Interferential Currents

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Learning Objectives

At the end of this lecture, the students will be able to-----

- define the interferential current
- describe basic principles of interferential therapy
- state about the definition and terms applied with interferential therapy
- identify methods of treatment , advantages of interferential currents and physiological effects of interferential therapy

Contents

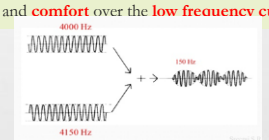
- Medium frequency current
- Interferential current
- Basic Principles of interferential therapy
- Definition and Terms applied with interferential therapy
- Methods of treatment
- Advantages of interferential currents
- Physiological effects of interferential therapy

Classification of Currents

- On the basis of the direction of flow of current
  - AC (flow in both direction)
  - DC (flow in one direction)
- On the basis of frequency
  - Low frequency (50 to 100 Hz)
    e.g. IDC, Faradic, galvanic, TENS
  - Medium frequency (100 to 4000 Hz)
    e.g. interferential currents
  - High frequency (frequency more than 1 MHz)
    e.g. SWD,MWD

Medium Frequency Currents

- the currents whose frequency falls between the range of 1000 to 10000 Hz
- due to their advantage of greater penetration and with a **higher tolerance** and **comfort** over the **low frequency current**

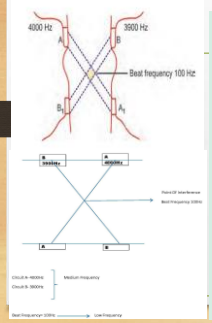


Amplitude modulation frequency

Interferential Therapy

- Nemec's currents
- Two medium frequency current → Low frequency current
- Direct application of faradic current → pain (high impedence of tissue)
- Two medium frequency current
  (1) 4000 Hz (minimum impedence)
  (2) 3900 Hz (can be varied accordingly)

Basic Principle of Interferential Therapy



- Two medium frequency currents crossing in the patient tissue
- Interference produced by two currents in the tissue is called beat frequency
- frequency of new current is called interferential current that is 100 Hz

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Basic Principle of Interferential Therapy

- By varying the frequency of the second channel relative to the constant frequency of the first, this can produce a range of beat frequencies deep in the patient's tissues
- Range of beat frequency 1 – 250 Hz
- As a major advantage, IFC can be used for pain relief as well as for muscle stimulation without unnecessary or uncomfortable skin stimulation

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Basic Principle of Interferential Therapy

- So that the patient cannot be given higher doses in low frequency therapy apparatus
- Skin resistance offered to the 4000 cycles/second is very much less than the resistance offered to the low frequency current
- The reduction in pain is because of gate control theory and stimulated release of pain reducing substances (endorphin and encephalin)

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Definition and Terms applied with Interferential Therapy

- ***Interferential current*** is the resultant current produced when two or more alternating currents are applied simultaneously at the point of intersection in a given medium
- ***Impedance :*** Resistance, capacitance and inductance all these collectively from the impedance of the circuit. This impedance is a type of resistance produced by the tissues against any electrical stimulation of low frequency

$Z = 1/2\Pi fC$

- Z = skin impedance
- f = frequency in Hertz (Hz)
- C = capacitance of skin in microfarads

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Definition and Terms applied with Interferential Therapy

Skin Impedance

$Z = 1/2\Pi fC$

- Z = skin impedance
- f = frequency in Hertz (Hz)
- C = capacitance of skin in microfarads

- It is assumed that a capacitance of 1 microfarad.
- For a 50-Hz alternating current we obtain:
- $Z = 1/2\pi \times 50 \times 10^{-6} = 3200\ \Omega$
- For a 4,000-Hz alternating current this means:
- $Z = 1/2\pi \times 4000 \times 10^{-6} = 39{,}8\ \Omega$

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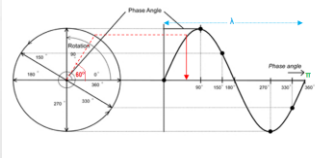
Definition and Terms applied with Interferential Therapy

- ***Phase :*** The current travelling from 0 to 180 is same phase and the current travelling from 180 to 360 is called in opposite phase



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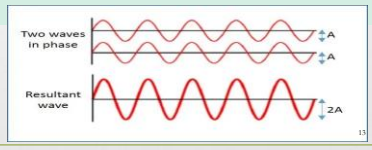
Definition and Terms applied with Interferential Therapy

- ***Phase :*** Wherever two waves of same frequency travel in same phase, then the peak of their crest and trough coincide and the resultant wave has amplitude more than the original amplitudes.
- But frequency will not change



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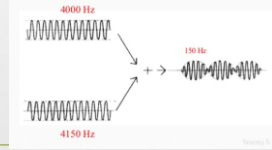
Definition and Terms applied with Interferential Therapy

- ***Phase :*** If two currents are traveling with little difference in their frequency then the amplitude of resultant wave will increase or decrease in regular cycle.
- This is called ***amplitude modulation frequency. (beat frequency)***



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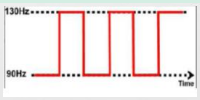
Definition and Terms applied with Interferential Therapy

- ***Sweep frequency :*** frequency which can be directly fed to the beat frequency by the machine
- ***Spectrum:*** varying frequency to prevent accommodation

Triangular Sweep pattern



Rectangular Sweep Pattern

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Definition and Terms applied with Interferential Therapy

- ***Electrodes :*** flexible electrodes are used (tape) or vacuum electrodes
- 4 electrodes are used
- Two electrodes (in same device)

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Methods of Treatment

1. Skin must be ***clean and clear*** before the start of the treatment
2. The part of the body to be treated should be washed and if there is ***any skin lesion*** it should be covered by applying petroleum jelly on it.
3. Electrodes positioning (---------)
4. Suitable frequency current

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Methods of Treatment

5. Select the ***spectrum mode*** rectangular, triangular or trapezoidal
6. ***Base frequency and upper frequency***
7. Increase power (-----)
8. Current in channel 1 and 2
9. Balance control
10. Two electrode ***(superimposition of two channels internally)***
11. After the treatment, -------
12. Switch "-------"

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Advantages of Interferential Currents

1. Any sensory nerve irritation
2. most useful in treating tissues at a greater depth
3. Resistance of skin is minimum
4. Localized more effectively in specific area

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Physiological effects of Interferential Currents

1. Magnitude of the current
2. Type of mode used- Rhythmic or constant
3. The frequency range used
4. Accuracy of electrode positioning

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1. Relief of Pain

- Relief of pain is an important physiological effect obtained by the use of interferential therapy.
- The increase in local blood circulation due to the local pumping effect of the stimulated muscles or the effect on autonomic nerves and thus the blood vessels help removing the chemicals from the local area.
- Short duration pulses at a frequency of 100 Hz may stimulate large diameter nerve fibers which will have an effect on the pain gate in the posterior horn, and inhibit transmission of small diameter nociceptive traffic.

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1. Relief of Pain

- A frequency of 80–100 Hz rhythmic is usually chosen for this effect, as the problem of accommodation is reduced
- In order to selectively activate the descending pain suppression system, a frequency of 15 Hz is required and the stimulation of small diameter fibers produced will eventually cause the release of endogenous opiates (enkephalin and β endorphin) at a spinal level
- A physiological blocking of nerve transmission is also postulated as a mechanism of pain modulation produced by interferential therapy. It is thought that the maximum frequency of transmission in C nerve fibers is 15 Hz and in Aδ fibers is 40 Hz.

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1. Relief of Pain

- The application of frequencies higher than this maximum could block transmission along these fibers altogether.
- Consideration should also be given to the effective aspects of

pain modulation, and there is probably a strong placebo effect associated in many different countries claim good results in the modulation of both acute and chronic pain syndromes.

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2. Motor Stimulation

- Normal innervated muscles will be made to contract if interferential frequencies between 1 and 100 Hz are used. The type of contraction depends on the frequency of stimulation, as the shape and length of each individual stimulus is of a muscle stimulating type.
- At low frequencies a twitch is produced, between 5 and 20 Hz a partial tetany, and from 30 to 100 Hz a tetanic contraction. A complete range of all these types of muscle contraction can be seen when a rhythmical frequency of 1–100 Hz is used

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2. Motor Stimulation

- Muscle contraction is produced with little sensory stimulation, and can be of deeply placed muscles, e.g. pelvic floor. Unfortunately, the patient is unable to voluntarily contract with the current (unlike faradism), but this does not seem to adversely affect the results. It is claimed that the rapid return of tune to the pelvic floor when treated with interferential therapy is the result of stimulation of both the voluntary and smooth muscle fibers; faradism can only stimulate the voluntary component.

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3. Absorption of exudates

- This is accelerated by a frequency of 1–10 Hz rhythmic, as a rhythmical pumping action is produced by muscle contraction, and there is possible an effect on the autonomic nerves which can affect the diameter of blood vessels, and therefore the circulation. Both of these factors will help absorb exudates and thus reduce swelling.

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References

- Singh, J. (2012) Medium Frequency Currents. In *Textbook of Electrotherapy*, ed. J. Singh; p. 135-139. 2nd ed. Jaypee Brothers Medical Publishers in New Delhi, India.