

### Microcurrent Electrical Therapy (MET): A Tutorial

MET may yield better clinical outcomes with less current, lower frequencies, and reduced treatment time.

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The last three decades have seen a rise in the use of microcurrent electrical therapy (MET). It is used primarily by physicians, dentists, veterinarians, occupational therapists, psychologists, chiropractors, and acupuncturists for the management of acute, chronic, and post-operative pain. The use of MET is often accompanied by the promotion or acceleration of healing. Table 1 provides a sample listing of the indications and contraindications for MET.<sup>1</sup>

It should be emphasized that with previous forms of electrotherapy (e.g., transcutaneous electrical nerve stimulators and other technologies based on using electric force as a counter-irritant), price often was the deciding factor when making purchase decisions among the many units offered. In choosing a microcurrent device, the most critical aspect is the waveform. Specific waveform attributes are essential to achieving good results. One must determine if there is legitimate research associated with a given technology before purchasing or prescribing. Some of the Asian manufacturers, for example, have simply reduced the current from their TENS devices and started to sell them as "microcurrent" devices. The Food and Drug Administration is not helpful in this instance as the FDA will readily accept devices being sold for pain indications as TENS. Accordingly, it is caveat emptor and each practitioner must do their own due diligence on the best technology and protocol.

The class of devices known as microcurrent have current levels less than one milliamper. However, that is only one aspect of the waveform. Just as not all 5 mg pills are alike, neither are 0.5 Hz MET devices. Heffernan compared a commercially available MET device using a variable maximum frequency of 0.5 Hz (0 to 2 second pulses) in a complex 10 second bipolar waveform with a control device built by the researcher delivering a simple repetitive 0.5 Hz bipolar waveform.<sup>2</sup> Using the same electrode locations (bilaterally on the wrists) and the same amount of current (500 microamperes), he found that the MET device was able to significantly reduce pain and produce beneficial smoothing on electroencephalographic analysis in patients with chronic degenerative joint disease that were unresponsive to medication. The 0.5 Hz control device did not produce a sig-

nificant reduction in pain and only produced an undesirable sinusoidal pattern on the EEG.

Fortunately, MET devices are often subsensory so that they lend themselves to the gold standard of double-blind studies in a manner similar to pharmaceutical research. There is no excuse for a medical device company—entrusted with patient care on the order of a licensed practitioner — not to sponsor or encourage research with its proprietary technology.

#### Mechanisms

Arndt's Law is often cited in discussions of MET. It states that weak stimuli excite physiological activity, moderate stimuli favors it, strong stimuli retards it, and very strong stimuli arrests it.<sup>3</sup> Chang found that 500 microamperes caused adenosine triphosphate (ATP) to increase by 500% while raising the current over 5 milliamperes caused ATP to drop below baseline norms. Further, at 100-500 microamperes, amino acid transport rose 30-40% above controls.<sup>4</sup>

An effective MET waveform will use resonant frequencies that activate central pain modulatory mechanisms. Cells throughout the body manufacture peptides that act as ligands to surface receptors on other remote cells, communicating throughout the body via the extracellular fluid and the circulatory system.<sup>5</sup> Nordenström has proposed a model of biologically-closed electric circuits analogous to closed circuits in electronic technology.<sup>6,7</sup> His premise is that mechanical blood circulation is closely integrated anatomically and physiologically with a controlling bioelectrical system. Endogenous biological circuits are affected by normal electrical activities of the body and pathological changes. Nordenström views bioelectricity as the primary catalyst of the healing process and has shown that augmenting it with MET can produce profound therapeutic effects.

MET treatment with an effective waveform may act similar to ligands in activating receptors to send their messages into cells and produce effects similar to a wide range of chemical messengers. The protocols presented herein effect the peripheral pain site directly and access the central nervous system by placing electrodes in position to direct the current through the spine.

INDICATIONS	HEAD AND NECK PAIN Cervicogenic headache Cluster headache Dental disorders (periodontal and orthodontic pain) Facial palsy Migraine Sinusitis Sprains and strains Suboccipital headaches Tinnitus Temporomandibular joint disorder Tension headache Torticollis Trigeminal neuralgia Whiplash	ABDOMINAL PAIN Bladder pain Bowel stasis Diverticulosis Dysmenorrhea Labor Postoperative pain Prostatitis	BACK PAIN Coccydynia Failed back surgery Intercostal neuralgia Intervetebral disc syndrome Low back pain Lumbrosacral pain Radiculitis Spasm Sprains and strains Thoracodynia Whole back pain
<b>SYSTEMIC PAIN</b> Acupuncture points Arthritis Bursitis Cancer Causalgia Cholecystitis (chronic) Decubital ulcers Effusions Fibrositis Hematoma calcification Hemiplegia Herpes zoster/schialgia Lymphedema Multiple sclerosis Myalgia Myositis Neuralgia Neuroma Osteoarthritis Pain (systemic and idiopathic) Phantom limb syndrome Post traumatic edema Raynaud's disease Rheumatoid arthritis Scars Synovitis Trigger points	<b>LOWER EXTREMITY PAIN</b> Ankle pain Anterior tibial syndrome Foot pain Fractures Joint mobilization Knee pain Passive stretch pain Sciatica Sprains and strains Spurs Tendinitis Thrombophlebitis	<b>UPPER EXTREMITY PAIN</b> Carpal tunnel syndrome Epicondylitis Frozen shoulder Hand pain Peripheral nerve injury Shoulder-arm syndrome Sprains and strains Subdeltoid bursitis Wrist pain	<b>CONTRAINDICATIONS</b>  Carotid sinus area Demand type pacemakers Pregnancy

**TABLE 1.** Indications and contraindications for microcurrent electrical therapy (MET).

### MET: A Tutorial

While MET devices differ, and the manufacturers' recommendations should always be followed when first learning to use a medical device, a basic protocol can be utilized for quick and consistent results. This article is based on the author's 33 years of experience with MET. It is not meant as a complete discourse on the subject, but rather a "how-to" tutorial to achieve substantial, cumulative effects in the least amount of time. MET is a very easy and efficacious procedure when performed properly. As with any medical intervention, there is a learning curve so don't give up if the first few treatments do not produce the desired outcomes. MET produces significant results (>25% pain relief) for over 90% of patients.<sup>8</sup>

MET is both long lasting and cumulative. The goal of a MET session is to achieve 100% pain relief. Although not achievable in every case, and seen less often with the first few treatments in a series, anything less than full pain relief in a treatment session will inversely impact the longevity of the results obtained and impact the cumulative effect. The protocols presented here will usually take 2-5 minutes, but may take up to 15 minutes in patients who have severe or multiple pathologies. Stop when the pain is no longer able to be elucidated, even in a position that previously exacerbated the pain. Of course, one can always cause pain in extreme positions so it is only reasonable to evaluate the treatment in comparison within the limits of the restricted lim-

itation of motion that the patient originally presented with and never more than the normal range of motion.

Results will vary with the technology utilized, the pathology of the patient undergoing treatment, the overall health, hydration, and compliance of the patient. The patient's history, especially as it pertains to prior medical intervention, may be a defining factor. It is not possible to achieve results when limiting treatment with MET to the chief complaint since the entire body is an electrical circuit.<sup>6,7</sup> Previous injuries and surgical scars may need to be treated due to their highly-resistive nature that cause subtle electrical blocks. If a patient is refractory to treatment with MET, place electrodes at the end of each scar or cover small scars with an electrode (with the other one being placed opposite the scar or on another scar), for at least 10 minutes, 4 days in a row. A successful scar treatment may exacerbate pain as it increases overall functioning and stamina. If the pain increases, the protocols that are the subject of this article will usually start to work. In rare, difficult cases, it could take 3 weeks or more of daily treatment to produce a significant cumulative effect. This is especially true in treating patients with fibromyalgia.

### Analyze the Patient

Naming a disease and knowing the patient's weight and perhaps medication allergies is often sufficient to prescribe pharmaceuticals. With MET, one needs to go beyond the chief com-

plaint(s) to understand all comorbidities, medical history, and prior interventions. This is essential because the electrical circuitry of the entire body must be considered. All current, and sometimes seemingly resolved pathologies, may need to be treated along with the chief complaint(s) if only for 10 to 30 seconds each in order to obtain optimum results.

A rheumatoid arthritis patient, for example, will only respond well to MET if all involved joints are treated. This can be accomplished quickly using these protocols. Treatment can then be concentrated on the chief complaint. Curiously, the degree of chronicity does not seem to be a significant factor in MET outcomes.

### History and Brief Exam

A comprehensive history is helpful to determine co-morbidities, past pathologies and trauma that might need to be treated along with the chief complaint. A standard brief pain evaluation is essential to determine when the pain first presented, its frequency, duration, intensity, limitations-of-motion, positions which exacerbate the pain, and any precipitating factors. This should include details of all surgical scars, traumatic injuries, and an analysis of the patient's current condition prior to initiating MET. Determine the patient's present pain level and positions that exacerbate the pain. Ask patients to rate their present pain on a scale of 0 (no

pain) to 10, with 10 being the worst the pain to be treated has been perceived.

Because the results of MET can be seen after only a minute or two of treatment in most people, these indicators are necessary reference parameters to determine effectiveness during a single treatment session.

### Adjust the Settings

If choices are offered, use the manufacturer's recommendations for the frequency setting of a given device. Higher frequencies (e.g., 100 Hz) might produce faster results but the effects do not last as long as the effects achieved from the use of a low frequency (e.g., <1.0 Hz). Set the current level at the highest comfortable position (e.g., 300 to 600 microamperes).

Be careful to only use low resistance electrodes. Standard TENS electrodes have a resistance of about 200 ohms, while some silver electrodes have a resistance of only 20 ohms. Only low resistance electrodes will work effectively with MET devices.

Most good MET devices utilize probes. These work better than self-adhesive electrodes. It is better to be on the right treatment site with probes for 10 seconds than on the wrong site with self-adhesive electrodes for 10 hours. When using probes, affix new electrodes and saturate them with an appropriate electromedical conducting solution. Saline solution may be

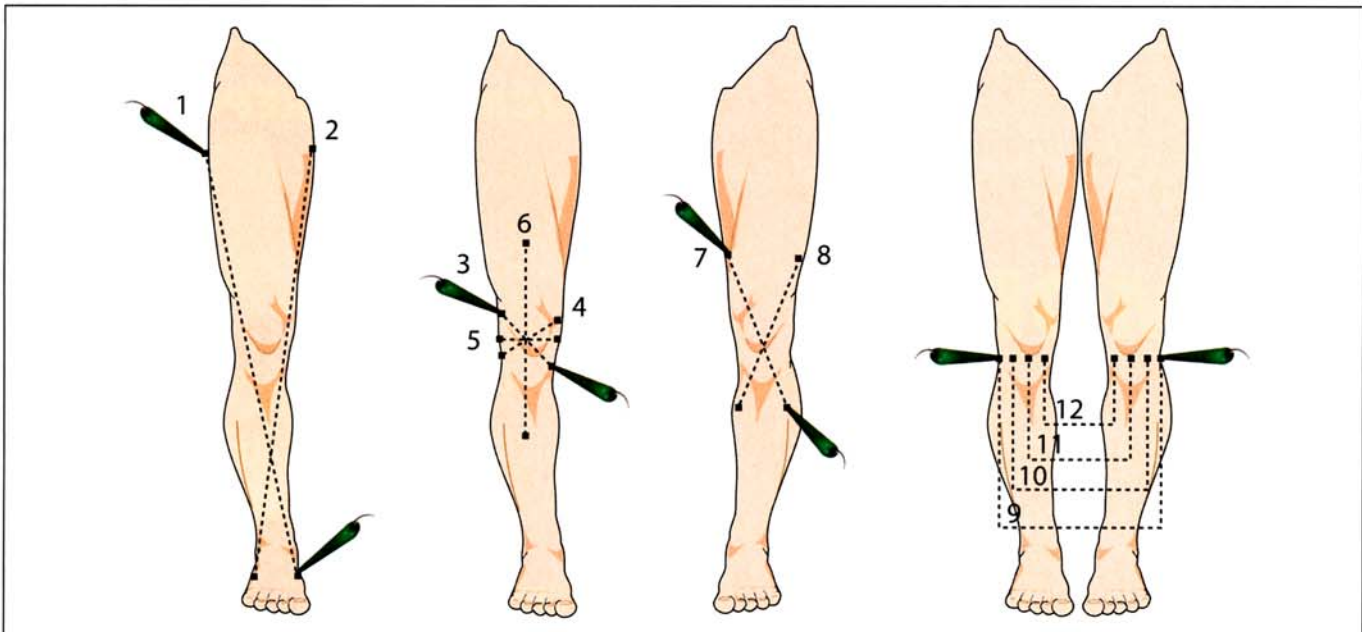
used if a conducting solution is not available. Apply firm pressure to help minimize skin resistance. A major cause of limited or no results is being too gentle with the probes.

For extremely hypersensitive people, such as fibromyalgia patients, it is necessary to start with a minimal amount of current. In some rare cases, even low level MET currents may be uncomfortable in some patients. Over a series of treatment it might be possible to increase the current to improve the results. However there is never any reason for patients to be uncomfortable during MET treatment. Additional treatment time will compensate for the reduction in current.

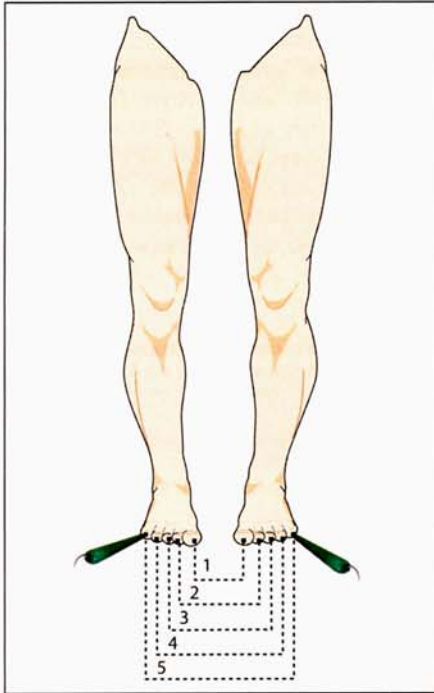
### Basic Treatment Strategy

The most important variable is the position of the electrodes. Place them on either side of the area being treated to direct the current through the problem area. Keep in mind that the body is 3-dimensional. Therefore, there will be many possible electrode positions. Some will work much better than others. The correct electrode location is the one that works! However, the one that works may be transient, working well one day, but ineffective another. As the problem begins to resolve, the electrode locations may require frequent adjustments.

A common mistake made by clinicians familiar with traditional TENS is placing



**FIGURE 1.** An example of the 2 Minute Probe Treatment Protocol for right knee pain. The ends of the lines represent approximate locations for probe placements, and the numbers represent the order in which the probes are placed to treat the area.



**FIGURE 2.** An example of the 1 Minute Probe Treatment Protocol connecting the toes for pains of the lower extremity, pelvis, hip, and low back.

the electrodes on each side of the pain (e.g., a few inches from the spine for back pain). This is a 2-dimensional approach. With such a placement, microcurrent will travel just under the skin between the electrodes and never reach the spine. Nor can the electrodes be effectively placed "between the pain and the brain." These are common placements for TENS electrodes, but MET is not TENS. When treating back pain with MET place one electrode next to the spine at the level where the problem is, and the other on the contralateral side, anteriolaterally (front and opposite side). This will direct the current



**FIGURE 3.** An example of self-adhesive electrode placements for local treatment of right knee pain.

through the spinal nerves. Next, reverse the sides. Then follow-up by doing another set of contralateral placements one spinal level above, and one below the problem to accommodate overlap in the dorsolateral fasciculus.

Always treat bilaterally. Bilateral treatment is directed towards the spinal cord thereby involving dermatomes, myotomes, and sclerotomes. Also if the problem is within the axial skeleton and the contralateral side is ignored, there is a good chance that the primary location of a pain problem will have been missed. Pain often presents itself ipsilaterally on the tense side which may be compensating for muscular weakness on the contralateral side.

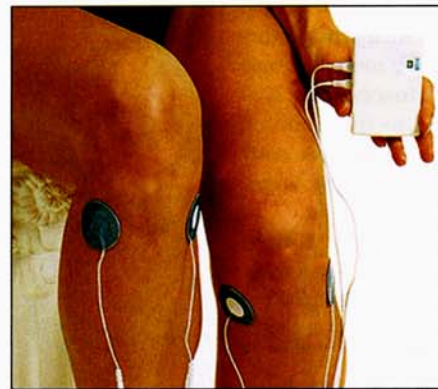
### The 2-5 Minute Probe Treatment Protocol

While manufacturer's recommendations vary, probes are typically applied for approximately 10 seconds per placement. Consider one treatment "set" as a group of 12-20 of these 10 second probe placements, each at a different angle of approach. The first set should take about 2 minutes, with additional treatments done at 1-2 minute intervals. The patient should be reevaluated between each set.

The protocol involves 4 steps. Figure 1 illustrates the protocol using the example of right knee pain:

1. First treat over a wide area well beyond the problem area. An example of this strategy for knee pain would be to treat from the medial, superior thigh to the lateral foot, then the lateral hip to the medial foot. At 10 seconds per location this is completed in 20 seconds.

2. Treat closer in directly around the involved area (e.g., two oblique angles, one



**FIGURE 4.** An example of self-adhesive electrode placements for contralateral treatment of right knee pain.

or two medial-lateral, one or two anterior-posterior probe placements, etc.) for a total of 1 minute.

3. Treat around the contralateral side, directly opposite the problem site (e.g., opposite knee) for at least 20 seconds, even if it is asymptomatic.

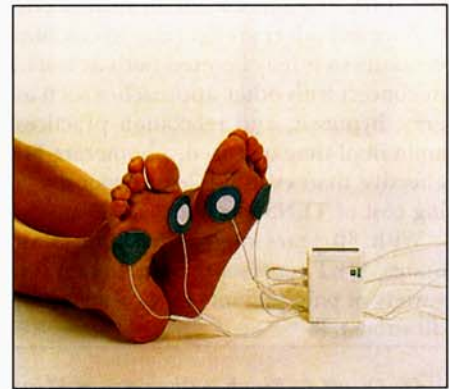
4. Connect the two contralateral sides by placing a probe on each side simultaneously at four or more locations distal to the area being treated.

The typical example shown in Figure 1 takes 2 minutes. The patient should then be reevaluated based on the original criteria. If the pain is gone, stop for the day. If it is reduced, ask the patient to point to where it hurts with one finger and treat for another minute or so directly through the area of pain, which may have moved after the original 2 minute treatment.

Think in terms of symmetry. Look, palpate, and otherwise examine areas above, below, and to the left and right of the primary area undergoing treatment. Always treat the contralateral side and connect both sides to encompass treatment of the central nervous system.

### The 1 Minute Probe Treatment Protocol

A very rapid effective means of pain relief with MET is to simply place the probes on the distal extremities simultaneously in equal contralateral locations. For example, for knee pain a probe is placed on each toe in succession as shown in Figure 2. Maintain a firm pressure. This will often alleviate pain within 1 minute. This placement may be used for pains of the lower extremity, pelvis, hip, and low back. Similarly, simultaneous probe placements on the fingers will treat the upper extremity, shoulders and neck.



**FIGURE 5.** An example of self-adhesive electrodes placements for pains of the lower extremity, pelvis, hip, and low back.

### Self-Adhesive Electrodes

Self-adhesive electrodes are placed within the same guidelines as the probes, except for a longer period of time. For optimum results, electrodes may also need to be moved around the problem area. Whereas the probes are used for 10 seconds a site, electrodes should be left at each location for at least 5 to 10 minutes. Some cases will require an hour or even several hours of stimulation daily. Accordingly, electrodes are best used for home care. Figures 3, 4 and 5 are examples of self-adhesive electrode locations.

### When to Stop

Reevaluate the patient after the brief protocol using the original criteria. Look for improvement in objective signs (e.g., range-of-motion increases). Stop when the pain is completely gone, or when the improvement has reached a plateau after several treatment sets. If the pain is gone, it is far better to stop treatment for that day even if the patient only had one or two minutes of treatment. Continuing to treat the area at this time may cause the pain to return! If the patient can no longer identify any pain, but complains of stiffness, this indicates that it is time to stop treatment for the day. MET will not reduce residual stiffness.

Although most patients will have an immediate response to treatment, effects in some patients will be delayed, continuing to improve over a day or two after the treatment. In these patients relief will generally occur 1-3 hours post-treatment or even as late as the next morning. Most patients will experience a cumulative effect, continuing to improve over time. However, for severe pathologies, palliative effects will be temporary and thus necessitate frequent treatment. Some patients will turn the MET device off but leave their electrodes attached so that all they have to do when the pain starts to return is turn the power back on. A pre- and post-treatment diary is helpful in analyzing the response of patients who self-treat at home.

### Conclusion

Prescription MET devices are a safe and effective means of controlling pain in many cases. MET is easy to use, and many devices are portable enough for the patient to carry for use as needed. It is not addictive and has no known tolerance. Adverse effects are minor and self-limiting, primarily consisting of skin irritation at the electrode site in light-skinned people. It may be used on a schedule and/or on an as-needed basis. It is not known to have any adverse effect due to combinations with other interventions so it may be used both as a stand-alone modality, and in concert with other approaches such as pharmaceuticals, surgery, hypnosis, and relaxation practices. Due to the minimal amount of time it is used, a homecare MET device is more cost-effective than even the least expensive TENS, when the ongoing cost of TENS electrodes and batteries are factored in.

With 30 years of research and clinical use in the United States, MET represents a viable first line treatment for a wide variety of pain patients in a clinical setting (see Table 1 for Indications). ■

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