for which types of patients. Although the investigators noted some methodological flaws in the studies (e.g., inadequate description of controls, effect sizes not always consistent with signs of confidence intervals), they stated that psychological interventions may be more effective for patients who have had RA for shorter duration. The authors concluded that more research was needed to determine which treatments may be of benefit for patients with RA.

**Stroke:** The goal for the treatment of stroke with biofeedback is to retrain the injured brain to replace the inattentive states of consciousness (theta wave) and/or excessive anxiety and tension (beta waves) with healthy waves needed for normal cognition, alertness and mental focus (Litvinas, 2007). Stanton et al. (2011) conducted a systematic review and meta-analysis of 22 randomized and quasi-randomized controlled trials to evaluate the effectiveness of biofeedback in enhancing lower-limb training for sitting, standing up, standing or walking following a stroke. Included clinical trials used various forms of biofeedback including any signal (position, EMG) via any sense (visual, auditor, tactile) during the practice of the whole activity. Based on pooled data from 17 trials (n=411) biofeedback improved lower limb activities compared to usual therapy or placebo in the short-term (i.e., one to five months following cessation of therapy). However, the author-noted that there was substantial heterogeneity of the low quality trials using any form of biofeedback; lack of blinding of subjects and therapists; possible small trial bias and selection bias based on intervention in the studies used for meta-analysis; and only half of the trials measured outcomes for any length of time following cessation of therapy. Well designed randomized controlled trials with long-term results are needed to support the effectiveness of biofeedback in stroke patients.

Tate and Milner (2010) conducted a systematic review of randomized controlled trials (n=7) to evaluate the effectiveness of biofeedback in treating gait abnormalities. The types of biofeedback included real-time kinematic, temporospatial and kinetic. In five studies the patient population (n=105) was status-post stroke. One study included 42 patients with hip or knee replacement, hip fracture or amputation and one study included 28 patients status-post total hip replacement. There was a large range in the structure of the treatment protocol (e.g., treatment time, frequency, duration) and meta-analysis was not performed because of the wide variety of study designs, methodologies and outcome measures. Although some studies reported short-term improvement, long-term outcomes were not reported and whether or not improvements were maintained is unknown. The authors concluded that there was insufficient data to make a guideline recommendation for biofeedback for gait training.

Zijlistra et al. (2010) conducted a systematic review of randomized controlled trials (n=17) and comparative studies (n=4) to evaluate the effectiveness of biofeedback training for balance and/or mobility in older adults. Twelve studies included post-stroke patients, six included frail older adults in a care center and three studies included lower limb amputation and/or hip surgery. The biofeedback was visual and/or audio. The studies were determined to be of moderate quality with variations in analyses and outcomes. Due to the inability to perform quantitative analysis and the absence of large-scale randomized controlled trials, definitive conclusions could not be made. The addition of biofeedback during gait training did not seem to improve disability and mobility functioning.

Woodford and Price (2007) conducted a meta-analysis of 13 studies (n=269) on the use of electromyographic biofeedback (EMG-BFB) for the recovery of motor function following a stroke. The analysis included randomized controlled trials and quasi-randomized controlled trials that compared physiotherapy or exercises or physical therapy alone to these treatment modalities plus EMG/EMG-BFB. There were variations in the time from stroke to randomization (35 to 1140 days), and the length of the studies ranged from four to 16 weeks. Small sample sizes (n=10–40) were also a limitation of the studies. Outcome criteria included changes in motor strength, range of motion, stride length, gait speed, functional ability and gait quality score. Overall, the data did not demonstrate a positive effect on the outcomes. The authors concluded that EMG-BFB did “not appear to have a positive benefit for recovery after stroke,” and it could not be recommended as a routine treatment modality. However, in view of the absence of reported adverse events, EMG-BFB could be considered as a cautious treatment for a select group of patients.

Pollock et al. (2003) conducted a systematic review on the recovery of postural control and lower limb function following stroke. The objective was to determine if outcomes were different if the physiotherapy treatment was based on orthopedic, neurophysiology, motor learning principles or a mixture of these modalities. The review included randomized or quasi-randomized controlled trials with interventions of physiotherapies, including

biofeedback. Outcomes measured the degree of disability and motor impairment. Eighteen studies were categorized as EMG biofeedback and fifteen studies as positional biofeedback. The authors concluded that there was insufficient evidence to determine if one method was more effective than the other.

In their 2010 guidelines on stroke rehabilitation, the Department of Veterans Affairs, Department of Defense, American Heart Association and American Stroke Association recommended EMG biofeedback as a treatment modality for pain control when appropriate. However, “due to methodological flaws in current studies, further research is indicated to assess the efficacy of biofeedback as an adjunct to conventional therapy for post-stroke patients.”

In their discussion of rehabilitation for stroke patients, the 2010 National Stroke Foundation (NSF) clinical guidelines stated that EMG biofeedback is one modality that can be used in conjunction with conventional therapy in patients who have reduced strength and/or have difficulty using their upper limbs. Joint position biofeedback in conjunction with conventional walking training may be an option for patients having difficulty walking. Biofeedback may also be helpful in patient with dysarthria and persistent moderate to severe spasticity that interferes with activity or personal care. However, NSF noted that biofeedback should be used with caution in this patient population due to the limited number of studies supporting its efficacy.

**Temporomandibular Disorders (TMD)/Temporomandibular Joint (TMJ) Disorders:** As in other chronic pain conditions, biofeedback has been investigated to determine if relaxation and relief of stress and tension following biofeedback would alleviate the pain of TMD. A systematic review by Medlicott and Harris (2006) included seven randomized controlled trials which evaluated the effectiveness of relaxation training or biofeedback in the management of TMD. From the review of these studies, the authors stated, “Programs involving relaxation techniques and biofeedback, EMG training, and proprioceptive reeducation may be more effective than placebo treatment or occlusal splints in decreasing pain and increasing total vertical opening in people with acute or chronic myofascial or muscular TMD in the short term and the long term.” They also noted that “these recommendations should be viewed cautiously.”

In 2005 systematic review, Crider et al. reported on six randomized controlled trials regarding the efficacy of biofeedback-based therapy for TMD. Two trials included surface electromyographic (SEMG) training of masticatory muscles; two combined SEMG with cognitive-behavioral therapy (CBT); and two involved biofeedback-assisted relaxation training (BART). The review determined the extent that each intervention met treatment efficacy criteria established by the Association for Applied Psychophysiology and Biofeedback (AAPB). Based upon the review of the studies, the authors stated that SEMG training and BART were “probably an efficacious treatment” and SEMG with CBT is an efficacious treatment. They recommended additional studies to identify specific treatment combinations.

The 2010 guideline for the treatment of temporomandibular disorders by the American Association of Oral and Maxillofacial Surgeons does not include biofeedback as a treatment modality.

**Tinnitus:** Weise et al. (2008) conducted a randomized controlled trial to compare the effects of biofeedback (n=63) to a wait-list control group (WLG) (n=67) in patients with chronic tinnitus (i.e., more than six months duration). Patients underwent 12, one-hour EMG biofeedback sessions with tinnitus-specific cognitive–behavioral therapy (CBT) (e.g., directing attention away from tinnitus, relapse prevention) over a three-month period. Final follow-up occurred six months following cessation of treatment. Following treatment, intention-to-treat statistical analysis based on results of interviews and self-reported questionnaires showed significantly less emotional and cognitive distress; less intrusive tinnitus, less auditory perceptual difficulties, less sleep disturbances and fewer somatic complaints in the biofeedback group ($p<0.01$ for each). No significant differences were reported in the WLG. Compared to pretreatment and the WLG, patients in the biofeedback group reported fewer feelings of helplessness, increased feelings of resourcefulness, fewer catastrophizing self-statements, and more helpful coping self-statements. However, no significant effect was found for depressive and general psychopathological symptoms. Following a waiting period, 52 WTG patients received biofeedback and showed a significant improvement in outcomes. The authors noted that the study was limited by the WTG instead of an active treatment control group (CBT without biofeedback). Other limitations of the study are the short-term follow-up, and the drop out rate (n=26).

**Upper Limb Pain:** A limited number of studies have been conducted to determine if the muscle relaxation effect of biofeedback could help alleviate the pain of repetitive strain in the upper limbs. Karjalainen et al. (2004)

conducted a systematic review of the literature to determine the effectiveness of biopsychosocial rehabilitation for upper-limb repetitive strain injuries among working-age adults. Two prospective randomized studies met inclusion criteria and both were considered to be of low quality due to methodological flaws. Studies which included EMG biofeedback as the only component of physiological rehabilitation were excluded. One study (n=32) compared the extra effect of hypnosis combined with biofeedback and autogenics (a form of autohypnosis using self-suggestion), given once a week for six weeks, compared to waiting-list controls (WLC). The authors concluded that the evidence was limited due to the low quality of the studies, but they noted there was a positive effect of hypnosis combined with biofeedback and autogenics as compared to biofeedback and autogenics after six weeks of follow-up. The second study (n=48) compared three behavioral therapies: EMG biofeedback, applied relaxation with progressive muscular relaxation and imagery methods. The biopsychosocial intervention groups were given a combination of EMG biofeedback and applied relaxation, or applied relaxation only. One control group was given EMG biofeedback, and the other control group waited eight weeks before treatment. The drop-out rate was reported to be 20.8% in this study. The authors concluded that there were no differences in effect between applied relaxation, EMG biofeedback plus applied relaxation, and WLC after eight weeks and six months of follow-up.

**Vulvodynia:** Following the hypothesis that vulvodynia, also called vulvar vestibulitis or vulvar vestibulodynia, may be due to an abnormality in pelvic floor muscle tone, biofeedback has been investigated as a treatment modality for muscle training. In a randomized controlled study, Bergeron et al. (2001) prospectively evaluated and compared EMG biofeedback (12-week trial), group cognitive-behavioral (12-week trial), and vestibulectomy in the treatment of dyspareunia resulting from vulvar vestibulodynia. Seventy-eight women were randomly assigned to one of the three treatment regimens. Following treatment, all groups reported statistically significant reductions on pain measures up to the six-month follow-up. The vestibulectomy group was significantly more successful than the other two groups, reporting a 70% mean reduction in pain and a greater quality of life improvement. The biofeedback participants experienced a higher six-month dropout rate, reflecting patient difficulty following through with the long-term and repetitive treatment protocols. The authors stated, that the "results need to be interpreted with caution since there were significantly more participants in the vestibulectomy condition who refused to undergo the treatment they had been randomized to, as compared to participants in the two other treatment conditions".

The American Society for Colposcopy and Cervical Pathology's (ASCCP) practice management recommendations (Haefner, et al., 2005) stated that biofeedback may be used in the treatment of vulvodynia to relieve pain and discomfort.

In 2006 (reaffirmed 2008), the American College of Obstetricians and Gynecologists (ACOG) and American Society for Colposcopy and Cervical Pathology (ASCCP) issued a joint opinion on the diagnosis and treatment of vulvodynia. They stated that "there are very few randomized trials of vulvodynia treatments and most treatment information is based on clinical experience, descriptive studies, or reports of expert committees. Some treatments that have been used include medication, biofeedback training, physical therapy, dietary modifications, cognitive behavioral therapy, sex counseling, and surgery. Newer treatments include acupuncture, hypnotherapy, nitroglycerin, and botulinum toxin, according to the document."

**EEG Biofeedback/Neurofeedback**

The evidence in the clinical trials has not established clinical efficacy and effectiveness of EEG biofeedback (Angelakis, et al., 2007; Dohrmann, et al., 2007; McDonough-Means and Cohen, 2007). A Hayes (2003) review of six studies that met inclusion criteria concluded that "there is insufficient evidence from the available peer-reviewed literature to conclude that EEG biofeedback therapy is effective for the treatment of disorders such as ADHD, epilepsy, insomnia, depression, mood disorders, posttraumatic stress disorder, alcoholism, drug addiction, or menopausal symptoms". Limitations of the studies included small patient populations, inadequate or no controls, lack of randomization or comparison to conventional therapies, and/or long-term follow-up, as well as inconsistent outcome measures and incomplete reporting of data. Because of these methodological flaws, Hayes stated that "no definitive conclusions regarding the efficacy of EEG biofeedback can be drawn." In a subsequent literature search (2008), Hayes' conclusions had not changed.

In a randomized controlled trial, Gevensleben et al. (2010) reported on the six-month follow-up of 61 of 94 children, ages 8–12 years, with ADHD who were treated with a computerized attention skills training (AST) (n=35) or neurofeedback (n=59). The neurofeedback system used was developed by the authors. Both treatments were divided into two blocks of 18 units consisting of 9 sessions, two to three times a week, for 50

minutes each. There was a two to three week break between the two blocks of treatment. Based on parental responses, there was a significant group overall effect (P<0.005) on the FBB-HKS ADHD rating scale and a significant group effect on the FBB-HKS inattention subscale (p<005), but no significant time effect following neurofeedback at the six-month follow-up. Compared to pre-training scores, reductions of inattention and hyperactivity/impulsivity at follow-up were 25–30% in the neurofeedback group compared to 10–15% in the AST control group. A significant group effect (p<0.005) was seen on the Strength and Difficulties Questionnaire hyperactivity subscale (SDQ) in the neurofeedback group. A significant group difference (p<0.05) was also seen in homework in the neurofeedback group. A total of 50% of children in the neurofeedback group showed a ≥ 25% reduction in the primary outcome measure following post-training and at the six-month follow-up. In the control group, 26.1% were responders at post-training and 30.4% at six-months. Limitations of the study include the small patient population, short-term follow-up, number of patients lost to follow-up (n=33), neurofeedback system developed by the authors and outcomes reported by parents.

**Home Biofeedback Devices**
Biofeedback should be performed in a clinical setting by trained professionals. The evidence in the published peer-reviewed scientific literature does not support the effectiveness of home electronic biofeedback devices. In some instances the results of clinical trials were limited due to the inability to monitor the use of home biofeedback used by subjects in the trial. One randomized controlled trial compared the use of anorectal manometry EMG biofeedback performed in a laboratory (n=24) to EMG biofeedback performed in the home (n=12) for children with chronic constipation who had failed conventional treatment. The outcomes indicated that no additional benefit was gained by the use of home biofeedback (Croffie, et al., 2005). In a randomized controlled trial, Aukee et al. (2004) reported that 11 of 16 women who received 12 weeks of home EMG-assisted biofeedback (FemiScanTM, MegaElectronics, Kuopio, Finland) avoided surgical intervention compared to ten of 19 control subjects who did not use home biofeedback. In a 2002 decision memo regarding the use of home biofeedback for urinary incontinence, the Centers for Medicare and Medicaid (2002), stated that “the scientific evidence is not adequate to conclude that the use of home biofeedback devices for the treatment of urinary incontinence is clinically effective, and, therefore, is not reasonable and necessary for treating urinary incontinence or to improve the functioning of a malformed body member”.

**Summary**
The evidence in the published peer-reviewed scientific literature and professional societies support the safety and efficacy of biofeedback for the treatment of constipation in adults, and the treatment of stress, urge, mixed and overflow urinary incontinence, as well as, migraine and tension headaches in children and adults.

The evidence in the published peer-reviewed scientific literature does not support the therapeutic effectiveness of biofeedback for any other indication due to the small number of clinical trials and/or small heterogeneous patient populations, short-term follow-ups, lack of documentation of sustained benefits and lack of a comparison to established therapeutic modalities. In most cases, patient selection criteria for biofeedback have not been established. There is insufficient evidence in the published, peer-reviewed scientific literature to conclude that biofeedback is effective for any of the following indications (list is not all inclusive):

- alcohol and drug abuse
- anxiety disorders
- asthma
- attention deficit hyperactivity disorder
- autism spectrum disorders
- cancer
- cardiovascular disease
- cerebral palsy
- chronic back pain
- chronic prostatitis
- cystic fibrosis
- epilepsy
- fecal incontinence
- fibromyalgia
- functional dyspepsia
- heart failure

- hyperhidrosis
- hypertension
- knee osteoarthritis
- labor pain
- pervasive developmental disorders
- posttraumatic stress disorder (PTSD)
- Raynaud's syndrome
- recurrent urinary tract infections
- reflex sympathetic dystrophy/complex regional pain syndrome
- rheumatoid arthritis,
- stroke
- temporomandibular disorders
- tinnitus
- type 2 diabetes mellitus
- upper limb pain
- vulvodynia
- whiplash

---

**Coding/Billing Information**

**Note:** 1) This list of codes may not be all-inclusive.
2) Deleted codes and codes which are not effective at the time the service is rendered may not be eligible for reimbursement.

**Biofeedback**

**Covered when medically necessary, if coverage is available:**

| **CPT®* Codes** | **Description** |
|---|---|
| 90875 | Individual psychophysiological therapy incorporating biofeedback training by any modality (face-to-face with the patient), with psychotherapy (e.g., insight oriented, behavior modifying or supportive psychotherapy); approximately 20-30 minutes |
| 90876 | Individual psychophysiological therapy incorporating biofeedback training by any modality (face-to-face with the patient), with psychotherapy (e.g., insight oriented, behavior modifying or supportive psychotherapy); approximately 45-50 minutes |
| 90901 | Biofeedback training by any modality |
| 90911 | Biofeedback training, perineal muscles, anorectal or urethral sphincter, including EMG and/or manometry |

| **ICD-9-CM Diagnosis Codes** | **Description** |
|---|---|
| 307.81 | Tension headache |
| 339.1-339.12 | Tension type headache |
| 346.00-346.93 | Migraine |
| 564.00-564.09 | Constipation |
| 625.6 | Stress incontinence, female |
| 788.31 | Urge incontinence |
| 788.32 | Stress incontinence, male |
| 788.33 | Mixed incontinence (male) (female) |

| | |
|---|---|
| 788.34 | Incontinence without sensory awareness |
| 788.35 | Post-void dribbling |
| 788.37 | Continuous leakage |
| 788.38 | Overflow incontinence |

**Experimental/Investigational/Unproven/Not Covered:**

| ICD-9-CM Diagnosis Codes | Description |
|---|---|
| 088.0-088.9 | Other arthropod-borne diseases |
| 250.00 | Diabetes mellitus without mention of complication, type II or unspecified type, not stated as uncontrolled |
| 250.02 | Diabetes mellitus without mention of complication, type II or unspecified type, uncontrolled |
| 250.10 | Diabetes with ketoacidosis, type II or unspecified type, not stated as uncontrolled |
| 250.12 | Diabetes with ketoacidosis, type II or unspecified type, uncontrolled |
| 250.20 | Diabetes with hyperosmolarity, type II or unspecified type, not stated as uncontrolled |
| 250.22 | Diabetes with hyperosmolarity, type II or unspecified type, uncontrolled |
| 250.30 | Diabetes with other coma, type II or unspecified type, not stated as uncontrolled |
| 250.32 | Diabetes with other coma, type II or unspecified type, uncontrolled |
| 250.40 | Diabetes with renal manifestations, type II or unspecified type, not stated as uncontrolled |
| 250.42 | Diabetes with renal manifestations, type II or unspecified type, uncontrolled |
| 250.50 | Diabetes with ophthalmic manifestations, type II or unspecified type, not stated as uncontrolled |
| 250.52 | Diabetes with ophthalmic manifestations, type II or unspecified type, uncontrolled |
| 250.60 | Diabetes with neurological manifestations, type II or unspecified type, not stated as uncontrolled |
| 250.62 | Diabetes with neurological manifestations, type II or unspecified type, uncontrolled |
| 250.70 | Diabetes with peripheral circulatory disorders, type II or unspecified type, not stated as uncontrolled |
| 250.72 | Diabetes with peripheral circulatory disorders, type II or unspecified type, uncontrolled |
| 250.80 | Diabetes with other specified manifestations, type II or unspecified type, not stated as uncontrolled |
| 250.82 | Diabetes with other specified manifestations, type II or unspecified type, uncontrolled |
| 250.90 | Diabetes with unspecified complication, type II or unspecified type, not stated as uncontrolled |
| 250.92 | Diabetes with unspecified complication, type II or unspecified type, uncontrolled |
| 277.00-277.09 | Cystic fibrosis |
| 296.00-296.06 | Bipolar I disorder, single manic episode, unspecified |
| 296.30-296.36 | Major depressive disorder, recurrent episode |
| 296.80-296.89 | Other and unspecified bipolar disorders |
| 299.00-299.91 | Pervasive developmental disorders |
| 300.00-300.09 | Anxiety states |
| 300.10- | Dissociative, conversion and factitious disorders |

| | |
|---|---|
| 300.19 | |
| 303.00–303.93 | Alcohol dependence syndrome |
| 304.00-304.93 | Drug dependence |
| 307.20-307.23 | Tics |
| 307.6 | Enuresis |
| 309.0-309.9 | Adjustment reaction |
| 309.81 | Posttraumatic stress disorder |
| 314.00-314.01 | Attention deficit disorder |
| 327.00-327.8 | Organic sleep disorders |
| 337.20-337.29 | Reflex sympathetic dystrophy |
| 338.3 | Neoplasm related pain (acute) (chronic) |
| 343.0-343.9 | Infantile cerebral palsy |
| 345.00-345.91 | Epilepsy and recurrent seizures |
| 348.30-348.39 | Encephalopathy, not elsewhere classified |
| 388.30-388.32 | Tinnitus |
| 401.0-401.9 | Essential hypertension |
| 428.0-428.9 | Heart failure |
| 434.91 | Unspecified cerebral artery occlusion with cerebral infarction |
| 443.0 | Raynaud's syndrome |
| 493.00-493.92 | Asthma |
| 524.60 | Temporomandibular joint disorders, unspecified |
| 524.61 | Temporomandibular joint disorders, adhesions and ankylosis (bony or fibrous) |
| 524.62 | Temporomandibular joint disorders, arthralgia of temporomandibular joint |
| 524.63 | Temporomandibular joint disorders, articular disc disorder (reducing or non-reducing) |
| 524.69 | Other specified temporomandibular joint disorders |
| 536.8 | Dyspepsia and other specified disorders of function of stomach |
| 599.0 | Urinary tract infection, site not specified |
| 601.1 | Chronic prostatitis |
| 625.70-625.79 | Vulvodynia |
| 705.21-705.22 | Focal hyperhidrosis |
| 714.0 | Rheumatoid arthritis |
| 715.00-715.98 | Osteoarthrosis |
| 724.5 | Backache, unspecified |
| 728.81-728.89 | Other disorders of muscle, ligament, and fascia |
| 729.1 | Myalgia and myositis, unspecified |
| 729.5 | Pain in limb |
| 780.8 | Generalized hyperhidrosis |
| 780.52 | Insomnia, unspecified |
| 787.60-787.63 | Incontinence of feces |
| 788.30 | Urinary incontinence, unspecified |
| 788.36 | Nocturnal enuresis |

| | |
|---|---|
| 788.39 | Other urinary incontinence |
| 788.91 | Functional urinary incontinence |
| 847.0 | Sprains and strains of neck |
| | All other codes |

**Biofeedback Devices**

**Experimental/Investigational/Unproven/Not Covered:**

| HCPCS Codes | Description |
|---|---|
| E0746 | Electromyography (EMG), biofeedback device |

| ICD-9-CM Diagnosis Codes | Description |
|---|---|
| | All codes |

***Current Procedural Terminology (CPT®) ©2012 American Medical Association: Chicago, IL.**

## References


1. Agency for Healthcare Research and Quality. (AHRQ). Evidence report/technology assessment. Number 161. Prevention of Fecal and Urinary Incontinence in Adults. Dec 2007. Accessed Jul 25, 2012. Available at URL address: http://archive.ahrq.gov/clinic/epcarch.htm

2. Agency for Healthcare Research and Quality. (AHRQ). Comparative effectiveness review. Number 36. Nonsurgical treatments for urinary incontinence in adult women: diagnosis and comparative effectiveness. April 2012. Accessed Jul 30, 2012. Available at URL address: http://www.effectivehealthcare.ahrq.gov/index.cfm/search-for-guides-reviews-and-reports/?pageaction=displayproduct&productid=834

3. Allen J. Photoplethysmography and its application in clinical physiological measurement. Physiol Meas. 2007 Mar;28(3):R1-39.

4. American Academy of Neurology. Update: NSAIDs and other complementary treatments for episodic migraine prevention in adults. 2012. Accessed Jul 25, 2012. Available at URL address: http://www.aan.com/practice/guideline/index.cfm?fuseaction=home.welcome&keywords=&Submit=Search+Guid

5. American Association of Oral and Maxillofacial Surgeons. Statements by the American Association of Oral and Maxillofacial Surgeons Concerning the Management of Selected Clinical Conditions and Associated Clinical Procedures Temporomandibular Disorders. Mar 2010. Accessed Jul 25, 2012. Available at URL address: http://www.aaoms.org/docs/practice_mgmt/condition_statements/tmj_disorders.pdf

6. American Cancer Society. Pain Control: A guide for those with cancer and their loved ones.Oct 25, 2010. Accessed Jul 30, 2012. Available at URL address: http://www.cancer.org/acs/groups/cid/documents/webcontent/002906-pdf.pdf

7. American College of Obstetricians and Gynecologists (ACOG). Committee on Gynecologic Practice. ACOG Committee Opinion: Number 345: vulvodynia. Oct 2006. Reaffirmed 2008. Accessed Jul 25, 2012. Available at URL address: http://www.acog.org/Resources_And_Publications/Committee_Opinions/Committee_on_Gynecologic_Practice/Vulvodynia

8. American Pain Society (APS). Pediatric chronic pain-A position statement from the American Pain Society. 2006. Accessed Jul 25, 2012. Available at URL address: http://www.ampainsoc.org/advocacy/statements.htm

9. American Society of Anesthesiologists Task Force on Chronic Pain Management; American Society of Regional Anesthesia and Pain Medicine. Practice guidelines for chronic pain management: an updated report by the American Society of Anesthesiologists Task Force on Chronic Pain Management and the American Society of Regional Anesthesia and Pain Medicine. Anesthesiology. 2010 Apr;112(4):810-33.

10. American Society of Colon and Rectal Surgeons. Treatment of fecal incontinence. 2007. Accessed Jul 25, 2012. Available at URL address: http://www.fascrs.org/physicians/practice_parameters/

11. American Society of Colon and Rectal Surgeons. Evaluation and management of constipation. 2007. Accessed Jul 25, 2012. Available at URL address: http://www.fascrs.org/physicians/practice_parameters/

12. American Urological Association. Topic 3: Management of children with vesicoureteral reflux and bladder/bowel dysfunction. 2010. Accessed Jul 25, 2012. Available at URL address: http://www.auanet.org/content/guidelines-and-quality-care/clinical-guidelines.cfm?sub=vur2010

13. Angelakis E, Stathopoulou S, Frymiare JL, Green DL, Lubar JF, Kounios J. EEG neurofeedback: a brief overview and an example of peak alpha frequency training for cognitive enhancement in the elderly. Clin Neuropsychol. 2007 Jan;21(1):110-29.

14. Astin JA, Beckner W, Soeken K, Hochberg MC, Berman B. Psychological interventions for rheumatoid arthritis: a meta-analysis of randomized controlled trials. Arthritis Rheum. 2002;47(3):291-302.

15. Aukee P, Immonen P, Laaksonen DE, Laippala P, Penttinen J, Airaksinen O. The effect of home biofeedback training on stress incontinence. Acta Obstet Gynecol Scand. 2004 Oct;83(10):973-7.

16. Babu AS, Mathew E, Danda D, Prakash H. Management of patients with fibromyalgia using biofeedback: A randomized control trial. Indian J Med Sci 2007;61:455-61.

17. Barragán Loayza IM, Solà I, Juandó PratsC. Biofeedback for pain management during labour. CochraneDatabase of Systematic Reviews 2011, Issue 6. Art. No.: CD006168. DOI: 10.1002/14651858.CD006168.pub2.

18. Bergeron S, Binik YM, Khalife S, Pagidas K, Glazer HI, Meana M, Amsel R. A randomized comparison of group cognitive--behavioral therapy, surface electromyographic biofeedback, and vestibulectomy in the treatment of dyspareunia resulting from vulvar vestibulitis. Pain. 2001 Apr;91(3):297-306.

19. Brazzelli M, Griffiths P. Behavioural and cognitive interventions with or without other treatments for the management of faecal incontinence in children. Cochrane Database Syst Rev. 2006 Apr 19;(2):CD002240.

20. Brazzelli M, Griffiths PV, Cody JD, Tappin D. Behavioural and cognitive interventions with or without other treatments for the management of faecal incontinence in children. Cochrane Database of Systematic Reviews 2011, Issue 12. Art. No.: CD002240. DOI: 10.1002/14651858.CD002240.pub4.

21. Brunnhuber K, Nash S, Meier DE, Weissman DE, Woodcock J. Putting evidence into practice: palliative care. BMJ 2008;1-88.

22. Burgio KL, Goode PS, Locher JL, Umlauf MG, Roth DL, Richter HE, Varner RE, Lloyd LK. Behavioral training with and without biofeedback in the treatment of urge incontinence in older women: a randomized controlled trial. JAMA. 2002 Nov 13;288(18):2293-9.

23. Burgio KL, Goode PS, Urban DA, Umlauf MG, Locher JL, Bueschen A, Redden DT. Preoperative biofeedback assisted behavioral training to decrease post-prostatectomy incontinence: a randomized, controlled trial. J Urol. 2006 Jan;175(1):196-201; discussion 201.

24. Centers for Medicare and Medicaid (CMS). Decision Memo for Home Biofeedback For Urinary Incontinence (CAG-00118N). Mar 1, 2002. Accessed Jul 25, 2012. Available a URL address: http://www.cms.hhs.gov/mcd/viewdecisionmemo.asp?from2=viewdecisionmemo.asp&id=34&

25. Chiarioni G, Nardo A, Vantini I, Romito A, Whitehead WE. Biofeedback is superior to electrogalvanic stimulation and massage for treatment of levator ani syndrome. Gastroenterology. 2010 Apr;138(4):1321-9.

26. Chiarioni G, Whitehead WE, Pezza V, Morelli A, Bassotti G. Biofeedback is superior to laxatives for normal transit constipation due to pelvic floor dyssynergia. Gastroenterology. 2006 Mar;130(3):657-64.

27. Coben R, Linden M, Myers TE. Neurofeedback for autistic spectrum disorder: a review of the literature. Appl Psychophysiol Biofeedback. 2010 Mar;35(1):83-105.

28. Cooke H, CAM-Cancer Consortium. Biofeedback. Aug 25, 2011. Accessed Jul 30, 2012. Available at URL address: http://www.cam-cancer.org/CAM-Summaries/Mind-body-interventions/Biofeedback

29. Crider A, Glaros AG, Gevirtz RN. Efficacy of biofeedback-based treatments for temporomandibular disorders. Appl Psychophysiol Biofeedback. 2005 Dec;30(4):333-45.

30. Croffie JM, Ammar MS, Pfefferkorn MD, Horn D, Klipsch A, Fitzgerald JF, Gupta SK, Molleston JP, Corkins MR. Assessment of the effectiveness of biofeedback in children with dyssynergic defecation and recalcitrant constipation/encopresis: does home biofeedback improve long-term outcomes. Clin Pediatr (Phila). 2005 Jan-Feb;44(1):63-71.

31. Dannecker C, Wolf V, Raab R, Hepp H, Anthuber C. EMG-biofeedback assisted pelvic floor muscle training is an effective therapy of stress urinary or mixed incontinence: a 7-year experience with 390 patients. Arch Gynecol Obstet. 2005 Dec;273(2):93-7.

32. Desantis DJ, Leonard MP, Preston MA, Barrowman NJ, Guerra LA. Effectiveness of biofeedback for dysfunctional elimination syndrome in pediatrics: a systematic review. J Pediatr Urol. 2011 Jun;7(3):342-8.

33. Department of Veterans Affairs. VA/DOD clinical practice guideline for the management of stroke rehabilitation. 2010. Accessed Jul 25, 2012. Available at URL address: http://www.healthquality.va.gov/index.asp

34. Dohrmann K, Weisz N, Schlee W, Hartmann T, Elbert T. Neurofeedback for treating tinnitus. Prog Brain Res. 2007;166:473-85.

35. Drechsler R, Straub M, Doehnert M, Heinrich H, Steinhausen HC, Brandeis D. 1Controlled evaluation of a neurofeedback training of slow cortical potentials in children with Attention Deficit/Hyperactivity Disorder (ADHD). Behav Brain Funct. 2007 Jul 26;3:35.

36. EEG Education and Research Inc. Neurofeedback. 2012. Accessed Jul 25, 2012. Available at URL address: http://www.eegspectrum.com/Applications/InfoNetwork/

37. Ehrenborg C, Archenholtz B. Is surface EMG biofeedback an effective training method for persons with neck and shoulder complaints after whiplash-associated disorders concerning activities of daily living and pain -- a randomized controlled trial. Clin Rehabil. 2010 Aug;24(8):715-26.

38. ECRI Institute. Neurofeedback for treatment of attention deficit hyperactivity disorder. Plymouth Meeting (PA): ECRI Institute Health Technology Assessment Information Service; 2007 Feb. 87 p. (Evidence Report; no. 144). Accessed Jul 25, 2012. Available at URL address: http://www.ecri.org.

39. Enck P, van der Voort IR, Klosterhalfen S. Biofeedback therapy in fecal incontinence and constipation. Neurogastroenterol Motil. 2009 Jun 30.

40. Erickson BA, Schaeffer AJ, Van Le B. Chronic prostatitis. Clin Evid (Online). 2008 May 22;2008. pii: 1802.

41. Farmer K, Freitag F. Special treatment situations: behavioral interventions for management of primary head pain. National Headache Foundation 2004. Accessed Jul 25, 2012. Available at URL address: http://www.guidelinecentral.com/CustomContentRetrieve.aspx?ID=1825219&A=SearchResult&SearchID=1027684&ObjectID=1825219&ObjectType=35

42. Fitz FF, Resende AP, Stüpp L, Sartori MG, Girão MJ, Castro RA. Biofeedback for the treatment of female pelvic floor muscle dysfunction: a systematic review and meta-analysis. Int Urogynecol J. 2012 Mar 17.

43. Fuchs T, Birbaumer N, Lutzenberger W, Gruzelier JH, Kaiser J. Neurofeedback treatment for attention-deficit/hyperactivity disorder in children: a comparison with methylphenidate. Appl Psychophysiol Biofeedback. 2003 Mar;28(1):1-12.

44. Gevensleben H, Holl B, Albrecht B, Vogel C, Schlamp D, Kratz O, Studer P, Rothenberger A, Moll GH, Heinrich H. Is neurofeedback an efficacious treatment for ADHD? A randomised controlled clinical trial. J Child Psychol Psychiatry. 2009 Jul;50(7):780-9.

45. Gevensleben H, Holl B, Albrecht B, Schlamp D, Kratz O, Studer P, Rothenberger A, Moll GH, Heinrich H. Neurofeedback training in children with ADHD: 6-month follow-up of a randomised controlled trial. Eur Child Adolesc Psychiatry. 2010 Sep;19(9):715-24.

46. Gladstein J. Headache. Med Clin North Am. 2006 Mar;90(2):275-90.

47. Glasscoe CA, Quittner AL. Psychological interventions for people with cystic fibrosis and their families. Cochrane Database Syst Rev. 2008 Jul 16;(3):CD003148.

48. Greenhalgh J, Dickson R, Dundar Y. The effects of biofeedback for the treatment of essential hypertension: a systematic review. Health Technol Assess. 2009 Oct;13(46):1-104. Accessed Jul 25, 2012. Available at URL address: http://www.hta.ac.uk/execsumm/summ1346.htm

49. Haefner HK, Collins ME, Davis GD, Edwards L, Foster DC, Hartmann ED, Kaufman RH, Lynch PJ, Margesson LJ, Moyal-Barracco M, Piper CK, Reed BD, Stewart EG, Wilkinson EJ. The vulvodynia guideline. J Low Genit Tract Dis. 2005 Jan;9(1):40-51.

50. Heinrich H, Gevensleben H, Strehl U. Annotation: neurofeedback - train your brain to train behaviour. J Child Psychol Psychiatry. 2007 Jan;48(1):3-16.

51. HAYES Medical Technology Directory™. Electroencephalogram (EEG) biofeedback therapy. Lansdale, PA: HAYES Inc; 2003 ©Winifred S. Hayes, Inc. Apr 11, 2003

52. HAYES Update Search™. Electroencephalogram (EEG) Biofeedback Therapy. Lansdale, PA: HAYES Inc; 2007 ©Winifred S. Hayes, Inc. Mar 13, 2008.

53. Herderschee R, Hay-Smith EJC., Herbison GP, Roovers JP, Heineman MJ. Feedback or biofeedback to augment pelvic floor muscle training for urinary incontinence in women. Cochrane Database of Systematic Reviews 2011, Issue 7. Art. No.: CD009252. DOI: 10.1002/14651858.CD009252.

54. Henschke N, Ostelo RWJG, van Tulder MW, Vlaeyen JWS, Morley S, Assendelft WJJ, Main CJ. Behavioural treatment for chronic low-back pain. Cochrane Database of Systematic Reviews 2010, Issue 7. Art. No.: CD002014. DOI:10.1002/14651858.CD002014.pub3.

55. Herbison GP, Dean N. Weighted vaginal cones for urinary incontinence. Cochrane Database ofSystematic Reviews 2002, Issue 1. Art. No.: CD002114. DOI: 10.1002/14651858.CD002114. Assessed up-to-date 2007.

56. Heymen S, Scarlett Y, Jones K, Ringel Y, Drossman D, Whitehead WE. Randomized, controlled trial shows biofeedback to be superior to alternative treatments for patients with pelvic floor dyssynergia-type constipation. Dis Colon Rectum. 2007 Apr;50(4):428-41.

57. Heymen S, Jones KR, Scarlett Y, Whitehead WE. Biofeedback treatment of constipation: a critical review. Dis Colon Rectum. 2003 Sep;46(9):1208-17.

58. Hjelland IE, Svebak S, Berstad A, Flatabø G, Hausken T. Breathing exercises with vagal biofeedback may benefit patients with functional dyspepsia. Scand J Gastroenterol. 2007 Sep;42(9):1054-62.

59. Holroyd KA, Mauskop A. Complementary and alternative treatments. Neurology. 2003 Apr 8;60(7).

60. Holroyd-Leduc JM, Tannenbaum C, Thorpe KE, Straus SE. What type of urinary incontinence does this woman have? JAMA. 2008 Mar 26;299(12):1446-56.

61. Holtmann M, Stadler C. Electroencephalographic biofeedback for the treatment of attention-deficit hyperactivity disorder in childhood and adolescence. Expert Rev Neurother. 2006 Apr;6(4):533-40.

62. Huffman J, Sakonju A. Chapter 19 – Neurology. Differential diagnosis of recurrent or chronic headaches. In: Johns Hopkins: The Harriet Lane Handbook: A Manual for Pediatric House Officers, 17th ed. Philadelphia. Mosby's, 2005.

63. Hunter KF, Moore KN, Cody DJ, Glazener CM. Conservative management for postprostatectomy urinary incontinence. Cochrane Database Syst Rev. 2004;(2):CD001843.

64. Institute for Clinical Systems Improvement (ICSI). Health care guideline: assessment and management of chronic pain. Fifth edition: Nov 2011. Accessed Jul 25, 2012. Available at URL address: http://www.icsi.org/pain__chronic__assessment_and_management_of_14399/pain__chronic__assessment_and_management_of__guideline_.html

65. Institute for Clinical Systems Improvement (ICSI). Health care guideline: diagnosis and management of Attention Deficit Hyperactivity Disorder in Primary Care for School-Age Children and Adolescents. Eighth edition: Mar 2012. Accessed Jul 25, 2012. Available at URL address: http://www.icsi.org/adhd/adhd_2300.html

66. Institute for Clinical Systems Improvement (ICSI). Health care guideline: diagnosis and treatment of headache. Tenth edition: Jan 2011. Accessed Jul 25, 2012. Available at URL address: http://www.icsi.org/headache/headache__diagnosis_and_treatment_of_2609.html

67. Karmody CS. Alternative therapies in the management of headache and facial pain. Otolaryngol Clin N Am. 2003;36:1221–30.

68. Karjalainen K, Malmivaara A, van Tulder M, Roine R, Jauhiainen M, Hurri H, et al. Biopsychosocial rehabilitation for upper limb repetitive strain injuries in working age adults. The Cochrane Review. In: The Cochrane Library, Issue 3, 2000. Update Dec 2004.Chichester, UK:John Wiley & sons, Ltd.; 2004. Oxford: Update software.

69. Kaushik R, Kaushik RM, Mahajan SK, Rajesh V. Biofeedback assisted diaphragmatic breathing and systematic relaxation versus propranolol in long term prophylaxis of migraine. Complement Ther Med. 2005 Sep;13(3):165-74.

70. Kiresuk TJ, Trachtenberg A. Alternative and complementary health practices. Sadock BJ, Sadock VA, editors. In: Kaplan & Sadock's Comprehensive textbook of psychiatry. PA: Lippincott Williams & Wilkins. 2005.

71. Klijn AJ, Uiterwaal CS, Vijverberg MA, Winkler PL, Dik P, de Jong TP. Home uroflowmetry biofeedback in behavioral training for dysfunctional voiding in school-age children: a randomized controlled study. J Urol. 2006 Jun;175(6):2263-8; discussion 2268.

72. Koh CE, Young CJ, Young JM, Solomon MJ. Systematic review of randomized controlled trials of the effectiveness of biofeedback for pelvic floor dysfunction. Br J Surg. 2008 Sep;95(9):1079-87.

73. Lacima G, Pera M, Amador A, Escaramís G, Piqué JM. Long-term results of biofeedback treatment for faecal incontinence: a comparative study with untreated controls. Colorectal Dis. 2009 Apr 10.

74. Landy S, Smith T. Treatment of primary headache: acute migraine treatment. National Headache Foundation. 2004. Accessed Jul 25, 2012. Available at URL address: http://www.guidelinecentral.com/CustomContentRetrieve.aspx?ID=1825214&A=SearchResult&SearchID=1027681&ObjectID=1825214&ObjectType=35

75. Leins U, Goth G, Hinterberger T, Klinger C, Rumpf N, Strehl U. Neurofeedback for children with ADHD: a comparison of SCP and Theta/Beta protocols. Appl Psychophysiol Biofeedback. 2007 Jun;32(2):73-88.

76. Litvinas, l. Ch 31 - stroke (cerebrovascular disease). In: Rakel: Integrative Medicine, 2nd ed. Philadelphia: Saunders Elsevier, 2007.

77. Ilnyckyj A, Fachnie E, Tougas G. A randomized-controlled trial comparing an educational intervention alone vs education and biofeedback in the management of faecal incontinence in women. Neurogastroenterol Motil. 2005 Feb;17(1):58-63.

78. Malenfant D, Catton M, Pope JE. The efficacy of complementary and alternative medicine in the treatment of Raynaud's phenomenon: a literature review and meta-analysis. Rheumatology (Oxford). 2009 Jul;48(7):791-5.

79. Mauskop A, Graff-Radford S. Special treatment situations: alternative headache treatments. National Headache Foundation. 2004. Accessed Jul 25, 2012. Available at URL address: http://www.guidelinecentral.com/CustomContentRetrieve.aspx?ID=1825222&A=SearchResult&SearchID=1027683&ObjectID=1825222&ObjectType=35

80. .McConaghy JR. Headache in primary care. Prim Care. 2007 Mar;34(1):83-97.

81. McDonough-Means SI, Cohen MW. Chapter 11. Attention deficit disorder. In: Rakel: Integrative Medicine, 2nd ed. Philadelphia: Saunders Elsevier, 2007.

82. McGinnis RA, McGrady A, Cox SA, Grower-Dowling KA. Biofeedback-assisted relaxation in type 2 diabetes. Diabetes Care. 2005 Sep;28(9):2145-9.

83. McGrady A. The effects of biofeedback in diabetes and essential hypertension. Cleve Clin J Med. 2010 Jul;77 Suppl 3:S68-71.

84. McKee MG, Moravec CS. Biofeedback in the treatment of heart failure. Cleve Clin J Med. 2010 Jul;77 Suppl 3:S56-9.

85. Medlicott MS, Harris SR. A systematic review of the effectiveness of exercise, manual therapy, electrotherapy, relaxation training, and biofeedback in the management of temporomandibular disorder. Phys Ther. 2006 Jul;86(7):955-73.

86. Merck Manual. Urinary incontinence. 2011. Accessed Aug 8, 2012. Available at URL address: http://www.merckmanuals.com/professional/genitourinary_disorders/voiding_disorders/urinary_incontinence.html

87. Middaugh SJ, Haythornthwaite JA, Thompson B, Hill R, Brown KM, Freedman RR, Attanasio V, Jacob RG, Scheier M, Smith EA. The Raynaud's Treatment Study: biofeedback protocols and acquisition of temperature biofeedback skills. Appl Psychophysiol Biofeedback. 2001 Dec;26(4):251-78.

88. Minardi D, d'Anzeo G, Parri G, Polito M Jr, Piergallina M, El Asmar Z, Marchetti M, Muzzonigro G. The role of uroflowmetry biofeedback and biofeedback training of the pelvic floor muscles in the treatment of recurrent urinary tract infections in women with dysfunctional voiding: a randomized controlled prospective study. Urology. 2010 Jun;75(6):1299-304.

89. Nagai Y, Goldstein LH, Fenwick PB, Trimble MR. Clinical efficacy of galvanic skin response biofeedback training in reducing seizures in adult epilepsy: a preliminary randomized controlled study. Epilepsy Behav. 2004 Apr;5(2):216-23.

90. Nakao M, Yano E, Nomura S, Kuboki T. Blood pressure-lowering effects of biofeedback treatment in hypertension: a meta-analysis of randomized controlled trials. Hypertens Res. 2003 Jan;26(1):37-46.

91. National Cancer Institute. Pain control: support for people with cancer. Jul 16, 2012. Accessed Jul 25, 2012. Available at URL address: http://www.cancer.gov/cancertopics/paincontrol/allpages

92. National Center for Complementary and Alternative Medicine (NCCAM). Mind-Body medicine: an overview. Feb 7, 2012. Accessed Jul 25, 2012. Available at URL address: http://nccam.nih.gov/health/providers/camterms.htm

93. ©National Comprehensive Cancer Network®, Inc. 2012 (NCCN®). Clinical Practice Guidelines in Oncology™. Cancer-related fatigue. V.1.2012. Nov 23, 2011. Accessed Jul 30, 2012. Available at URL address: http://www.nccn.org/professionals/physician_gls/f_guidelines.asp

94. National Institute for Health and Clinical Excellence (NICE). Clinical guidance on cancer services. Improving outcomes in beast cancer. Manual Update. Aug 28, 2002. Accessed Jul 25, 2012. Available at URL address: http://guidance.nice.org.uk/csgbc/guidance/pdf/English

95. National Institute for Health and Clinical Excellence (NICE). CG99. Constipation in children and young people: full guidance. May 26, 2010. Accessed Jul 25, 2012. Available at URL address: http://guidance.nice.org.uk/CG99/Guidance/pdf/English

96. National Institute for Health and Clinical Excellence (NICE). Clinical guideline 137. The epilepsies: the diagnosis and management of the epilepsies in adults and children in primary and secondary care. Jan 2012. Accessed Jul 25, 2012. Available at URL address: http://guidance.nice.org.uk/CG137

97. National Institute for Health and Clinical Excellence (NICE). Clinical guideline 49. Faecal incontinence. Jun 2007. Accessed Jul 25, 2012. Available at URL address: http://guidance.nice.org.uk/CG49/guidance/pdf/English

98. National Institute for Health and Clinical Excellence (NICE). Clinical guideline 40. Management of urinary incontinence in women. Oct 2006. Accessed Jul 25, 2012. Available at URL address: http://guidance.nice.org.uk/CG40/niceguidance/pdf/English

99. National Institute for Health and Clinical Excellence (NICE). Clinical guideline 127. Hypertension: clinical management of primary hypertension in adults. August 2011. Accessed Jul 25, 2012. Available at URL address: http://www.nice.org.uk/guidance/CG127

100. National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS). Health topics. Questions and answers about Raynaud's phenomenon. Apr 2009. Accessed Jul 25, 2012. Available at URL address: http://www.niams.nih.gov/hi/topics/raynaud/ar125fs.htm#5

101. National Institute of Dental and Craniofacial Research (NIDCR). TMJ disorders. Mar 2010. Accessed Jul 25, 2012. Available at URL address: http://www.nidcr.nih.gov/OralHealth/Topics/TMJ/TMJDisorders.htm

102. National Stroke Foundation. Rehabilitation. In: Clinical guidelines for stroke management 2010. Accessed Jul 25, 2012. Available at ULR address: http://www.strokefoundation.com.au/clinical-guidelines

103. Neblett R, Mayer TG, Brede E, Gatchel RJ. Correcting abnormal flexion-relaxation in chronic lumbar pain: responsiveness to a new biofeedback training protocol. Clin J Pain. 2010 Jun;26(5):403-9.

104. Nelson LA. The role of biofeedback in stroke rehabilitation: past and future directions. Top Stroke Rehabil. 2007 Jul-Aug;14(4):59-66.

105. Nestoriuc Y, Martin A. Efficacy of biofeedback for migraine: a meta-analysis. Pain. 2007 Mar;128(1-2):111-27.

106. Nestoriuc Y, Rief W, Martin A. Meta-analysis of biofeedback for tension-type headache: Efficacy, specificity, and treatment moderators. J Consult Clin Psychol. 2008 Jun;76(3):379-96.

107. [No author]. Comparison of sustained-release nifedipine and temperature biofeedback for treatment of primary Raynaud phenomenon. Results from a randomized clinical trial with 1-year follow-up. Arch Intern Med. 2000 Apr 24;160(8):1101-8.

108. Norton C, Cody JD. Biofeedback and/or sphincter exercises for the treatment of faecal incontinence in adults. Cochrane Database of Systematic Reviews 2012, Issue 7. Art. No.: CD002111. DOI: 10.1002/14651858.CD002111.pub3

109. Norton C, Cody JD, Hosker G. Biofeedback and/or sphincter exercises for the treatment of faecal incontinence in adults. Cochrane Database Syst Rev. 2006 Jul 19;3:CD002111.

110. Norton C, Hosker G, Brazzelli M. Biofeedback and/or sphincter exercises for the treatment of faecal incontinence in adults. The Cochrane Review. In: The Cochrane Library, Issue 2, 2000. Update Jan 31, 2002. Chichester, UK:John Wiley & sons, Ltd.; 2002.

111. Norton C, Chelvanayagam S, Wilson-Barnett J, Redfern S, Kamm MA. Randomized controlled trial of biofeedback for fecal incontinence. Gastroenterol. 2003 Nov;125(5):1320-9.

112. Ostelo RW, van Tulder MW , Vlaeyen JW, Linton SJ, Morley SJ, Assendelft WJ. Behavioural treatment for chronic low-back pain. The Cochrane Review. In: The Cochrane Library, Issue 2, 2000. Update Oct 1, 2003. Chichester, UK:John Wiley & sons, Ltd.; 2005.

113. Payne, CK. Chapter 63 - Conservative management of urinary incontinence: behavioral and pelvic floor therapy, urethral and pelvic devices. Pelvic floor rehabilitation. In; Wein AJ, Kavoussi LR, Novick AC, Partin AW, Peters CA, editors. Wein: Campbell-Walsh Urology, 9th ed. Orlando, Fl. WB Sanders Company. 2007.

114. Pearlman E. Special treatment situations: pediatric migraine. National Headache Foundation. 2004. Accessed Jul 25, 2012. Available at URL address: http://www.guidelinecentral.com/CustomContentRetrieve.aspx?ID=1825221&A=SearchResult&SearchID=1027705&ObjectID=1825221&ObjectType=35

115. Pollock A, Baer G, Pomeroy V, Langhorne P. Physiotherapy treatment approaches for the recovery of postural control and lower limb function following stroke. Cochrane Database Syst Rev. 2007 Jan 24;(1):CD001920.

116. Pollock A, Baer G, Pomeroy V, Langhorne P. Physiotherapy treatment approaches for the recovery of postural control and lower limb function following stroke. Cochrane Database Syst Rev. 2003;(2):CD001920.

117. Porena M, Costantini E, Rociola W, Mearini E. Biofeedback successfully cures detrusor-sphincter dyssynergia in pediatric patients. J Urol. 2000 Jun;163(6):1927-31.

118. Ramaratnam S, Baker GA, Goldstein LH. Psychological treatments for epilepsy. Cochrane Database Syst Rev. 2008, Issue 3. Art. No.: CD002029. DOI: 10.1002/14651858.CD002029.pub3. Assessed as up-to-date Feb 15, 2011.

119. Rao SS, Seaton K, Miller M, Brown K, Nygaard I, Stumbo P, Zimmerman B, Schulze K. Randomized controlled trial of biofeedback, sham feedback, and standard therapy for dyssynergic defecation. Clin Gastroenterol Hepatol. 2007 Mar;5(3):331-8.

120. Reiner R. Integrating a portable biofeedback device into clinical practice for patients with anxiety disorders: results of a pilot study. Appl Psychophysiol Biofeedback. 2008 Mar;33(1):55-61. Epub 2008 Feb 20.

121. Shamliyan TA, Kane RL, Wyman J, Wilt TJ. Systematic review: randomized, controlled trials of nonsurgical treatments for urinary incontinence in women. Ann Intern Med. 2008 Mar 18;148(6):459-73. Epub 2008 Feb 11.

122. Sokhadze TM, Cannon RL, Trudeau DL. EEG biofeedback as a treatment for substance use disorders: review, rating of efficacy, and recommendations for further research. Appl Psychophysiol Biofeedback. 2008 Mar;33(1):1-28.

123. Stanton R, Ada L, Dean CM, Preston E. Biofeedback improves activities of the lower limb after stroke: a systematic review. J Physiother. 2011;57(3):145-55.

124. Sterman MB. Biofeedback in the treatment of epilepsy. Cleve Clin J Med. 2010 Jul;77 Suppl 3:S60-7.

125. Tate JJ, Milner CE. Real-time kinematic, temporospatial, and kinetic biofeedback during gait retraining in patients: a systematic review. Phys Ther. 2010 Aug;90(8):1123-34.

126. U.S. Food and Drug Administration (FDA). Title 21—food and drugs. Biofeedback device. Apr 1, 2007. Accessed Jul 25, 2012. Available at URL address: http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfCFR/CFRSearch.cfm?FR=882.5050

127. Vasudeva S, Claggett AL, Tietjen GE, McGrady AV. Biofeedback-assisted relaxation in migraine headache: relationship to cerebral blood flow velocity in the middle cerebral artery. Headache. 2003;43:245-50.

128. Wahbeh H, Elsas SM, Oken BS. Mind-body interventions: applications in neurology. Neurology. 2008 Jun 10;70(24):2321-8.

129. Wasielewski NJ, Parker TM, Kotsko KM. Evaluation of electromyographic biofeedback for the quadriceps femoris: a systematic review. J Athl Train. 2011;46(5):543-54.

130. Weise C, Heinecke K, Rief W. Biofeedback-based behavioral treatment for chronic tinnitus: results of a randomized controlled trial. J Consult Clin Psychol. 2008 Dec;76(6):1046-57.

131. Weber W, Newmark S. Complementary and alternative medical therapies for attention-deficit/hyperactivity disorder and autism. Pediatr Clin North Am. 2007 Dec;54(6):983-1006; xii.

132. Woodford H, Price C. EMG biofeedback for the recovery of motor function after stroke. Cochrane Database Syst Rev. 2007 Apr 18;(2):CD004585.

133. Work Loss Data Institute. Low back - lumbar & thoracic (acute & chronic). Corpus Christi (TX): Work Loss Data Institute; 2011. Accessed Jul 25, 2012. Available at URL address: http://www.guideline.gov/summary/summary.aspx?doc_id=12674&nbr=6562

134. Yagci S, Kibar Y, Akay O, Kilic S, Erdemir F, Gok F, Dayanc M. The effect of biofeedback treatment on voiding and urodynamic parameters in children with voiding dysfunction. J Urol. 2005 Nov;174(5):1994-7; discussion 1997-8.

135. Yilmaz OO, Senocak O, Sahin E, Baydar M, Gulbahar S, Bircan C, Alper S. Efficacy of EMG-biofeedback in knee osteoarthritis. Rheumatol Int. 2010 May;30(7):887-92.

136. Yucha CB, Clark L, Smith M, Uris P, LaFleur B, Duval S. The effect of biofeedback in hypertension. Applied Nursing Research. 2001;14(1):29-35.

137. Zijlstra A, Mancini M, Chiari L, Zijlstra W. Biofeedback for training balance and mobility tasks in older populations: a systematic review. J Neuroeng Rehabil. 2010 Dec 9;7:58.