AOTA Position Paper

Physical Agents and Mechanical Modalities

INTRODUCTION

The American Occupational Therapy Association (AOTA) asserts that physical agents and mechanical modalities (PAMs) may be used by occupational therapy practitioners[1] as part of a comprehensive plan of intervention designed to enhance engagement in occupation (AOTA, 2014b). Occupational therapy practitioners possess the foundational knowledge of basic sciences, understanding of relevant theory and evidence, and clinical reasoning to recommend and safely apply PAMs to support achievement of client goals.

This Position Paper clarifies the context for the appropriate use of PAMs in contemporary occupation-based occupational therapy practice. As guided by the *Occupational Therapy Practice Framework: Domain and Process, 3rd Edition* (*OTPF–3;* AOTA, 2014b), exclusive or stand-alone use of PAMs without linking it to a client-centered, occupation-based intervention plan and outcomes is not occupational therapy. Consistent with the Choosing Wisely initiative, AOTA supports that practitioners "don't use PAMs without providing purposeful and occupation-based intervention activities" (Choosing Wisely, 2018,).

DEFINITIONS

Therapeutic modalities refer to the systematic application of various forms of energy or force to effect therapeutic change in the physiology of tissues. *Physical agents* such as heat, cold, water, light, sound, and electricity may be applied to the body to impact client factors, including the neurophysiologic, musculoskeletal, integumentary, circulatory, or metabolic functions of the body. Physical agents may be used to reduce or modulate pain, reduce inflammation, increase tissue extensibility and range of motion, promote circulation, decrease edema, facilitate healing; stimulate muscle activity, and facilitate occupational performance (Bracciano, 2019).

Physical agent modalities may be categorized based on their properties:

1. *Thermal—Thermal modalities* refer to those physical agents that provide a change in tissue temperature, either heating or cooling the tissue. Thermal modalities can also be categorized into superficial or

thermal agents and deep thermal agents on the basis of the depth of energy penetration into the underlying tissue, body function, or body structure they are targeting. Thermal agents (heat or cold) facilitate transfer of energy through conduction, convection, or conversion.

a. *Superficial thermal agents*--

i. *Conduction*—Heat or cold is transferred from an object to the body with direct contact with the modality. Examples include, but are not limited to, hot packs, cold packs, and paraffin.

ii. Convection—Heat or cold is transferred between 2 objects where 1 is moving/flowing around the body part. Examples include, but are not limited to, whirlpool or hydrotherapy, which can be done with hot or cold water, and Fluidotherapy™ or dry whirlpool, which uses dry heat to circulate dry cellulose medium around the distal extremity.

b. *Deep thermal agents*--

i. *Conversion*—Energy from low frequency soundwaves is converted into heat. A common example is therapeutic ultrasound where the mechanical waves in sound energy are converted to heat using an ultrasound machine. Therapeutic ultrasound can be used to penetrate deeper tissue structures. Deep thermal agents include, but are not limited to, therapeutic ultrasound, phonophoresis, and other commercially available technologies.

2. *Electromagnetic*—Electromagnetic modalities use electromagnetic waves such as radio waves, microwaves, and light waves to transport electrical and magnetic energy through space to effect changes in body structures (Post & Nolan, 2016).

a. *Diathermy*—Diathermy uses short-wave frequencies to impact healing tissue or higher frequencies that cause tissue heating.

b. *Low Level Light Therapy (LLLT)*—Low intensity, nonthermal (cold) lasers use light energy to cause a photochemical reaction in body tissue that can influence tissue repair, inflammation, and pain.

3. *Electric*—Electrotherapy uses electrotherapeutic currents and waveforms to influence physiological effects on client body structures and functions (Bellew, 2016). Electrotherapy has many potential clinical uses and may be categorized as follows:

a. Influence physiologic change in tissues to increase circulation, facilitate tissue healing, modify edema, and modulate pain. Examples include, but are not limited to, high-voltage galvanic stimulation for tissue and wound repair (ESTR) and high voltage pulsed current (HVPC). A specific electrotherapeutic agent, iontophoresis, uses direct electrical current to move ions of medication across skin into target tissues (Bracciano, 2019).

b. Facilitate neuromuscular or sensory activity to improve muscle strength, reeducate muscle function, or modulate pain response. Examples include, but are not limited to, neuromuscular electrical stimulation (NMES), functional electrical stimulation (FES), transcutaneous electrical nerve stimulation (TENS), and interferential current (IFC; Bracciano, 2019).

Mechanical modalities refers to therapeutic use of mechanical devices to apply force such as compression, distraction, vibration, or controlled mobilization to modify biomechanical properties and functions of tissues. Effects of these mechanical modalities include increased circulation and lymphatic flow or increased tissue and joint mobility. Examples include, but are not limited to, mechanical traction, vasopneumatic devices, and continuous passive motion machines.

OCCUPATIONAL THERAPYPRACTITIONER QUALIFICATIONS AND ETHICAL OBLIGATIONS

The Accreditation Council for Occupational Therapy Education (ACOTE) requires that entry-level educational programs must prepare occupational therapists to *demonstrate* and occupational therapy assistants to *define* the "safe and effective application of (thermal, electrotherapeutic and mechanical) modalities as a preparatory measure to improve occupational performance… (and the) foundational knowledge, underlying principles, indications, contraindications, and precautions" for use (2018, p. 31). Foundational knowledge such as human anatomy, physiology, and biomechanics is part of entry-level education for the occupational therapist and occupational therapy assistant.

Certain states have additional regulatory requirements for demonstrating competence beyond entry-level education and for specific types of PAMs. Occupational therapy practitioners need to be aware of and comply with these requirements, which may include, but are not limited to, continuing professional education, institution-specific procedures for ascertaining service competence, and supervised contact hours by a qualified practitioner in the respective state. PAMs coverage and billing policies set forth by federal and state payers (e.g., Medicare, Veterans Administration, state Medicaid programs), as well as by commercial payers, may vary widely. Practitioner are responsible for checking their payer policies to learn of any restrictions in coverage.

Occupational therapy practitioners should refer to the *Occupational Therapy Code of Ethics* (AOTA, 2015a) for relevant principles and the *Standards of Practice for Occupational Therapy* (AOTA, 2015b) to guide their practice. Different models and new technology are routinely being developed based on most currently available evidence. Practitioners are responsible for maintaining their awareness of these new developments as well as their competency in the safe and effective application of new technologies.

As part of their ethical responsibility, occupational therapy practitioners should also be mindful of the client's ability to access services that include PAMs. In situations in which a practitioner has limited access to PAMs equipment, he or she should apply clinical reasoning skills to use low-tech substitutes to which the client has access and that have known therapeutic effects.

OCCUPATIONAL THERAPY PROCESS

The *OTPF–3* (AOTA, 2014b) provides guidance to occupational therapy practitioners when evaluating the need for PAMs and in incorporating their use as preparatory methods and tasks. During the evaluation process, occupational therapists establish an occupational profile to identify client priorities, gain an appreciation of the client's health and well-being, and understand the contextual supports and barriers to performance. Therapists further analyze client performance in chosen occupations to identify specific focus of intervention, including impairments in client factors, deficits in performance skills, and overall limitations in occupational performance. The presence of impairments in body functions and body structures as barriers to occupational performance may facilitate clinical reasoning in choosing the appropriate PAMs. Therapists consider the evidence, pragmatics, and benefits of PAMs as an integral component of the occupation-based intervention plan.

As part of the intervention plan, the therapeutic use of PAMs may be categorized as follows:

1. *Preparatory to occupation*—Occupational therapy practitioners administer PAMs to address barriers to body functions and structures *prior to* engagement in occupation. For example, a practitioner may apply thermal modalities on a client's hands and wrists to increase tissue extensibility and alleviate pain prior to engaging in cooking activities.
2. *Concurrent to therapeutic occupation or purposeful activities*—Occupational therapy practitioners may administer PAMs to support impairments in body functions and structures *while* the client is engaged in occupation to improve performance. For example, a practitioner may apply a functional electric stimulation on the client's affected wrist extensors and flexors during a morning grooming routine to facilitate grasp and release.
3. *As a necessary component of a person's occupational routine*—Occupational therapy practitioners may recommend and train a client to self-administer PAMs as part of their health management and maintenance. For example, a practitioner may teach a client how to perform manual lymph drainage massage, use an intermittent pneumatic compression device, and properly apply compression garments to abate the effects of lymphedema on occupational performance.

Occupational therapists may collaborate on the implementation of the intervention plan that involves the use of PAMs with occupational therapy assistants who demonstrate service competence. Both occupational therapist and occupational therapy assistant should monitor and appropriately document the outcome of interventions. Using PAMs as part of a comprehensive intervention plan can facilitate active engagement and participation in occupational tasks and improve occupational performance (Bracciano, 2019; see also Table 1 for case examples).

Table 1. Case Examples Highlighting the Use of PAMs in Occupational Therapy Interventions

Case Description	Examples of Occupational Therapy Interventions Incorporating PAMs	Application of Evidence Into Practice
A **52-year-old certified nursing assistant** has a diagnosis of adhesive capsulitis and frozen shoulder after a fall 3 months ago. She works full-time and cares for her elderly mother at home. *Occupational Goals*: The client's desired occupation is to continue to work and care for her mother in the home.	***PAMs used as a preparatory activity prior to occupations*** Although the client's desire to continue to work full-time and keep her mother in the home are a strength, impairments in client factors (pain and limited ROM) impact her ability to achieve goals. The client wants to be independent to get dressed and prepare meals without pain. The OT assesses pain and limited ROM as barriers to occupational performance and establishes a treatment plan that incorporates use of thermal modalities like moist heat, ultrasound, or diathermy to increase ROM while decreasing pain. The OTA can use these PAMs as preparatory activities prior to functional activities and occupation-based treatment that support client's goals. If an ultrasound or a diathermy machine was not available for the OT practitioner, other superficial heating PAMs can be used to decrease pain in preparation for occupation-based activity. LLLT can also be used to decrease pain prior to occupation-based interventions.	Evidence supports use of heat modalities to increase ROM and improve function. The therapeutic outcome desired is increased tissue temperature to subsequently increase ROM and positively affect function. This outcome can be achieved through several different or a combination of modalities, including ultrasound (Nakano, Yamabayashi, Scott, & Reid, 2012; Yavuz, Duman, Taskaynatan, & Tan, 2014). Clients with shoulder pain often have limited function. One study compared LLLT to continuous ultrasound for shoulder pain. Both groups showed statistically significant decreases in pain and improved function; one intervention was not superior over the other (Yavuz et al., 2014).
A **64-year-old sales manager** with right side hemiparesis presented with decreased arm function on his dominant side. His occupational therapy evaluation indicates weakness of wrist and finger extension and grip, that makes grasping and releasing objects difficult. He is motivated to return to	***PAMs applied concurrent with therapeutic occupation/purposeful activities*** The OT assessed that the client has potential to regain motor function with the help of task-oriented training combined with electrical stimulation to augment lack of motor activation of key muscle groups. The OT provided training and a home program to enable	In 1 study, patients with stroke who received usual rehabilitation care and additional FES applied to the wrist and finger extensors showed a statistically significant improvement in UE function vs. those who received usual care alone (Karakus, Erso, Koyuncu, Turk, Sasmaz, & Akyu, 2013). According to a systematic review with meta-

his hobbies like yardwork, gardening, and traveling with his wife. *Occupational Goals:* The client would like to improve arm and hand function and return to work for another 8–12 months prior to his retirement.	the client be able to reach and manipulate garden tools and yard tools. Because of an unstable grip, the OT trialed the use of FES to support the wrist extensors as the client attempts to sustain his grip with positive results. The FES was also used to assist with hand opening during pre-grasp practice with various objects while at midreach. Subsequently, the OT recommended ongoing training with the use of a home FES unit along with an intensive task-oriented training program	analysis, the addition of functional electrical stimulation to task oriented training has a large effect on UE activity for persons with stroke regardless of onset (Howlett, Lannin, Ada, & McKinstry, 2015).
A **26-year-old computer engineer** presents with severe pain in her dominant UE after a fall 4 months ago where she sustained an elbow fracture and wrist sprain. She has 9/10 pain with all grasping, lifting and carrying and has a diagnosis of CRPS. She has limited grip strength and therefore limited function. She works full-time and has a 1-year-old child at home. She is having difficulty with activities involving lifting and carrying, child care, and meal preparation and reports that she has increased pain while typing on the computer for her work-related tasks. *Occupational Goals:* The client would like to be able to better manage her pain as she resumes her usual occupations in the home and work setting.	***PAMs as a component of the client's occupational routine*** In collaboration with the client, the OT provided strategies to manage her CRPS through activity modifications and the use of TENS. Prior to recommending a TENS unit, the OT evaluated key areas of pain that may benefit from TENS and their level of tolerance to stimulation. The OT educated the client on proper application and scheduling of TENS use and then trialed and assessed her ability to use a home TENS unit to manage pain at work and at home during activity to decrease pain and support improved function. The OT used a time-log to gain an understanding of the client's experience of pain linked to daily activities, and the use of the TENS unit was incorporated into her daily routine based on the information gleaned from the log.	There is evidence to support the use of TENS in the treatment of pain due to complex regional pain syndrome (Bilgili, Çakır, Doğan, Erçalık, Filiz, & Toraman, 2016). TENS is a modality that can be portable, safe, and can be readily incorporated into the client's occupational routine.

Note. CRPS = complex regional pain syndrome; OT = occupational therapist; FES = functional electrical stimulation; LLLT = low level light therapy; PAMs = physical agents and mechanical modalities; ROM = range of motion; TENS = transcutaneous electrical nerve stimulation; UE = upper extremity.

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[1] When the term *occupational therapy practitioner* is used in this document, it refers to both occupational therapists and occupational therapy assistants (AOTA, 2015c). *Occupational therapists* are responsible for all aspects of occupational therapy service delivery and are accountable for the safety and effectiveness of the occupational therapy service delivery process. *Occupational therapy assistants* deliver occupational therapy services under the supervision of and in partnership with an occupational therapist (AOTA, 2014a).

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