

Medium Frequency: Interferential Therapy

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Objectives

Explain the physical principles of IFT

Provide rationale for the electro-physical and clinical effects of IFT

Discuss clinical applications of IFT

Describe methods and protocol used in applying IFT

Identify indications and contraindications to be considered prior to use of IFT

Outlines

- ❖ Introduction
- ❖ Definition
- ❖ Physical characteristics
- ❖ Therapeutic uses
- ❖ Contra-indications/Dangers
- ❖ Treatment parameters
- ❖ Practical application

Interferential Therapy (IFT)

Introduction

Developed by Dr. Hans Nemec of Vienna in Australia 1950s

Utilise the therapeutic aspects of low frequency currents without the discomfort.

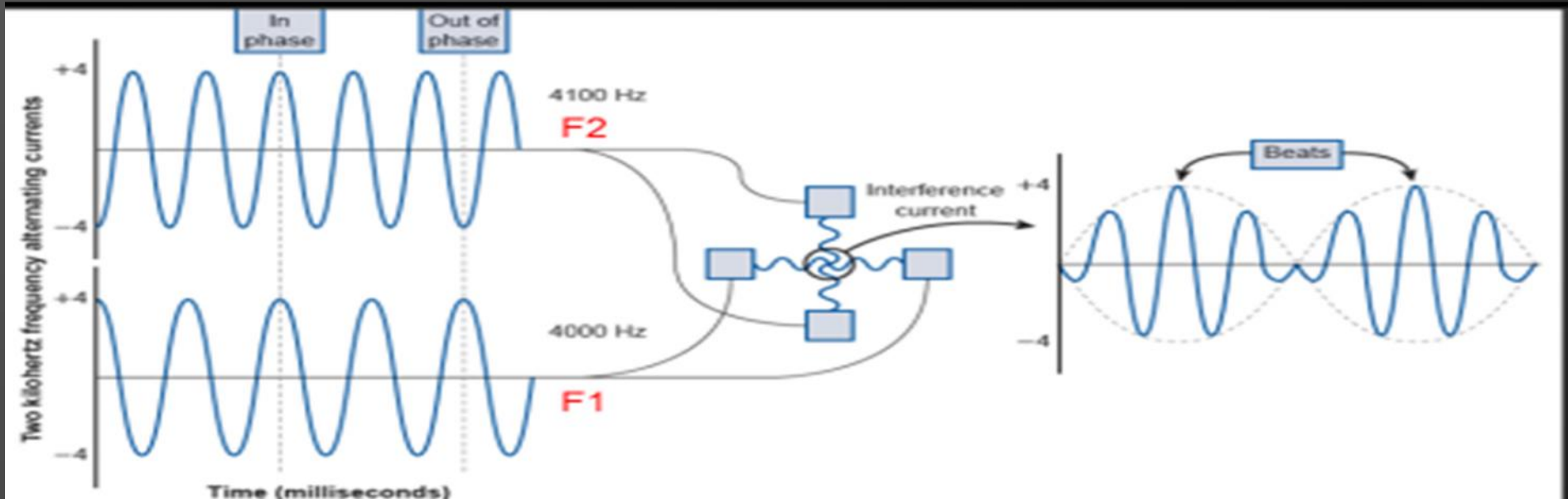
Used in United States by 1980s, become most popular current 2000,

Widely used electrotherapy modality (77-89% PT)

Principal Of Interferential Therapy

Trancutaneous uses of two alternating **out of phase** medium frequency (2000 to 5000Hz) sinusoidal current to introduce low frequency (1 to 250Hz) current used for therapeutic purposes.

IFT used to stimulate sensory and motor nerves without painful and unpleasant side effect associated with low frequency current and with little skin resistance.



Interferential Therapy Principle

- Tissue resistance is **inversely** proportional to *frequency*.

$$Z = 1 / 2 \pi f C$$

Where

Z = Skin resistance by Ohm ()

F = Frequency

C = Capacity of the skin in microfarad ($1 = 10^{-6}$)

The tissue impedance at

50Hz is 3200

4000Hz is 40

Why Interferential Therapy (IFT)

1. Associated with lower skin resistance
2. More comfortable & tolerable
3. Deep penetration

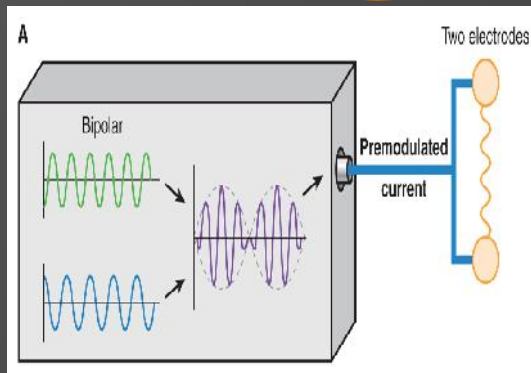
Methods of IFT Production/Applications

Application Modes

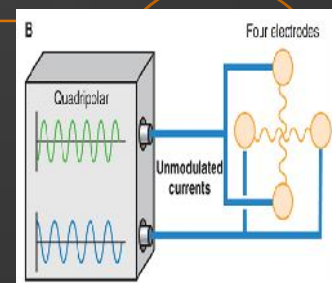
2-poles(Bipolar)

4-poles

Stereo-dynamic Method(3D)



1-Quadripolar static

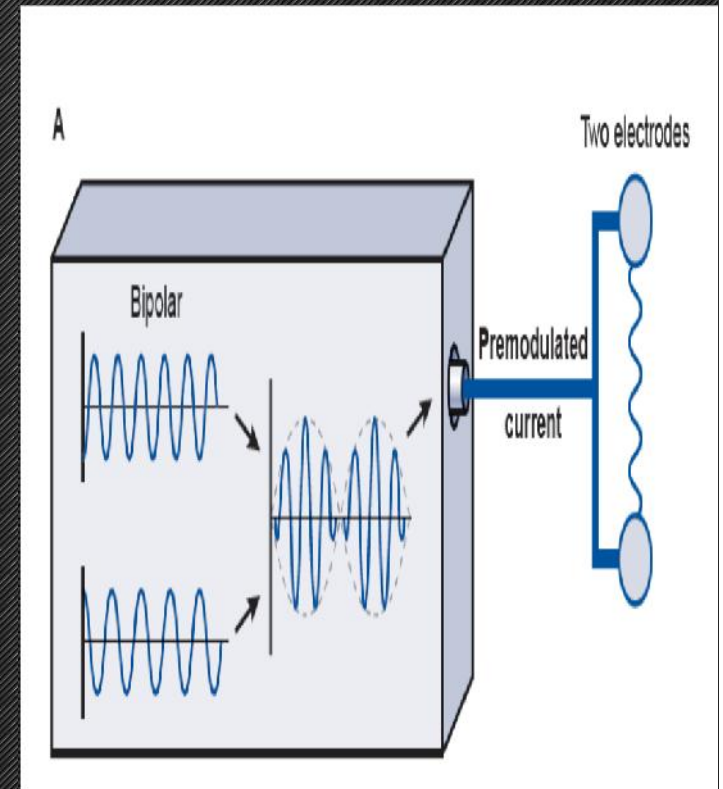


2-Quadripolar with Vector Scan



Pre - Modulated IFC

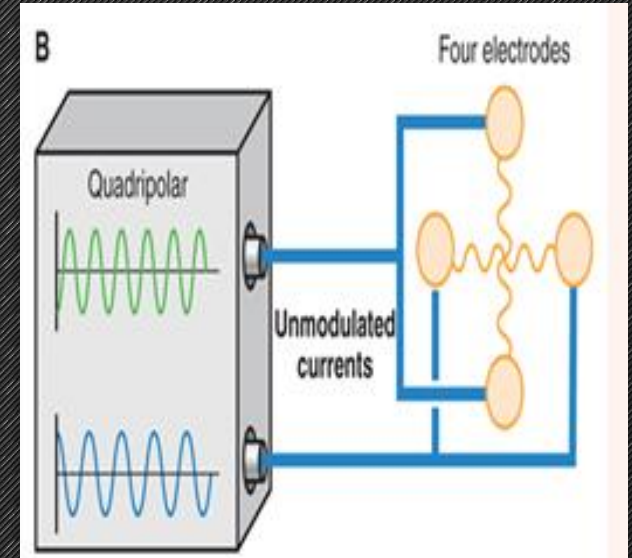
- ❖ 2-poles IFC (Bipolar)/1channel/2electrodes
- ❖ **Production** Interference of two medium frequency sinusoidal current circuit 1 ; $C1=3000\text{Hz}$), with another Circuit ; $C2=3050\text{Hz}$), to introduce low frequency current with beat frequency (50Hz).
- ❖ **Modulation**: Amplitude and frequency modulated beats are pre-mixed in the machine before it is delivered in the patient's skin
- ❖ **Filed** :static
- ❖ **Shape** :oval
- ❖ **Intensity** : Strong but comfortable , highest tolerance of muscles contraction .
- ❖ **Uses**: Suitable for small area (ankle, elbow)



Modulated IFC: static quadripolar

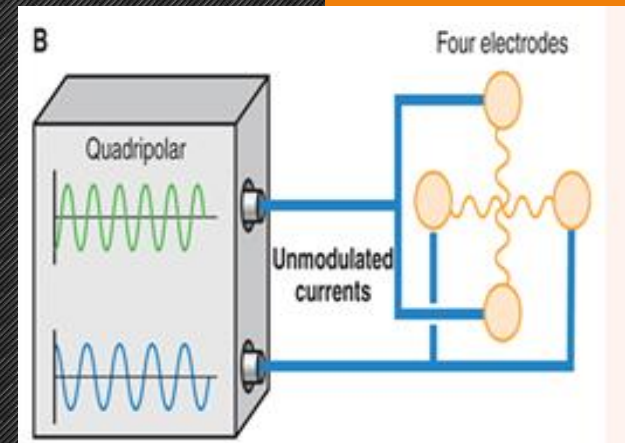
- ❖ 4-poles IFC (quadripolar)/2channels/4electrodes
- ❖ **Production** Interference of two medium frequency sinusoidal current circuit 1 ; $C1=3000\text{Hz}$), with another Circuit ; $C2=3050\text{Hz}$), to introduce low frequency current with beat frequency (50Hz).
- ❖ **Modulation**: Amplitude and frequency modulated beats are pre-mixed in the patient's skin
- ❖ **Filed** :static
- ❖ **Shape** :Four-leaf clover
- ❖ **Intensity** : Strong but comfortable , highest tolerance of muscles contraction . The **maximum amplitude** of current is **halfway** between the **lines of two currents**.

Uses: for acute conditions because of its mildness effect

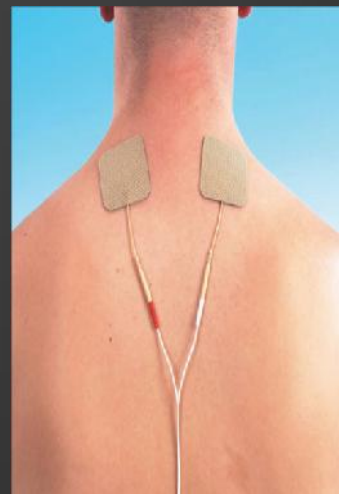
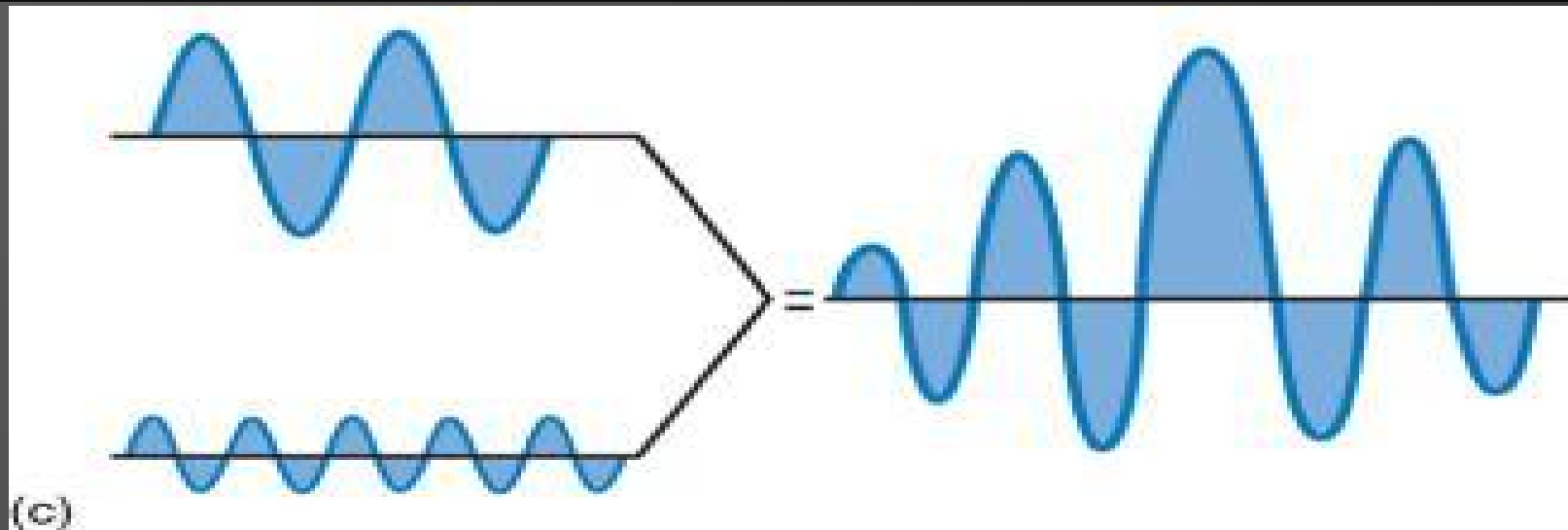


Modulated IFC: quadripolar vector scan

- ❖ 4-poles IFC (quadripolar)/2channels/4electrodes
 - ❖ **Production** Interference of two medium frequency sinusoidal current circuit 1 ; $C1=3000\text{Hz}$), with another Circuit ; $C2=3050\text{Hz}$), to introduce low frequency current with beat frequency (50Hz).
 - ❖ **Modulation**: Amplitude and frequency modulated beats are pre-mixed in the patient's skin
 - ❖ **Filed** :dynamic
 - ❖ **Shape** :circular
 - ❖ **Intensity** : Strong but comfortable , highest tolerance of muscles contraction . The **maximum amplitude** of current is **halfway** between the **lines of two currents**.
- Uses**: best suited for large area and diffuse pain as shoulder, back, and thigh.

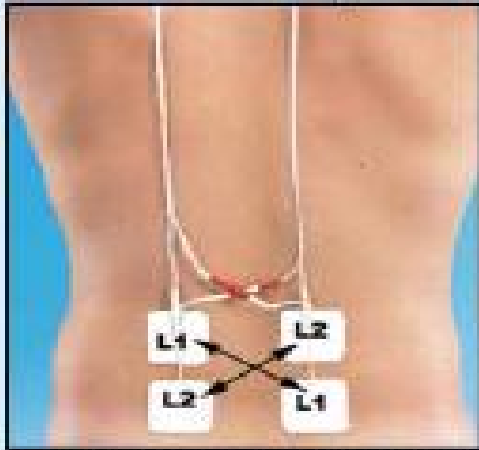


Bipolar Method

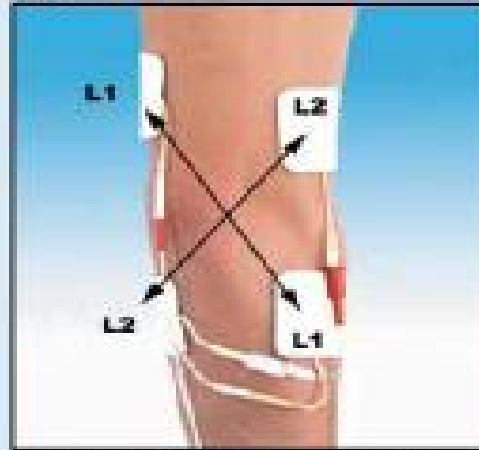


Quadripolar Method

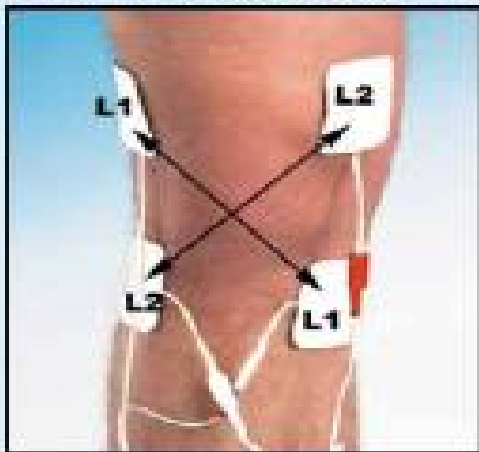
Examples of Application



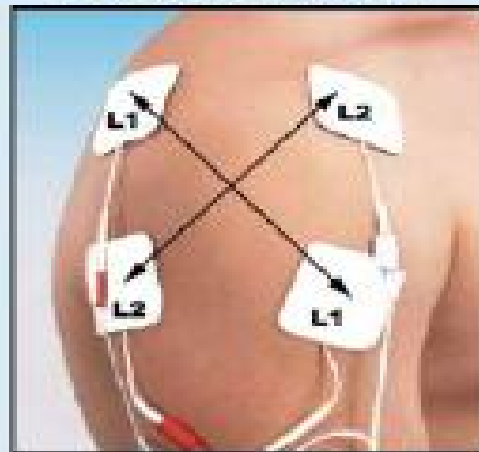
Chronic Lower Back Pain



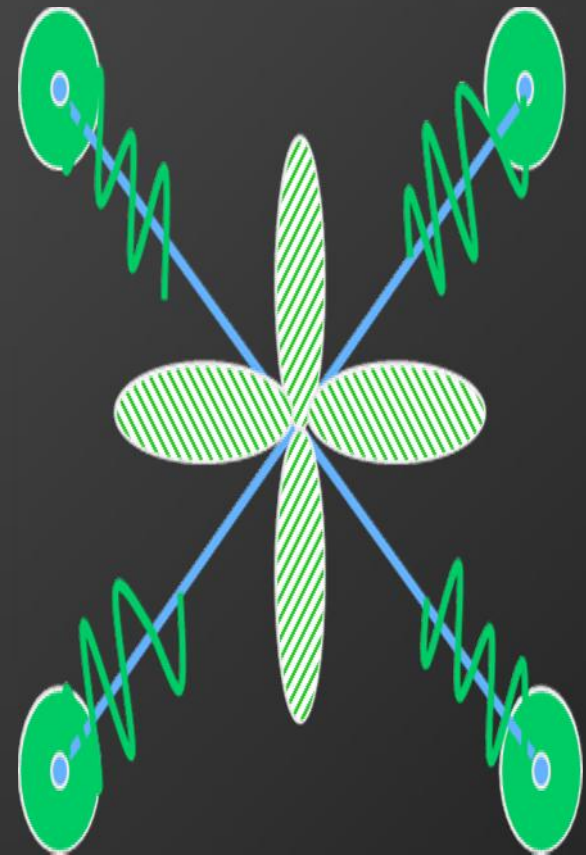
Elbow and Joint Pain



Knee Pain and Swelling

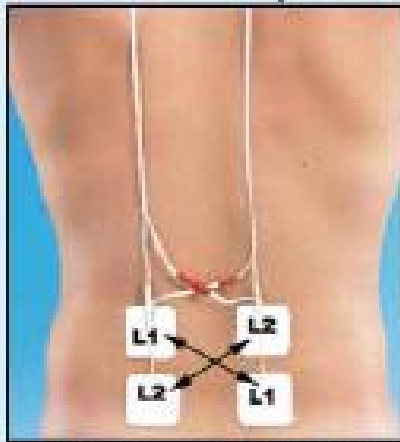


Shoulder Muscle Spasm

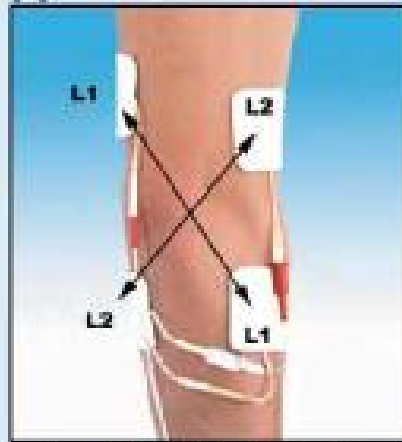


Quadripolar with Vector Scan

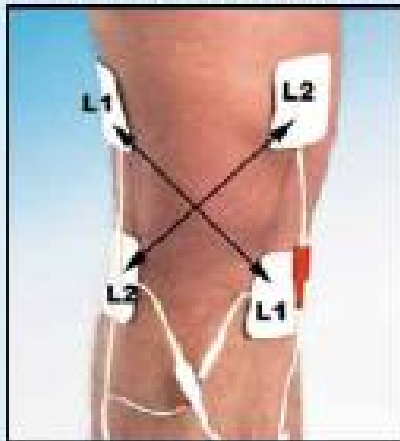
Examples of Application



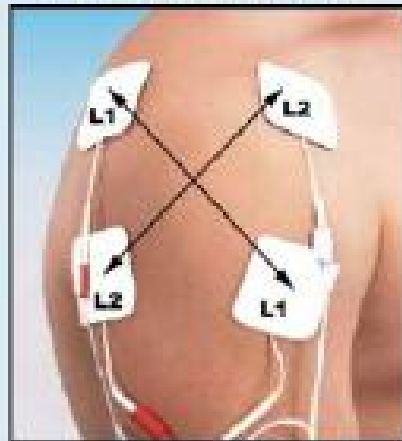
Chronic Lower Back Pain



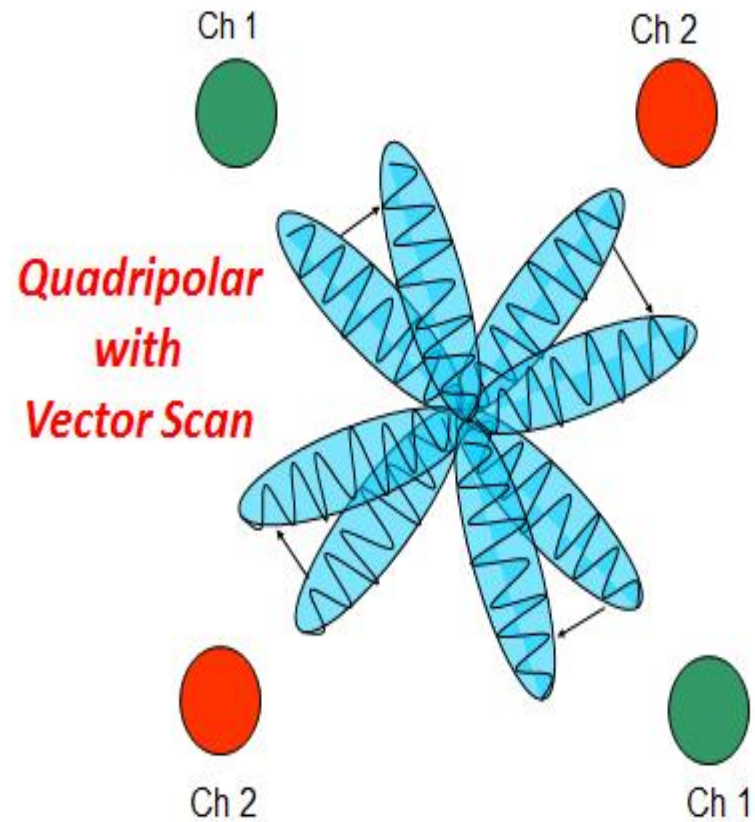
Elbow and Joint Pain



Knee Pain and Swelling



Shoulder Muscle Spasm



Frequency Sweep

Interference frequencies come in automatic pre selected modes with a desired intensity at a constant/rhythmic level .

Frequency scale: 1 to 100Hz **Constant frequency**

1 to 10Hz **Rhythmic frequency**

90 to 100Hz **Rhythmic frequency**

Constant Beat Frequency

Constant difference between the two circuits and this results in a constant beat frequency, If $C1=4040\text{Hz}$ and $C2=4000\text{Hz}$, $BF=40\text{Hz}$. Allows frequency differences between 1-120Hz

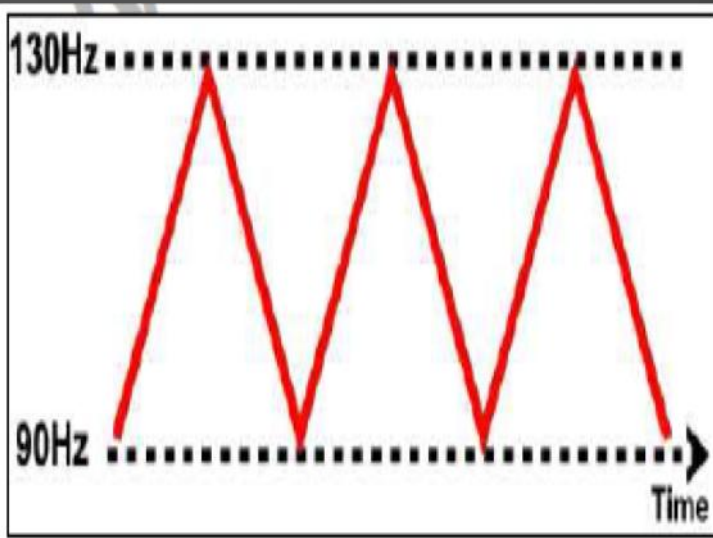
Rhythmic Beat frequency

It is obtained when one carrier frequency remains fixed and the other keeps on changing in frequency at regular interval from lower to higher value and back down. It may take **10 seconds to go up and 5 seconds to come down**, it is known as **Sweep** , this sweep prevents accommodations of the excitable tissue.

Frequency Sweep Pattern

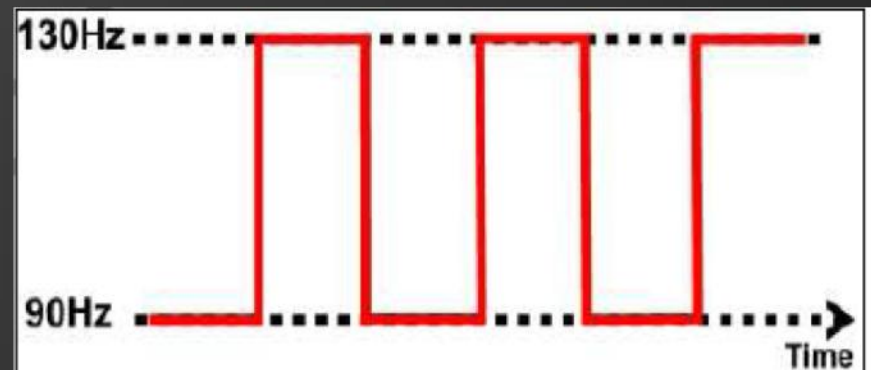
Triangular sweep pattern:

The machine gradually changes from the base to the top frequency over 6 seconds (1-3seconds)



Rectangular (sweep pattern:

This produces a very different stimulation pattern in that the base and top frequencies are set but the machine then “switches” between these two specific frequencies rather than gradually changing from one to other.



Faster sweep is used for less painful stimulation & strong muscle contraction

IFC advantages & disadvantages

Advantages

1. More comfortable than TENS
 - a. Medium-frequency currents meet with less skin resistance than low frequency currents; TENS uses low frequency currents
2. Stimulates tissues deeper than a TENS unit
3. Larger coverage area than TENS

Disadvantages

- 1-Eliminates pain; doesn't deal with cause of the pain
2. Few portable units available
3. Expensive

Physiological Effects of IFT

- **The depends upon**

- 1-Magnitude of current.
- 2-Mode: rhythmic, constant
- 3-Frequency of current
- 4-Accuracy of electrodes position
- 5-Patency of circulation and neurological function
- 6-Underlying pathophysiology in relation to desired effect

- **The 4 main clinical applications are**

1. Pain relief
2. Muscles stimulation
3. Increased local blood flow
4. Reduction of edema

Effect of Rhythmic or constant frequency

100 Hz Constant	1 to 10 Hz Constant	1 to 100 Hz Rhythmic	90 to 100 Hz Rhythmic	1 to 10 Hz Rhythmic
<p>(+++) sensory nerve endings, producing analgesia.</p> <p>Fine vibration of ions without producing heat.</p> <p>(---)sympathetic system</p> <p>Long lasting pain relief.</p>	<p>(+++) motor nerves & causes muscle contraction</p> <p>Less sensory stimulus, greater depth of contraction and quite pleasant to feel than faradic-type currents</p> <p>Only stimulate normal innervated muscles</p>	<p>Alternate rhythmic excitation & relaxation of tissues producing more hyperaemia and increased cellular activity</p> <p>Caused by stimulating fine vibrations in the ions</p> <p>Aids in relief of oedema and in facilitating healing process</p>	<p>Analgesic & vasodilatory effects on tissues</p> <p>Used for neuralgic types of pain</p> <p>less adaptation than with 100Hz constant</p>	<p>(+++) motor nerves Vasodilatory effects causes vigorous pumping effect that aids in the absorption of exudates</p>

Pain

This may be achieved through

Higher frequencies (90-130Hz) stimulate pain gate mechanisms

Lower frequencies (2-10Hz) can be used to activate the opioid

IFT has marked analgesic effect on pain in following conditions.

- 1. Reflex sympathetic dystrophy**
- 2. Stump pain**
- 3. Herpes Zoster**
- 4. Vascular insufficiency**
- 5. Myofascial Pain Syndrome (MPS)**

IFC is not effective in post-traumatic pain in the acute stages

Acute pain

90 to 100 Hz rhythmic
Medium dosage
10 mins.

Chronic pain

100 Hz constant, 1-100 Hz rhythmic
Medium dosage
10 mins

Muscle Stimulation

- No significant evidence that has demonstrated a significant benefit of IFT over active exercise.
- Note: Except for clinical circumstances where assisted contraction is beneficial.
- Choice of parameters will depend on the desired effect.
- Most effective motor nerve stimulation range= 10 and 20, 10 and 25 Hz
- 1-10 Hz rhythmic, high dosage, 5-10 mins. Up to 15 mins.

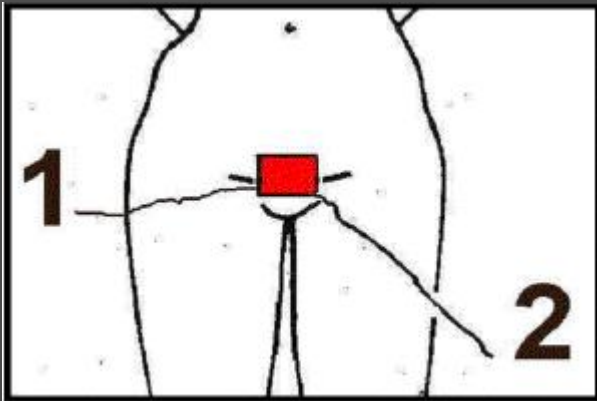
Urinary Incontinence

Strong muscle contraction using interferential therapy will be used to cause muscle re-education for pelvic floor muscles

- ▶ **Program I** **1-100Hz rhythmic**
- ▶ **Program II** **10-100Hz rhythmic**
- ▶ **Program III** **100Hz consistent**

Electrodes placement Technique I

One electrode placed under the ischial tuberosity and other placed inferior to the symphysis pubis



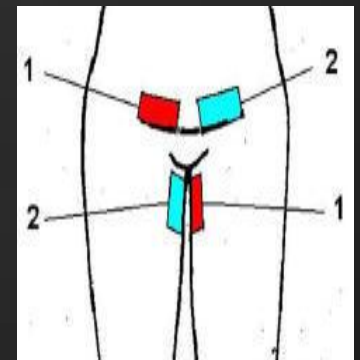
Duration of treatment
Dosage :

10-30 minutes.
Medium

Technique II

Two electrodes are placed symmetrically on the abdomen above the inguinal ligament, 3 cm apart.

- Two electrodes are placed on the inside of the thighs below the inferior border of the femoral triangle



Edema & Hematoma

Edema

PI- 1-100Hz rhythmic

PII- 100Hz consistent

Physiological effects :

- Vibration of ions and facilitates ions movement in the cells.
- Alternative rhythmic excitation and relaxation produce muscles pump
- Alteration of cell membrane permeability (**electroporation**)
- Increase venous and lymphatic drainage

Hematoma

Acute stage Using 100Hz constant current, with ice application.

Chronic stage: Using 100Hz constant current with ultrasound

Interferential Contraindication

- Arterial disease
- DVT
- Infective conditions
- Pregnant uterus
- Hemorrhage
- Malignant tumors
- Artificial pacemakers
- During menstruation
- Febrile conditions
- Large open wound
- Unreliable patients
- Dermatological conditions

Dangers and Precautions

Burn

- May be due to
1. Bar metal electrodes against skin
 2. Increased intensity
 3. Insufficient moisture pads

Hematoma

Suction force (negative pressure) may cause hematoma & ecchymosis

Poor results

Improper position of electrodes
Poor balanced circuit
Incorrect choice of frequency

Device must be away from diathermy device by 6 meters

IFT Applications Parameters

I-Stimulator types

1. Desk cabinet (lined –powered).
2. Portable (battery powered).

II-Methods of delivery

1. **Bipolar**: for localized tissue
2. **Quadripolar** : for deeper tissue
3. **Quadripolar with vector** :for deeper tissue with enlarged area.

III-Current modes

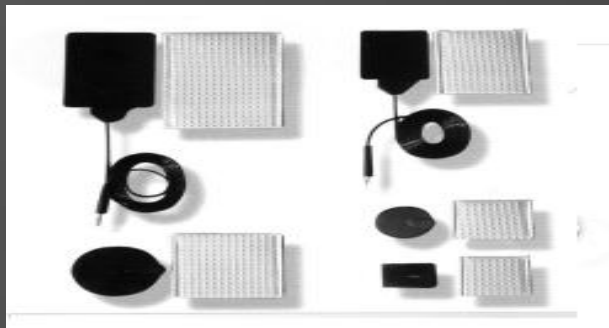
Constant current modes

Sweep current (rhythmic current modes)

IFT Applications Parameters

IV-Electrode types (plate , Pen and vacuum)

Pad, rubber carbon-impregnated.



Large more comfortable /deep
Secure with straps/ Velcro
Flat smooth area
Not suitable for Irregular area

Vacuum or suction (rubber or metal) electrodes.



Causing bruising of tissues
Secure
Flat smooth area
Irregular area
Not ideal for hairy area

IFT Applications Parameters

V-Intensity of Current

-use an intensity of current which produces a strong but **comfortable prickling** sensation without a muscular contraction;

-Steps to follow:

- 1) Increase current until the patient feels a definite prickling, and leave for 1-5 minute for it to decrease.
- 2) Increase current again until the patient reports a slight muscular contraction, then decrease until contraction stops

VI-Duration of treatment:

- IFC usually applied for 10-20 minutes treatment at a normal intensity.
- Should not be given to one area for longer than 20 minutes
- If more than one area is to be treated a total time should not exceed 30 min.

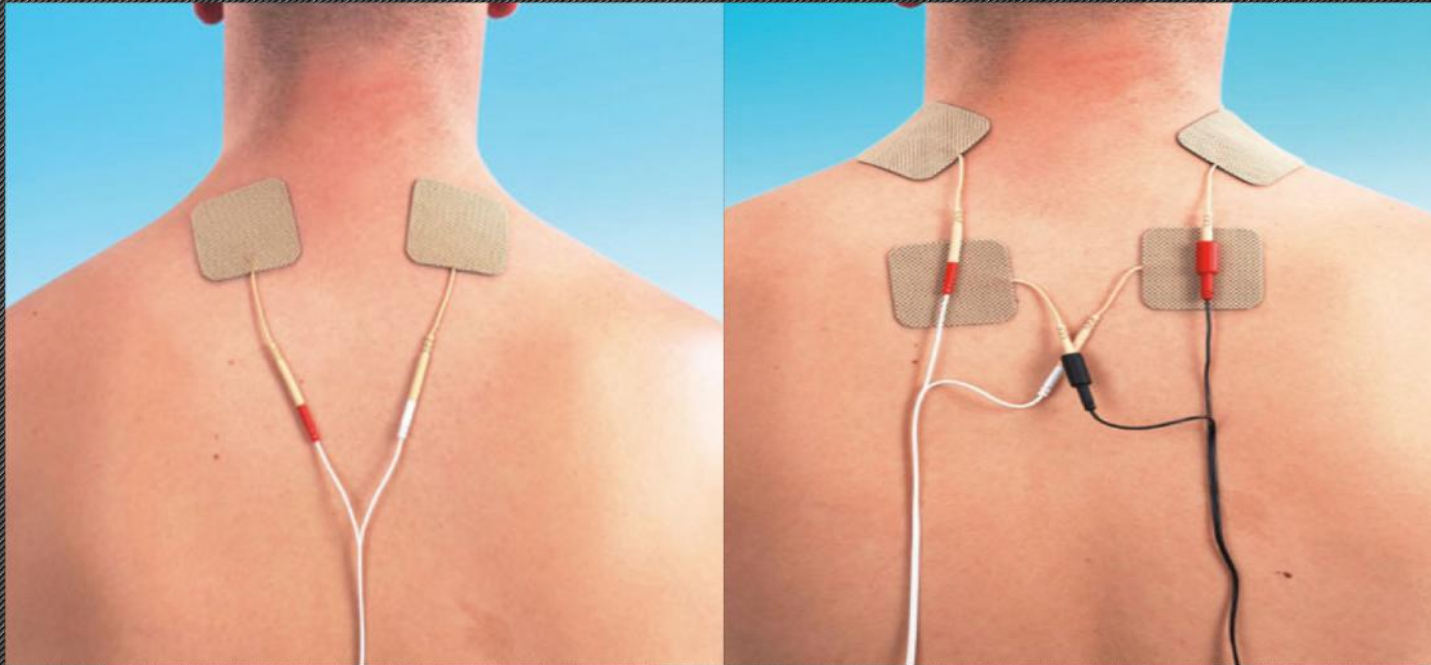
VII-Frequency of Treatment

- In most cases, treatment every other day (i.e. 3/wk.) is ideal
- A course of 12-24 treatments is given (Use until IFT is no longer effective)

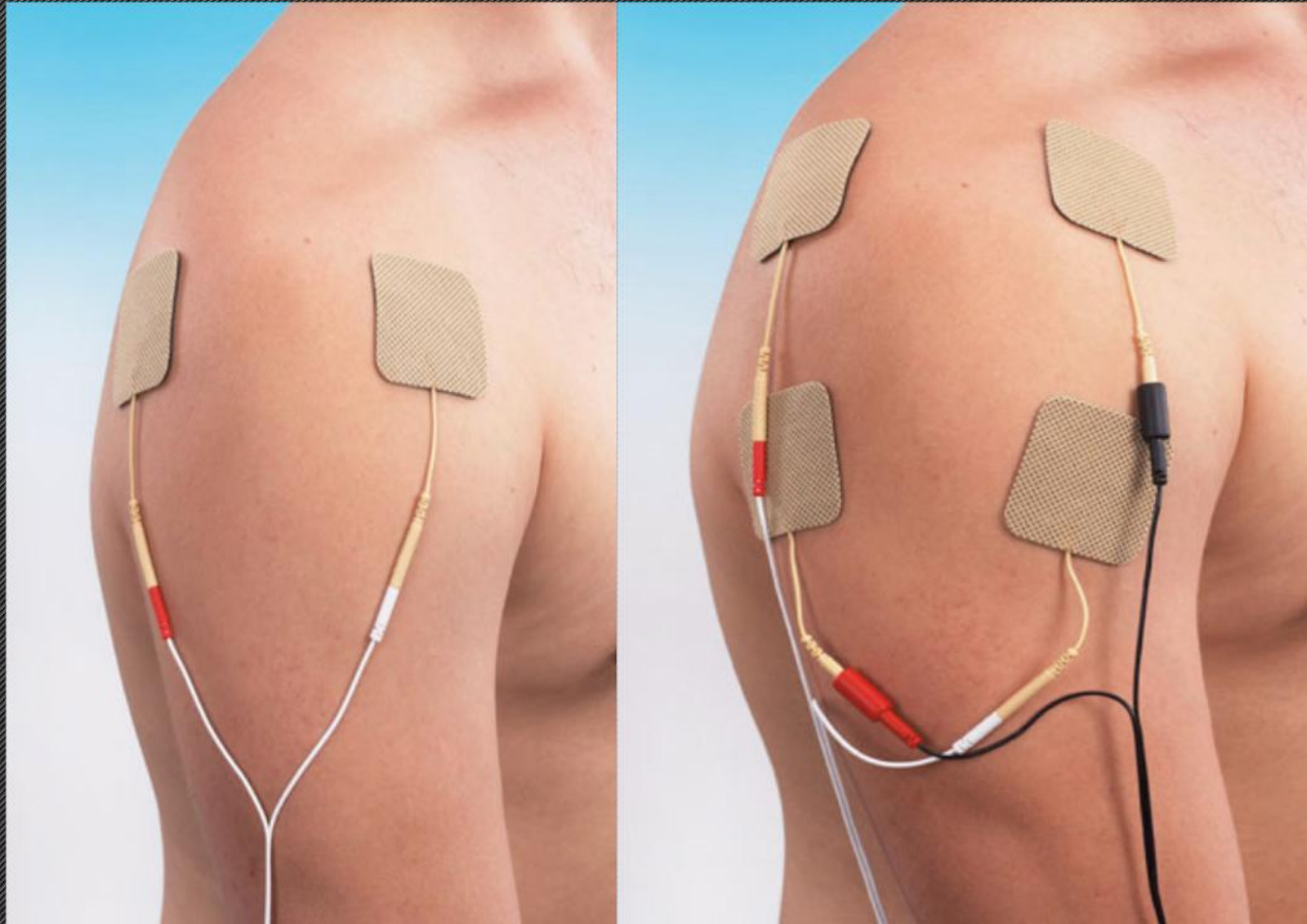
TENS-Electrodes Placement: Knee/elbow Pain



TENS-Electrodes Placement: Neck Pain



TENS-Electrodes Placement: Shoulder Pain



TENS-Electrodes Placement: Low Back Pain

