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Biofeedback for Occupational Therapy



Introduction	4
Section 1: History and Background 1,3,4,5	4
Section 1: Personal Reflection	5
Section 1: Key Words	5
Section 2: Purpose 2,8	5
Section 2: Personal Reflection	6
Section 2: Key Words	7
Section 3: Biofeedback Methods & Technology 2,6,7,8.....	7
Galvanic Skin Response (GSR) meter	7
Electromyograph (EMG)	7
Respiratory Inductive Plethysmography (RIP)	8
Electrocardiogram (ECG or EKG)	8
Thermal feedback machine	8
Electroencephalogram (EEG).....	8
Motion Detection Tests	9
Section 3: Personal Reflection	10
Section 3: Key Words	11
Section 4: Equipment 2,6,7,8,9,10,11,12.....	11
High-tech	11
Mid-tech	12
Low-tech	12
Meditation.....	14
Breathwork.....	14

Guided Imagery	15
Body Scanning	16
Progressive Muscle Relaxation (PMR)	16
Section 4: Personal Reflection	17
Section 4: Key Words	18
Section 5: Applications.....	18
Anxiety 13,14,15,16,17	19
Stress 18,19,20,21,22,23,24	19
Chronic pain 25,26,27,28,29.....	21
Fibromyalgia 30,31,32	21
Urinary & Fecal Incontinence & Constipation 33,34,35	22
Migraines and Tension Headaches 36,37,38,39	22
Depression 40,41,42,43.....	23
Addiction 45,46,47,48	24
High and Low Blood Pressure 49,50	24
Attention-Deficit Hyperactivity Disorder 51,52	24
Chronic Obstructive Pulmonary Disease & Asthma 53.....	25
Post-Traumatic Stress Disorder 54,55.....	25
Autism Spectrum Disorder 56,57	25
Spinal Cord Injury 58,59	26
Anecdotal Evidence 44	26
Section 5: Personal Reflection	27
Section 5: Key Words.....	27

Section 6: Certification 60.....28
 Section 6: Personal Reflection29
Section 7: Standards and Reimbursement 60.....29
 Section 7: Personal Reflection31
 Section 7: Key Words31
Section 8: Pros and Cons.....31
Section 9: Case Study.....32
Section 10: Case Study Review32
Section 11: Case Study.....33
Section 12: Case Study Review34
References34



Introduction

Biofeedback is a mind-body technique that increases a person's awareness of their body by using visual and auditory cues (also known as feedback). This feedback is used to make someone more attune to physical manifestations of stress, such as a faster breathing rate, spikes in body temperature, increased heart rate, and more muscle tension.

Occupational therapists receive education and training in a variety of techniques to manage physical symptoms such as these. They can teach these techniques to patients or use them during sessions to improve someone's ability to manage their health. Biofeedback is one such treatment modality that therapists can use for a range of physical and mental health concerns.

After completing a thorough, client-centered evaluation with patients to identify particular areas of need, therapists can then use this intervention tool to address those areas. As with most other modalities, biofeedback is best used as one part of an occupational therapy plan of care alongside patient education, skills training, and other stress management tools.

Section 1: History and Background ^{1,3,4,5}

While biofeedback itself didn't evolve until the 1970s, its roots go back several decades farther. In the 1920s, Edmund Jacobson did research at Harvard University on a behavior technique called progressive muscle relaxation. This study assessed its utility for stress management in individuals with anxiety diagnoses and symptoms as well as physical health conditions. He eventually elaborated on this by using a device to measure patients' muscle tension throughout the study.

Other notable researchers who used this type of behavior modification treatment include B.F. Skinner (who studied operant conditioning), Joseph Wolpe (who studied systematic desensitization), and Albert Bandura, who studied social learning and socioemotional development. For the first 50 years after its discovery, biofeedback was studied numerous times for a range of health conditions. However, these studies were found to have limited reliability and validity and were discredited by many.

The 1970s brought more attention and consistency to the field, which is when providers developed standardized protocols for the use of biofeedback for migraines, Raynaud's disease, incontinence, hypertension, lower back pain, tension headaches,

temporomandibular joint dysfunction (TMJ), and other health concerns. Healthcare providers began using this technique on patients with the help of several pieces of technology that would soon become commonplace in the realm of biofeedback. This is also when the name changed from an unofficial “behavior modification technique” to biofeedback.

Section 1: Personal Reflection

How does social learning relate to what you already know about biofeedback?

Section 1: Key Words

Operant conditioning: Also known as instrumental conditioning, this system uses rewards and punishments to change behavior positively; consisting of positive reinforcement, positive punishment, negative reinforcement, and negative punishment

Social learning: A theory created by Albert Bandura that posits learning occurs in social environments through close teaching and spectating

Systematic desensitization: A behavior modification technique that involves slow and graded exposure to a feared stimulus that is part of a phobia; individuals are taught relaxation techniques throughout this process to lessen their negative reaction to said stimulus

Behavior modification: The process of changing behaviors using any range of methods

Progressive muscle relaxation: A relaxation technique that involves the isolated tensing and relaxing of muscle groups in the body to release general muscle tension and improve relaxation

Section 2: Purpose ^{2,8}

Biofeedback is broken into two main categories: biomechanical and physiological. When used to monitor biomechanics, machines track bodily movement with simple sensors. The more common use is to track physiological functions such as muscle activity, heart rate, breathing rate, and more.

This type of tracking is traditionally done by placing electrical sensors on various parts of the body. This will vary based on the symptom or condition the biofeedback is intended to assist with. Wherever the sensors are, they track the body’s stress response. This can range from sweat to heart rate to brain waves. This data is immediately available to the

patient on a screen in front of them. From there, they are able to see graphs, charts, small flashing lights, and other visual markers that show the frequency of each stress response in real-time. The biofeedback machine also gives auditory data in the form of beeps or rings that indicate the same levels and haptic feedback in the form of vibrations.

It may seem that giving patients this information is overwhelming, useless, or proves counterproductive by causing them more stress. But the idea behind it is to improve someone's awareness of how their body reacts to the world around them. Many people who are under chronic stress are not cognizant of the impact it has on their body. As a result, they may have trouble connecting physical indications of tension or evolving health concerns with their stress levels. This prevents them from making the changes they need to relieve their discomfort. This is why biofeedback was originally called behavior modification.

Presently, biofeedback is popularly used in hospitals, medical offices, and outpatient therapy clinics. Similar to acupuncture and other complementary health approaches, biofeedback takes around 10 regular visits for patients to see a difference. For certain chronic conditions, patients may not see their symptoms remediate until up to 20 sessions later.

The effectiveness of biofeedback is dependent on someone's compliance with their treatment plan. So if they do not attend the full amount of visits recommended by their provider or they do not follow up with stress management and mindfulness strategies at home, they may not get the desired results.

The main focus of biofeedback is not on the information that is being relayed to the patient, but rather on their increased ability to be mindful of bodily cues. The goal of biofeedback treatment is not to have patients continually seeking help from a provider to get this information from the machine. Instead, the intention is to have patients learn to track these symptoms and stress responses on their own, make the behavior changes needed immediately, and observe the impact it has on their physical and mental health.

Section 2: Personal Reflection

What modifications do you think can be made to improve the biofeedback process for someone with visual or auditory impairments?

Section 2: Key Words

Biomechanical functions: The body's capacity for movement

Physiological functions: Basic bodily functions that aim to metabolize, respond, organize, move, and reproduce; for the purposes of biofeedback, these functions refer to bodily processes such as breathing, heart rate, and sweat

Electrical sensors: Devices with circuits that are connected to the body by adhesive pads on the skin; electrical sensors are intended to detect specific physical functions of the body and convert this information to electrical signals that can be tracked more easily

Section 3: Biofeedback Methods & Technology ^{2,6,7,8}

As we mentioned, there are a range of methods (and a lot of equipment to go along with them) that are used to track certain bodily processes. Depending on the person's reason for getting biofeedback, certain processes will be tracked while others will not.

Galvanic Skin Response (GSR) meter

One of the most common tools is the Galvanic Skin Response (GSR) meter, which measures electrical changes in the skin. This is also known as an electrodermal response. This device works due to the idea that skin is a better conductor of electricity when someone's level of arousal increases. This arousal, which typically manifests as sweating, can come from an internal or external stimulus. This stimulus can be positive such as happiness, excitement, etc. or negative in the form of fear, anxiety, etc. The GSR meter uses small sensors on the fingers and palms to measure these electrical changes and variation in conductivity within the skin.

Electromyograph (EMG)

Another common device is an electromyograph (EMG) that tracks the electrical charge of muscle fibers both big and small. This is done by placing several small needles called electrodes on the skin and into the muscle fibers. Individuals are asked to slightly, then forcefully contract the muscle that is being measured. Muscles will not give off any electrical signals when at rest, so there should be minimal information to start. The signals should then increase when an individual tenses and remain this way until the muscle is relaxed again. Since muscular changes are involved with a range of nervous system activity, this tool can be used to measure muscle tension almost anywhere in the body.

Respiratory Inductive Plethysmography (RIP)

Respiratory data can be tracked using two bands placed around the abdomen and the ribcage. This not only allows the machine to monitor how many breaths someone takes per minute, but it also measures how wide their chest expands with each breath. This is called the depth of breath. Individuals tend to take quick, shallow breaths when they are anxious or stressed. So this information is intended to encourage deeper, more even breathing.

Electrocardiogram (ECG or EKG)

This test is well-known because it is commonly used to look for abnormalities in the heart and assist with diagnosing heart conditions. ECGs are often performed in hospitals, doctor's offices, and clinics, but they are also a big part of the biofeedback process. Sensors stick to the surface of the skin just over the heart and other central locations on the chest. These specifically test something called heart rate variability (HRV), which is the variation in time between each heart beat. The more irregularities there are in the time between each beat, the less evenly the heart is pumping. A big difference in HRV means that the heart rate is not in line with the breathing rate. This places the body under more stress and increases someone's risk for developing heart conditions.

Thermal feedback machine

Thermal feedback machines are used to monitor skin temperature and blood flow through temperature sensors typically located on the finger, hands, or feet. The hands are usually a point of focus because this is where a lot of people carry tension or nerves and they are more easily accessible than the feet usually are. When the body is stressed, it triggers a rush of blood away from the top layer of the body (the skin) to organs and muscles that need it. This helps the body remain active and able to respond to any nearby threats. As a result, the skin temperature is high when we are either relaxed or asleep.

Electroencephalogram (EEG)

While this tool is not often used for biofeedback, it is very common within the field of neurology, which is the study of the brain and its processes. EEG devices may come with a headband that has electrical sensors on the inside or numerous sensors placed directly on the scalp. The first of those two options is more common with home-based biofeedback units, since they are simpler and easier for someone to implement on their own. Regardless of the type, these sensors monitor brain activity in the form of waves.

Tracking these waves provides information on a person's mental states. The use of EEGs for behavior modification is referred to as neurofeedback. Brain waves may indicate alertness, relaxation, light sleep, or deep sleep.

Of all the types of brain activity, gamma waves consist of the sharpest peaks. Gamma waves indicate the brain is in a state of concentration or critical thinking. Beta waves are slightly less sharp in their peaks but they are somewhat similar to gamma waves in that they also indicate an active mind that is engaged in a task. Alpha waves are looser waves that have more rounded peaks when they do spike occasionally. These indicate the brain is in a reflective state and restful state. This may be common in the evening after dinner but several hours before bed.

Theta waves are even looser with one or two gradual peaks noted. Theta waves do not indicate relaxation, rather drowsiness. So they are usually observed in someone who is tired or about to fall asleep. Delta waves are the most even of all the waves, as they are characterized by the fewest peaks of all. One discernable peak may be noted amidst other waves that look akin to rolling hills. Delta waves are present in someone who is asleep and dreaming.

Since the goal of this treatment method is to increase someone's ability to observe and modify bodily cues at home, it makes sense that EEGs are not a central part of biofeedback. While individuals can use home devices, EEG equipment is more complicated and pricier than other measurement tools that serve a similar or greater benefit.

Motion Detection Tests

We mentioned the lesser-known biomechanical methods that are used during biofeedback. These track larger movements in the body as well as spatial orientation and positioning. Tools used can vary based on the specific areas of the body that are to be measured. Inertial motion detectors sense motion and velocity, which can be helpful for tracking larger body parts. An accelerometer is an example of an inertial motion detector that tracks how a body part accelerates based on its level of vibration. Another inertial motion detector is a gyroscope, which measures large-scale rotational movement around a certain axis.

Another type of motion detection tool is a force plate sensor. Rather than focusing on bodily motion, force plate sensors measure the ground reaction forces as they pertain to the body's movement.

Imaging tools typically used for diagnostic purposes have also been used to provide visual cueing during the biofeedback process. While these are less common, they have been used with good effect when the situation warrants. One such technique is real-time ultrasound imaging (RUSI). This can assist in retraining muscular contraction. RUSI gives visual information immediately after the contraction happens to help individuals understand what happens when their muscles do certain things.

Endoscopy is a minimally-invasive procedure that involves the insertion of a small camera down the throat to provide a clearer, more defined view of the internal structures. This tool can help individuals get a closer look at the contraction and how this impacts their throat, esophagus, and windpipe. Endoscopy during biofeedback can be especially helpful for those at risk of aspiration or breathing concerns due to muscular tension in this area.

Each of these pieces of equipment is used to establish a baseline for the patient's vital signs. Once this happens, a provider often walks patients through a variety of activities and tests to attempt to adjust these vitals to a more acceptable range. These activities include repositioning, where the provider will ask the patient to adjust how they sit, move, or stand. This can assist in relieving muscle tension that the equipment may be picking up on. Providers may also walk you through breathing patterns to help regulate the rate and depth of breathing. Another activity may be releasing muscles through processes called body scanning and progressive muscle relaxation. This can not only relieve pain but change the patient's perception of their pain. Mindfulness and focus-enhancing techniques may also be part of sessions, which can help patients slow their heart rate, control their breathing, and remain in the present moment. Another activity may involve taking a test of sorts. Providers may offer patients a word problem, riddle, or math equation to solve in an attempt to see how stress impacts the body. This activity is then paired with one of the previously mentioned stress management techniques to assist in further regulating emotions. We will discuss these stress management techniques in greater detail later.

Section 3: Personal Reflection

Can you think of a physical manifestation of stress that may benefit from the use of biomechanical tracking?

Section 3: Key Words

Heart rate variability (HRV): The differences in time between each of heart beat; the more irregular this is, the less evenly the heart is pumping; a big difference in HRV means the heart rate is not in line with the breathing rate, which causes the body more stress

Galvanic Skin Response (GSR) meter: This device measures electrical changes in the skin, which is also known as an electrodermal response

Electromyograph (EMR): A device that uses small needles called electrodes placed into the muscle in question to measure its electrical activity while its tensed and at rest

Respiratory Inductive Plethysmography (RIP) test: A measurement procedure that uses two bands placed around the abdomen and rib cage to measure the depth of someone's breaths

Electrocardiogram (ECG or EKG): A test that uses electrical sensors to measure heart rate variability or the time between each heartbeat

Thermal feedback machine: A machine used to measure skin temperature and blood flow

Electroencephalogram (EEG): A device that uses electrical sensors to track brain activity in the form of waves and monitor mental states associated with them

Section 4: Equipment ^{2,6,7,8,9,10,11,12}

High-tech

We just discussed the high-tech version of biofeedback and tools that providers use to perform biofeedback in clinics and other medical offices.

Virtual reality is another high-tech tool that can be used to assist in the implementation of biofeedback. When used for the purposes of behavior modification, virtual reality therapy (VRT) involves the use of artificial environments created by specialized computers. These elements are supplemented by visual immersion devices to create a more realistic and interactive experience that involves several senses.

Through these routes, VRT can simulate scenarios where an individual's bodily cues are triggered and they must respond appropriately in order to minimize discomfort, relieve

tension, and ultimately lower their body's stress response. This is a great way to get more exposure and experience with increased alertness to make the biofeedback process more effective.

Mid-tech

There is also more user-friendly and easily accessible technology to assist with biofeedback. We mentioned the main goal of biofeedback is to make someone more mindful of bodily cues that can worsen their health concerns. The goal is for someone to carry these skills over to their home environment, where technology may or may not be part of the equation.

There are less sophisticated pieces of equipment that someone can use in their home. Mobile applications can sync with wearable devices such as heart monitors and headbands that monitor brain activity. These are some of the most common devices that carry over to the home environment. They can be used through USB attachments to either mobile devices, laptops, or desktop computers where information can be synced and stored.

However, home practice of biofeedback can be even simpler than this. Most smartphones have built in health apps that allow for tracking of heart rate and breathing rate in real-time. This makes it convenient, since users don't need to download anything nor do they need external equipment, since smartphones have sensors built-in to specific areas of the phones. Most phones have this feature most notably to monitor heart rate. For this measurement, sensors are in the phone's camera. So someone needs to place one finger over the camera, which is then used to track color changes that indicate variations in blood flow. From here, the application is able to monitor your pulse as long as your finger remains over the camera.

The Android versions of this are Samsung Health and Google Fit, where the Apple equivalent is Apple Health. Other applications that can be downloaded include MyFitnessPal, which offers capabilities for tracking other health habits such as water intake, diet, exercise levels, and sleep. Other apps that specialize solely in offering heart rate monitoring are Instant Heart Rate and Cardio, which are free to download and use.

Low-tech

Perhaps the most straightforward way of all to practice biofeedback is to train your mind to be attuned to physical stress signals in the body. Once you do this, you eliminate the

need for an expensive piece of equipment or even an app to remind you to check in with yourself.

We've all been in a situation where we're painfully aware of our body's stress response. We may call it having nerves, but it might surface when we feel butterflies in our stomach or a pit that won't go away. The next time you're aware of this sensation, check in with those basic vital functions. Take one minute to measure your breaths in that period of time. Place your hand either over your heart, at the base of your wrist below the pinky finger, or in the crook of your arm at the inner elbow to measure your heart rate.

When you take the time to do this in stressful situations (which is when it matters most), you will likely find that your breaths are uneven or quick and shallow. You may also find that your heart rate is fast and irregular at times. When this happens, guide yourself through some relaxation techniques.

This can include guided imagery, breathwork, meditation, body scanning, progressive muscle relaxation, or stretching. All of these can be done in the moment and discreetly. This helps you maintain a high level of awareness and active engagement in monitoring these signs as they go from uncomfortable and tense back to normal.

For example, someone who notices their breathing rate is higher than normal may also feel tightness in their chest and as if they can't get a full breath. They can then sit in a quiet place and visualize somewhere they love. This may be a childhood vacation spot, a favorite room in their home, a gazebo overlooking the beach, a hiking trail they like to frequent, or any other place that gives them a feeling of calmness. They can do this while closing their eyes and potentially even putting earplugs in or noise-cancelling headphones with relaxing instrumental music.

This enhances their feelings of solitude and allows them to shut out the stressful environment that may be causing them to experience tension and discomfort. This technique, called visualization, should be done for long enough to reap the full benefits. This means that someone wanting to use this relaxation strategy should take at least 5 minutes or up to 15 or 20 minutes before measuring their breathing rate again to take note of a change. How long someone does this is based on their personal preference, attention span (some people, especially beginners, can only tolerate a few minutes), and schedule.

Meditation

Another relaxation technique is meditation, which can involve some of the visualization we mentioned above. Meditation can also entail focusing on a positive thought or imagining a goal or dream of yours. Similarly to visualization, meditation can be done for several minutes or up to 20 based on your own needs. Some people like to explore the various types of meditation:

- **Focused meditation:** Narrowing your attention on only one thing for an extended period of time, such as a candle flickering or counting beads
- **Mindfulness meditation:** Acknowledging thoughts but letting them pass through without giving them your attention or judgment
- **Movement meditation:** Actively moving your body in ways that feel natural and authentic; this is often combined with a practice of tai chi or qi gong, where people focus on slow, rhythmic motions based on quality rather than quantity
- **Spiritual meditation:** Using quiet and calm to forge a deeper connection with a god, the universe, or anything else around you that brings feelings of solace and belonging
- **Loving-kindness meditation:** A practice involving sending feelings of gratitude, optimistic, and good fortune toward those around you
- **Mantra meditation:** The internal or out-loud repetition of a word or phrase that brings you happiness; this can be an affirmation, personally meaningful words, or a sound like “ohm”

Breathwork

Another relaxation method that patients can use to control their stress in response to physical symptoms of tension is breathwork. The name might suggest that this exclusively or primarily assists in regulating someone’s breathing rate and depth. However, breathwork can also help regulate and even the heart rate as well as assist in heightening your awareness and even improving body posture. Breathwork involves slowing your mind and body to focus solely on your breathing. As with meditation, there are several forms of breathwork that each elicit the same general effect but are completed differently.

- **Biodynamic breathwork:** This form of breathwork taps into past memories combined with deep breathing to release trauma that may be stored in the body; the six main components are movement, breath, emotion, touch, sound, and meditation; this may mean that activities such as dance therapy, whole-body shaking, and music therapy are regularly part of this practice
- **Holotropic breathwork:** Uses evocative music and some body work (gentle movement) to achieve an altered state of consciousness; each session ends with sharing and discussion to process emotions related to the experience
- **Rebirthing breathwork:** A type of breathwork that involves re-experiencing a person's birthing process to release trauma that may be associated with it
- **Clarity breathwork:** A practice that teaches people how to breathe fully to expand their lungs and release bodily tension

Other simpler forms of breathwork can be done at any time. One type is continuous circular breathing, which involves breathing in and out deeply again and again. Most deep breathing consists of holding an in breath followed by holding an out breath. This eliminates the holding period and encourages more constant and continual breathing as one breath flows into the next. Another type is called 20 connected breaths. This involves someone taking four sets of four short breaths through the nose followed by four deep breaths in and out. This is reportedly intended to sharply increase alertness and focus.

Guided Imagery

This relaxation method is similar to visualization in that it involves conjuring up peaceful images in order to provide a sense of calmness. Where these two methods differ is that visualization is very much self-directed, so someone can go to their place of choice and stay there as long as they wish. Guided imagery, on the other hand, can be self-directed but often is practiced by following an audio script from an online recording or a person who is leading a group guided imagery session.

Because it is led by someone else, in-person guided imagery sessions do not give individuals much personal liberty to choose the place and surroundings they are part of. However, someone who wants the structure of a script but would like to incorporate their preferences into the practice can find specific audio recordings online that cater to some of their needs. For example, there are a range of online scripts that guide

someone through a beach scenery, along a trail in the forest, and other common nature-based themes.

Body Scanning

The next two modalities can be used in conjunction to relieve muscular tension in the body, but they also can help in lowering stress levels and regulating breathing rate. The first is body scanning, which places a heavy emphasis on mindfulness. For this reason, it is closely aligned with the intention of biofeedback.

Body scanning can be done while sitting or laying down but it is often more effective when they are laying down because someone's sitting posture can exacerbate muscular tension and make them feel worse. By laying down on a carpet, yoga mat, blanket, or other soft surface, you are eliminating the weight that gravity puts on the body in other traditional positions. It is recommended to start by taking one or two deep breaths in and out. This releases some surface-level tension and helps you realize what areas of the body are truly in need of attention and relaxation.

From here, you can start at the head and move down to other body parts or start at the toes and move up to other body parts. Spend 20-30 seconds on each section noticing sensations there. You are looking for stiffness, clenching, pain, pressure, or anything else that stands out.

This is the recommended version for people to really attend to parts of the body that may be overlooked. But people can complete a modified version if they don't have time to lay down and complete a full practice or if they can't get to a quiet place. An abridged version can consist of simply sitting in a chair and noticing tension wherever it may be, as opposed to going through each body part.

Progressive Muscle Relaxation (PMR)

The second part of these related modalities is progressive muscle relaxation, also called PMR. This is helpful for individuals who use body scanning to note places of tension in their body but may be unaware of how to relieve it on their own.

PMR involves a similar posture to body scanning in that it can be done while sitting or laying down. But PMR is also more effective when laying down because someone's sitting posture can exacerbate muscular tension and make them feel worse. By laying down on a carpet, yoga mat, blanket, or other soft surface, you are eliminating the weight that gravity puts on the body in other traditional positions. It is recommended to

start by taking one or two deep breaths in and out. This releases some surface-level tension and helps you realize what areas of the body are truly in need of attention and relaxation.

From here, you can start at the head and move down to other body parts or start at the toes and move up to other body parts. Spend 10-15 seconds tightening the muscles in that body section and then relaxing them for 10 seconds. Then move on to the next part of the body. The sequence can take you through the following areas:

- Raising the eyebrows
- Wrinkling the nose
- Pursing the lips tightly
- Moving the head back to tense the neck
- Raising the shoulders up toward the ear
- Squeezing the chest
- Tensing the abs
- Clenching the buttocks
- Squeezing the thigh muscles
- Flexing the calves
- Curling the toes

This can be done from the head to the toes or the toes to the head, based on personal preference or where someone feels they need it the most.

Depending on the practitioner and the particular patient's needs, patients receiving biofeedback may also get education and instruction on any one or more of these modalities. Based on the effectiveness for that person and their desire to continue, these relaxation strategies can become a central part of their home program to be used regularly outside of sessions.

Section 4: Personal Reflection

Can you think of any clinical scenarios where someone might benefit from progressive muscle relaxation?

Section 4: Key Words

Visualization: A relaxation strategy that involves visualizing somewhere they love; this may be a childhood vacation spot, a favorite room in their home, a gazebo overlooking the beach, a hiking trail they like to frequent, or any other place that gives them a feeling of calmness; this enhances feelings of solitude and allows someone to shut out the stressful environment that may be causing them to experience tension and discomfort

Meditation: A stress management strategy that can involve visualization, focusing on a positive thought, or imagining a goal or dream

Breathwork: A relaxation technique that involves slowing your mind and body to focus solely on your breathing; there are several forms of breathwork that each elicit the same general effect but are completed differently

Guided imagery: Conjuring up peaceful images in order to provide a sense of calmness; unlike visualization, guided imagery is more structured and is practiced by following an audio script from an online recording or a person who is leading a group guided imagery session

Body scanning: A relaxation technique that allows for the recognition of bodily tension by scanning each individual part of the body to understand the sensations present in each; when started with several deep breaths, this releases some surface-level tension and helps someone realize what areas of the body are truly in need of attention and relaxation

Progressive muscle relaxation: A relaxation technique that people can use to relieve muscle tension; this involves moving from one body part to another and clenching those muscles for 15-20 seconds at a time; this helps individuals who use body scanning but have trouble relieving the tension they find

Section 5: Applications

There have been many studies done on the effectiveness of biofeedback and neurofeedback on a range of conditions. Some have larger evidence bases than others, while some need more research to develop a definitive link.

Anxiety 13,14,15,16,17

One such condition for which the use of biofeedback has been proposed is generalized anxiety disorder, or GAD. One study looked at a control group on which they used neurofeedback to analyze and modify brain waves and compared these results to a group that did not receive any treatment for their anxiety. Results showed that the group who received neurofeedback demonstrated a statistically significant reduction in anxiety symptoms along with a similar increase in their global level of functioning. The group that received no treatment did not demonstrate these same results.

Another study assessed the impact of biofeedback on stress levels in dental patients ages 7 to 12 when compared to the use of audio-visual distractions such as reading and cartoons. Results showed that the use of biofeedback showed clinically significant improvements on outcome measures compared to audio-visual distraction. Subjective reports from children showed equal preferences for the two methods.

A literature review showed that biofeedback was an effective and non-invasive way of managing anxiety symptoms and chronic panic attacks in pregnant women in the first trimester. Long-term monitoring showed this intervention had no prenatal or postnatal complications.

One group of researchers studied a different approach to neurofeedback by monitoring alpha waves over the parietal lobe. This intervention was found to lower the severity of anxiety traits demonstrated by individuals with generalized anxiety disorder. Individuals in this sample group initially exhibited depressive traits as well, and these were also found to be lower after the intervention was provided.

Another study looked at the impact of biofeedback on test anxiety in college students. 34 students across three groups received either biofeedback, self-led breathing exercises, or psychoeducation. Results showed that only students in the biofeedback group experienced a significant reduction in the recurrence of test anxiety. Participants in that same group also reported an overall increase in well-being and a decrease in general depression and anxiety.

Stress 18,19,20,21,22,23,24

A study examined the impact of heart rate, stress, and alertness biofeedback on the marksmanship accuracy of police officers in live-fire stress shoots. Results showed that biofeedback had no significant effect on these factors when compared to no intervention.

Basic research has been done on the potential use of stress-exposure biofeedback training using virtual reality for police. Technical and user-experience challenges were posed as a result of this study, which only outlined preliminary data for implementation rather than an experiment.

Another study looked at the impact of general self-regulation and biofeedback on primary care physicians and nurses. Intervention for one group consisted of a 12-week self-regulation program with optional biofeedback training. This was compared to a 6-week delayed program consisting of the same treatments. When results were compared, the two groups both demonstrated a slight increase in job satisfaction as well as a slight decrease in stress and burnout levels.

Research has also studied the impact of a stress management program on military personnel. Heart rate was the main vital measured throughout the program and the study focused on optimizing tactical potential by reducing stress levels. Participants were involved in a psychological and physiological stress management program. Results showed that both programs increased heart rate variability (which is shown to decrease disease risk and lower bodily tension) and reduced perceived stress levels.

The use of biofeedback was also assessed for its ability to reduce stress related to the COVID pandemic. One study used a stress management technique called noise sonification (a technique used to convey information through sound) and other simple auditory cues. Respiratory rate is the vital sign that was measured. Results showed that noise sonification was the most beneficial in lowering respiratory rate and stress levels of participants.

Another research study delved into the use of biofeedback to reduce stress levels in individuals living with anorexia nervosa. When combined with traditional psychotherapy, participants demonstrated some decrease in stress levels but persistent levels of reactivity, which is related to their pathology.

Additional research has been done on the impact of biofeedback on college students who reported being under chronic stress. One group of participants entered into a mindfulness-only program while another group entered into a biofeedback-based program incorporating mindfulness. Outcomes showed that both groups experienced lower levels of stress after the study concluded, indicating the biofeedback device had little to no effect on their results.

Chronic pain ^{25,26,27,28,29}

One large-scale study focused on the use of biofeedback with men and women ages 30 to 86 who experienced chronic pain and other medically-unexplained symptoms. Participants received six half-an-hour sessions with electrodermal biofeedback or a placebo. This was done twice per week for three weeks. Results showed that the treatment group experienced significantly less pain ratings and less inflammatory proteins than the group who received a placebo.

Another study analyzed the impact of a biofeedback splint on teeth grinding at night when compared to a group that used a standard splint. The group that used the biofeedback splint reported significantly fewer and less intense pain episodes than the group who used the traditional splint. After treatment was stopped, the frequency of pain spiked again but the intensity of pain remained at the lower levels that were noted during treatment.

One study focused on the impact of biofeedback on lower back pain. One group wore a biofeedback-enabled motion sensor while another group wore a simple motion sensor. Both groups also followed standard physical therapy guidelines to assist in managing back pain. Over the course of one year, the group that wore the biofeedback sensor experienced greater and sustained pain relief and activity participation as compared to the other group.

Another study compared a group of participants who took part in cognitive behavioral therapy (CBT) and biofeedback with a group who only participated in CBT. All participants had experienced some form of torture that left them with chronic pain. Results from both groups showed that these interventions had no significant impact on the disability levels after the study. The same results were also recorded at the three-month follow-up date.

A systematic review of literature focused on the use of biofeedback for individuals with chronic pain related to multiple sclerosis. The review found that there was very little support for this modality in such a population.

Fibromyalgia ^{30,31,32}

A study analyzed the impact of heart rate variability biofeedback on veterans living with fibromyalgia. Results showed that short sessions focused on regulating heart rate yielded some decrease in pain levels, a significant decrease in disability levels, and improvements in overall quality-of-life.

Another study compared the impact of EMG versus EEG biofeedback in those with fibromyalgia. Results showed that EMG had a greater impact by significantly reducing pain levels when compared to the levels resulting from the EEG group.

A different piece of research counters this evidence, though. Results from a study solely on EMG in fibromyalgia patients shows no improvement in functional status and minimal improvements in trapezius pain.

Urinary & Fecal Incontinence & Constipation ^{33,34,35}

Some research looked at the efficacy of home-based biofeedback for fecal incontinence when compared to clinic-based biofeedback for the same purpose. Results showed that both were effective in improving bowel control, bowel patterns, and quality-of-life. Respondents also reported ease-of-use related to home-based biofeedback.

Another study analyzed the impact of biofeedback on non-age-appropriate pediatric fecal incontinence. One group received electrical stimulation alone and the other group received biofeedback along with electrical stimulation. Results showed that a short stint of biofeedback and electrical stimulation resulted in a significant reduction in incontinence as well as an improvement in quality-of-life compared to the other group, which had less improvement. These gains were found to be sustained in both groups six months after the interventions were provided.

One study involved participants undergoing a two week stint of biofeedback-guided pelvic floor muscle training both with and without the assist of magnetic innervation. Participants were middle-aged women who all experienced symptoms of stress urinary incontinence. Results showed there was no clinically significant difference between the improvement in the two groups.

Migraines and Tension Headaches ^{36,37,38,39}

One study looked into heart rate variability biofeedback for migraines. Participants used a sensor-based mobile application for 8 weeks. Those who had higher levels of compliance with the program were found to have an increase in migraine-related quality-of-life after one month. Users with poorer compliance did not reap as many benefits from this program.

Another study observed the impact of a partial splint and biofeedback program on individuals who grind their teeth while awake. Results showed that individuals who experienced migraines, neck pain, TMJ pain, and other jaw pain experienced significantly

less pain one month later. Extended surveys also found that these results were sustained six months and one year after the initial treatment.

A different study looked at a mix of participants, including those with migraines and those with tension headaches. Those with migraines got vasoconstriction and vasodilation therapy, while those with tension headaches got EMG training alongside biofeedback. All participants received between 8 and 11 sessions of their chosen intervention. Results showed moderate to significant reduction in headache frequency, duration, and intensity. The biofeedback group experienced the same results but with an additional increase in self-efficacy and pain tolerance along with a lower disability level.

Another common method of biofeedback that does not have as much related evidence is the use of skin temperature. There also isn't much recent research on the effectiveness of biofeedback for tension headaches, but it still appears to be a promising area of use. One study compared the effectiveness of EEG-based biofeedback, manual therapy, and stretching to provide cervical sensory feedback in an attempt to reduce tension-type headaches. Participants in three separate groups took part in these interventions three times per week for four weeks. Results from the biofeedback group showed improved spinal alignment, attention, quality-of-life, and stress levels (as measured by skin conductance and skin temperature). These participants also reported decreased disability levels after intervention.

Depression ^{40,41,42,43}

Mood disorders are another area where there have been mixed reviews on the use of biofeedback. Researchers in Brazil compared one group that received one session of EEG-based biofeedback per week for six weeks with a group that received conventional treatment. Results showed that the group who received standard treatment was at least 16 times more likely to report depressive symptoms.

A separate study took a more interesting approach in viewing the influence of neurofeedback using functional magnetic resonance imaging (fMRI) on depression. Early research on the immediate benefits of this treatment method show improvement, but not enough research has been done on the long-term impact. A similar study mirrored these same results with a slightly different population.

A meta-analysis deviated from the seemingly standard neurofeedback-based protocol and looked at the use of heart rate variability to address depressive symptoms. Results showed significant improvement in symptoms across several populations and age ranges, indicating this is a viable treatment for this condition.

Addiction ^{45,46,47,48}

One study looks at the use of virtual reality-based biofeedback to minimize cravings of individuals with methamphetamine use disorder. The program monitored heart rate variability, Galvanic Skin Response, and eye tracking in a group of healthy subjects and a group of those with methamphetamine use disorder. Results showed that these vital signs were able to trigger a drug craving in 84% of the individuals with methamphetamine use disorder where there were no notable cravings noted in the control group.

Another paper outlines the ways that biofeedback and neurofeedback can be used to modify the brain response related to resistance to the urge to smoke. This does not cite research but states that there is early promise in the mechanisms involved.

A similar study looked at potential utility of functional magnetic resonance imaging for those with nicotine dependence. This program was determined to be useful in measuring the blood-oxygen levels in certain parts of the brain that are indicative of nicotine addiction.

EEG-based biofeedback was also found to be effective in monitoring a range of brain wave activity to prevent the relapse of individuals with alcohol use disorder.

High and Low Blood Pressure ^{49,50}

Several studies show utility in the use of biofeedback to lower diastolic blood pressure, namely in individuals who have systemic arterial hypertension (SAH). Another piece of research found similar results for another aspect of blood pressure. Hemodialysis patients who underwent regular biofeedback experienced a drop in systolic blood pressure. The patients with the most significant decrease in blood pressure had undergone greater amounts of biofeedback than the others.

Attention-Deficit Hyperactivity Disorder ^{51,52}

One major study showed that neurofeedback changed the brain connectivity of teenagers with ADHD. These results were further compounded by the fact that parents reported a significant decrease in ADHD symptoms in the four weeks following sessions. Another similar study yielded results that were even more long-lasting and showed a decrease in symptoms for 13 months after neurofeedback was provided.

Chronic Obstructive Pulmonary Disease & Asthma ⁵³

One experiment offered four different types of intervention to participants with COPD, asthma, and other breathing concerns. Treatments included conventional flutter (a device that removes secretions from the lungs), visual biofeedback, auditory biofeedback, and both visual and auditory biofeedback. Treatments were provided 20 minutes per day for five days. Results showed that the group who received visual biofeedback produced significantly more wet sputum compared to the other groups. The symptoms of dyspnea were notably higher in the conventional group compared to all the other groups. Oxygen saturation levels were also recorded after all interventions and were noted to be higher in the participants who received visual and auditory biofeedback.

Post-Traumatic Stress Disorder ^{54,55}

Research has also looked specifically at the impact of neurofeedback on individuals with post-traumatic stress disorder (PTSD). Results from one study using an fMRI shows that PTSD actually improved atrophy in the hippocampus, which is the main area of the brain impacted by this condition.

Another study looked at soldiers with PTSD and chronic pain to determine the impact of opioid treatment versus non-pharmacological interventions (including biofeedback, exercise, and acupuncture). Results showed that the group who received non-pharmacological interventions was less likely to request additional opioids than the group that received that medication only.

Autism Spectrum Disorder ^{56,57}

There is not as much evidence surrounding biofeedback and Autism as there is for other conditions. However, some research shows that individuals with ASD who received low frequency transcranial magnetic stimulation (TMS) experienced more normalized gamma waves, improved executive functioning, and less repetitive behaviors.

Another piece of research studied the impact of neurofeedback on concrete thinking in individuals with Autism. Results showed that individuals were better able to regulate their arousal levels, apply these techniques in real life, improve their function in work and social settings, and show more self-determination.

Spinal Cord Injury ^{58,59}

Electromyography was used on individuals who experienced spinal cord injuries less than 6 months ago. The results of this group of participants was compared to those who received traditional physical therapy with exercise and stretching. Data showed that the intervention group saw great improvements in quadriceps femoris strength when compared to the other group. Neither group saw an improvement in thigh circumference or ADL function.

Another study analyzed the impact of biofeedback on female spinal cord injury patients with neurogenic bladder dysfunction. Four groups of participants each received one of the following interventions: pelvic floor muscle training, pelvic floor muscle training with TMS, pelvic floor muscle training with biofeedback, or pelvic floor muscle training with biofeedback and TMS. Results were analyzed 1 month, 3 months, and 6 months after consistent treatment, and showed that participants who received biofeedback along with pelvic floor training demonstrated the most significant improvements in pelvic floor function and incontinence.

Anecdotal Evidence ⁴⁴

There are some sources that cite the use of biofeedback is indicated to assist people with learning disabilities. However, literature reviews show several outdated studies that have little validity and minimal positive outcomes with no recent research to the contrary.

Similar results have been found for motion sickness. There are a few studies completed between 1990 and 1996 that yielded some results. But the lack of any recent research means the use of biofeedback for this health concern is inconclusive.

Insomnia can be a symptom of many health concerns, ranging from cancer to sleep apnea to asthma. A review of the literature shows that, while there may be slight improvements in sleep quality and duration when other symptoms of these conditions are treated with biofeedback, there does not appear to be a transferrable or notable connection directly between biofeedback and sleep.

Early literature mentioned the use of thermal measurements in biofeedback as an effective way to manage sensation changes related to Raynaud's Disease. There is not much recent research on this use of biofeedback, so it is unclear whether these claims are presently verifiable.

Rheumatoid arthritis is another condition that some sources claim can be treated with biofeedback. There is some cursory evidence focused on the use of biofeedback alongside anti-inflammatory medication. Results showed an increase in functional levels as well as improved self-control. Since there were no significant changes in inflammatory symptoms, it is possible there is no correlation between biofeedback and inflammation levels, which is a primary and limiting symptom of this form of arthritis.

There are also limited recent studies that demonstrate the efficacy of biofeedback for individuals with traumatic brain injury. However, it is safe to say that biofeedback may be able to help TBI patients who experience mood dysregulation such as depression and anxiety. There is preliminary research on those symptoms, but more research would need to be done to determine its exact utility for this population.

The majority of the research surrounding diabetes and biofeedback focuses on its benefit for symptoms of hypertension and chronic pain. There are not any studies that show the use of biofeedback for concerns specific to diabetes such as blood glucose levels.

Section 5: Personal Reflection

Can you think of other TBI symptoms that biofeedback may help address?

Section 5: Key Words

Opioids: A class of controlled prescription drugs that is intended to assist with acute pain, but is often prescribed to help manage chronic pain

Raynaud's phenomenon: A circulatory condition that causes loss of blood flow to the fingers; this is typically caused by stress or cold temperatures

Neurogenic bladder dysfunction: A bladder condition that results from neurological conditions like spinal cord injuries; symptoms include increased urinary frequency, urgency, incontinence, and retention

Pelvic floor muscle training: An exercise program that strengthens muscles in the pelvic floor; these muscles support nearby structures including the bowel, bladder, and uterus

Transcranial magnetic stimulation: Sometimes known as TMS or rTMS, this is a non-invasive procedure that uses large magnets to stimulate neurons and produce some relief from symptoms of depression and anxiety

Functional MRI: Abbreviated as fMRI, this non-invasive imaging procedure that is used to pinpoint areas of the brain that are the most active due to increased blood flow

Oxygen saturation levels: A vital sign, given in percentages, that indicates how much oxygen is in the blood; this is measured by determining how much light is absorbed as it passes through the fingertip; in healthy adults, levels may fluctuate between 95 and 100% based on exertion levels

Vasoconstriction: Muscular contractions inside blood vessel walls that cause them to narrow

Vasodilation: Relaxation of blood vessel wall muscles that causes them to widen

Section 6: Certification ⁶⁰

As we've detailed, there is a lot of equipment involved in traditional biofeedback. For this reason, education beyond an occupational therapist's standard schooling is required to practice this modality. Being board certified gives patients the assurance that the person providing biofeedback has met the minimum educational requirements set forth by a trusted organization.

Therapists who are interested in obtaining certifications for biofeedback have several options through the BCIA, or the Biofeedback Certification International Alliance. BCIA offers entry-level, entry-level technician, and technician certified by prior experience credentials for standard biofeedback, heart rate variability biofeedback, neurofeedback, and pelvic floor biofeedback.

Entry-level certifications of all types are for individuals who have a Bachelor's degree in an allied health field but less than 5 years experience performing the desired specialty. Individuals with applicable experience who do not meet the degree requirement may receive the entry-level credential if they work under the supervision of someone with a standard certification. This designation makes them an entry-level technician.

Someone who has an advanced amount of hours working with patients using this modality will qualify for the "certification by prior experience" option. This requires proof of extensive education related to biofeedback along with over 5 years using this modality with patients. This makes someone a biofeedback technician. There is a brief examination for all certification options.

It is important to note that many states do not place any restrictions on people performing biofeedback services. For this reason, it is important that you receive the appropriate credentials and display them in your treatment space to inform patients of your qualifications.

Occupational therapists who offer biofeedback must also use equipment that is regulated by the Food and Drug Administration (FDA). The FDA sets rigorous standards to ensure working order and reliability, which has a major impact on safety and the effectiveness of the treatment provided. Therapists should carefully assess all claims that device and equipment manufacturers make and not take any information at face value without doing their own research.

Since there are several different types of biofeedback certifications that each have various purposes, patients should seek care from someone who has experience working with the symptom(s) and/or condition they are looking to manage. This will offer them the best results.

Section 6: Personal Reflection

What are some other healthcare or non-healthcare professionals who may seek certification in biofeedback or a biofeedback speciality?

Section 7: Standards and Reimbursement ⁶⁰

Most insurances offer partial or full reimbursement for biofeedback services. This is often dependent on the setting where service is provided (hospital-based clinic, doctor's office, or private practice), the geographic location, and the documented medical purpose for the treatment. Large cities typically have longer wait times for these services and charge more due to heightened demand.

Session charges vary between providers depending on their payment structures and the insurances they are contracted with. Each visit can range anywhere from \$35 to \$85. As we mentioned, biofeedback is often covered by insurance so patients may have no outstanding charges or small copays of \$10 or \$15 per session. If someone is self-pay or does not have insurance, this can add up when you consider most patients need at least 10 visits before they see results. It is the responsibility of an occupational therapist to educate patients about this so they are prepared for the personal cost that a full treatment plan may incur.

Despite there being a growing amount of evidence for the use of biofeedback to manage a range of health concerns, this does not always translate to the insurance industry. When medical coverage does reimburse for biofeedback, they may place stipulations on the type of health condition it used for. They may also only offer coverage for 10 visits, which may conflict with a treatment plan that recommends a minimum of 10 sessions, for example. Therapists should be sure to educate patients that this is a possibility from the start so they are prepared for potential out-of-pocket costs.

Occupational therapists should be used to adding medical necessity, clinical rationale, and justification for therapy to all of their documentation. This is done to demonstrate the need for skilled services, contribute to the credibility of the profession, and obtain reimbursement from insurance companies. Documentation for biofeedback is no different than modalities such as therapeutic ultrasound, massage, and adaptive equipment in that a therapist's notes must reflect the need for this modality to be performed.

The American Occupational Therapy Association lists biofeedback as a physical agent modality (PAM). You may or may not be aware that some states require therapists to have a separate certification to use PAMs such as therapeutic ultrasound, paraffin, electrical stimulation, and others in practice. So, if you are practicing in a state that requires a PAM certification and you only have a biofeedback certification, you will not be able to perform biofeedback in clinical settings until you also have an active PAM credential.

As with other PAMs, biofeedback is not used to cure or directly treat any health condition. As such, therapists should not make any reference to curing, treating, healing, or using other similar words when teaching someone about biofeedback and its outcomes. Documentation should be free of this verbiage as should marketing materials and discussions with patients. It is more appropriate for therapists to use terms like manage, cope with, address, educate, advise, teach, and instruct when referring to the effects of biofeedback. For example, therapists can note that biofeedback is used to manage symptoms of migraines and tension headaches and teach the body to regulate its own vital signs to address symptoms. However, therapists cannot indicate that biofeedback treats migraines and tension headaches.

This is best practice because it protects a therapist's license and avoids the possibility of making false claims. Migraines or other health concerns will not go away as a result of biofeedback, because they require continual maintenance from the patient to ensure

they are successfully managed. This is the same for any condition that biofeedback can assist with.

Section 7: Personal Reflection

What might an occupational therapist write in notes to prove continued medical need for biofeedback?

Section 7: Key Words

Physical agent modality: Also known as a PAM, these are interventions that involve the use of technology or other devices that are applied to the body; they involve following standardized protocols and are intended to help manage symptoms of integumentary, musculoskeletal, or neurological health concerns

Section 8: Pros and Cons

There are many benefits of using biofeedback with patients. First off, it's non-invasive so there are no known risks of using biofeedback for any health concern. Biofeedback itself also doesn't require the use of any medications, though patients who receive biofeedback may take prescription medications for other reasons. Biofeedback is not contraindicated with any health concerns and it is safe to use alongside other treatments. Since this modality requires the user to have intact cognition, it is especially beneficial for patients who are highly independent and motivated to improve their own health and wellness. This can also be a good way to empower individuals who only have average management skills and a slight desire to advocate for their own health. Regardless of what biofeedback is used for, research shows that it has a long-term impact on someone's behavior and cognitive function. Devices used during sessions are often portable or have lighter, simpler, and more accessible versions for use at home, which helps enhance carryover and patient independence.

The downsides of biofeedback include the high cost of some devices. This does not always serve as a barrier, since it can be completed with some individuals in the absence of equipment. The results of biofeedback can take some time to show, as most conditions require between 10 and 12 visits before patients see improvements. This can be somewhat discouraging to patients who do not expect this or are impatient, impulsive, or have tendencies toward agitation. While there has been a lot of evidence on the positive outcomes related to biofeedback, researchers have difficulty pinpointing the exact mechanisms since it is a non-invasive procedure. Patients seeking this care

may have difficulty finding a qualified professional to provide it, especially if they have limited health literacy or live in a rural area. Insurance coverage will vary so patients may end up paying a significant amount out-of-pocket for each session if they are uninsured or underinsured. The outcomes of biofeedback are highly dependent on user engagement. This means the results are variable, which may be off-putting to some patients.

Section 9: Case Study

A 23-year-old woman has been experiencing chronic migraines for about 5 years. Episodes cause her 8/10 shooting and stabbing pain in the head and these instances last for several hours. Her migraines have not responded to prescription medications or herbal supplements. She has begun practicing yoga to manage stress, which she believes may be a trigger for her migraines. She has not yet seen a benefit to this, but she has only attended classes for one week and plans to continue. She is seeking biofeedback for the first time in an attempt to lessen the frequency and duration of her migraines, which are beginning to impact her productivity and attendance at work as well as her social life.

1. What type of biofeedback do you think might benefit this patient the most?
2. What other tips might you give her to assist in managing her migraine pain?

Section 10: Case Study Review

This section will review the case studies that were previously presented. Responses will guide the clinician through a discussion of potential answers as well as encourage reflection.

1. What type of biofeedback do you think might benefit this patient the most?

Patients with migraines often benefit from a combination of electromyography (EMG) and skin temperature biofeedback. The idea behind using skin temperature monitors is to focus and relax the body so that blood vessels direct blood toward the hands and other areas of the body instead of the head. EMG directly targets the area of the headache with electrodes being placed on the head to relieve tension and muscle stiffness that can contribute to headaches. When these two methods are used in combination with relaxation strategies such

as deep breathing and affirmations, they work synergistically to relieve pain and discomfort related to migraines.

2. What other tips might you give her to assist in managing her migraine pain?

Occupational therapists are well-positioned to offer lifestyle recommendations and environmental modifications that can assist in managing migraines. A therapist should counsel this patient to develop better sleep hygiene. This may include taking melatonin 30 minutes before bed, dimming lights one hour before bed, and turning off screens at least an hour and a half before bed. Some people also develop a routine that involves taking a shower or warm bath, lighting candles, reading a book, journaling, meditating, or practicing gratitude for the day that has passed.

Therapists can also educate patients on adopting an anti-inflammatory diet to assist in managing swelling that may worsen migraines. This diet includes nuts, green leafy vegetables, berries, oranges, tomatoes, fatty fish like salmon or tuna, and other sources of omega 3 acids such as olive oil. Water is another factor that can worsen or trigger migraines, since dehydration is not good for the body. So therapists can educate patients on the importance of drinking around 60 ounces of water daily to help the body properly dispose of waste that may otherwise lead to inflammation and pain.

Section 11: Case Study

A 60-year-old woman was recently diagnosed with fibromyalgia. She has systemic pain, muscle aches, and fatigue. She has been experiencing these symptoms on and off for the past year, but her recent diagnosis has come along with some pain medications from her doctor. She reports that taking these medications makes her feel “foggy” and causes some poor concentration. She would like to stop taking them and use biofeedback to manage her pain levels.

1. What type of biofeedback would be the best option to address this patient's pain?
2. Can you direct your patient to stop taking her pain medications if biofeedback makes her feel better?

Section 12: Case Study Review

This section will review the case studies that were previously presented. Responses will guide the clinician through a discussion of potential answers as well as encourage reflection.

1. What type of biofeedback would be the best option to address this patient's pain?

EMG would be the most ideal option for this patient, since the majority of her symptoms are surrounding muscle function, endurance, and changes in sensation. EMG can first be used to target some of the biggest areas where she experiences muscle pain. Therapists can also use this as a way to determine what pain may be referred pain or due to poor posture and other compensatory mechanisms that may have developed over time. From here, a therapist can address the remaining areas of concern that may persist.

2. Can you direct your patient to stop taking her pain medications if biofeedback makes her feel better?

Medication recommendations are not within an occupational therapist's scope of practice. Therapists cannot make adjustments or changes to a patient's medication regimen nor is it in anyone's best interest to advise patients to stop taking medications. It is best practice for a therapist to refer patients back to their doctor for counsel on any medication.

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