Interferential Current Therapy: Often Used but Misunderstood

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USE OF interferential current therapy (IFC) began in Europe in the 1950s. It was introduced in the United States and Canada in the early 1980s. In 1999 it ranked as high as fifth among the most frequently used therapeutic modalities by physical therapists in Ireland¹ and Australia.²,³ IFC therapy use also appears to be widespread in North America.

IFC is the interference or superimposition of at least two separate medium-frequency sinusoidal currents on one another.⁴ If you have ever been in a speeding motorboat, you have seen the waves that are created by the boat’s wake. As another boat crosses these waves at a 90° angle, the boat might fishtail a little, and the mutual action of the bisecting (or interfering) waves causes an agitating, uneven, sometimes bigger wave. Like the action of waves from two crossing boats, interference, or interferential current, is the mutual action of waves of any kind (water, sound, heat, or light) on each other by which the vibrations and their effects are increased, diminished, or neutralized.

Principle Behind IFC

IFC employs two medium-frequency currents, passed through the tissues simultaneously, that are set up so that their paths cross (interfere with) each other. This interference gives rise to an interference or beat frequency that has the characteristics of a low-frequency stimulation. Although there are differing opinions about the validity of IFC, the underlying principle is to employ the strong physiological effects of low-frequency (< 250 pps) electrical stimulation of muscle and nerve tissues without the associated uncomfortable side effects of such stimulation. When low-frequency effects are produced at sufficient intensity and depth, most patients experience some discomfort. This is because the resistance of the skin is inversely proportional to the frequency of the stimulation. The lower the stimulation frequency, the greater the resistance to the passage of the current, and thus the more discomfort experienced. The skin impedance at low frequency, 50 Hz, is approximately 3,200 Ω; at medium frequency, 4,000 Hz, it is reduced to approximately 40 Ω. The theory regarding application of medium frequency is that it will pass more easily through the skin, requiring less electrical energy input to reach the deeper tissues while being more comfortable for the patient. We note that this theory is not supported by all scientists—some think that medium frequency is no more comfortable for patients than low frequency.

The Bottom Line

Basically, when an electrical current is used for muscle reeducation, IFC appears to have a better effect on the larger and deeper muscles (such as the quadriceps). Low frequency appears to have a better effect on the smaller, shallower muscles (such as the wrist extensors). Clinicians who are treating pain prefer IFC for deep joints where the vector field can be crossed at the joint, providing more current density in the deeper tissues. Because most trigger points are superficial, however, they lie within the appropriate range to be treated with low-frequency currents (i.e., TENS).

When to Use IFC

IFC’s main use is pain relief, although there are protocols for using it for bone stimulation.⁴ Probably its
greatest advantages over traditional TENS therapy are its abilities to cover a large area and to penetrate deeper into the tissues.4

As stated earlier, IFC uses a medium-frequency current as its carrier frequency (the set frequency built into machine), thereby providing less resistance by the skin while being able to generate a deeper current. Four electrodes are used in a criss-cross pattern, two electrodes from one channel and two from another (Figure 1). The location where these two currents cross or interfere is called a vector. There are two types of vectors, static and dynamic. A static vector does not move but stays centered where the currents cross. A dynamic vector can move throughout the entire treatment field between the four electrodes. Advantages of the vector pattern include

- Both surface and deep stimulation in the tissues
- Targeted tissues for added benefit (static vector)
- Treatment of easily localized pain (static vector)
- Treatment of large areas (dynamic vector)
- Treatment of poorly defined pain (dynamic vector)

**How to Use IFC**

Suppose you want to decrease a patient’s poorly localized back pain. Your carrier frequency is 5,000 Hz and you decide to choose a beat frequency (the frequency that can be adjusted) of 100 Hz. After the patient has defined the area of greatest pain, apply four electrodes on the patient in a criss-cross pattern with the pain centered in the middle. Attach two electrodes to one channel and two electrodes to another channel. Slowly turn up the intensity until the patient feels tingling without contracting the muscle. One channel will run the current at 5,000 Hz while the other runs it at 5,100 Hz, creating a sensory beat frequency of 100 Hz. The 100 Hz delivered at a sensory-stimulation level will stimulate A-beta fibers to overcome the painful A-delta and C fibers while closing the gate to the pain. In this occasion, because the pain is poorly localized you can use a dynamic vector (or sweep or scan, depending on the manufacturer’s instructions). As the vector moves throughout the back, it stimulates a large area, treating most of the region bracketed by the electrodes.

There is a setting on most machines labeled “pre-modulated.” This is for treating mainly longitudinal areas where four electrodes cannot effectively bracket the treatment area. With this two-pole stimulation, electronic manipulation of the currents results in interference in the machine, not the body.

**The Effectiveness of IFC**

Opinions vary regarding the effectiveness of IFC. This is probably because of the lack of clinical research and cross-comparisons with other modalities such as TENS. One scientist found IFC to be effective at increasing blood flow, but four others failed to show an increase in circulation with IFC.5-8 IFC was beneficial for osteoarthritic pain in one study9 but showed little or no benefit in others.10,11 Chronic posttraumatic edema has been found to be reduced by the milking of the venous and lymphatic return systems through electrically evoked muscle contractions using IFC.12

Therapists who have had success with IFC therapy do the following4:

- Correctly position the vector to stimulate the target tissue.
- Use the appropriate size and positioning of the electrodes to stimulate the target tissue.