

# **ADVANCED BIO MEDICAL INSTRUMENTATION**

## **LECTURE 07: ULTRASONIC INSTRUMENTS**

### **ULTRASONIC DIATHERMY**

Ultrasound diathermy employs high-frequency acoustic vibrations which, when propelled through the tissues, are converted into heat. This type of diathermy is especially useful in the delivery of heat to selected musculatures and structures because there is a difference in the sensitivity of various fibers to the acoustic vibrations; some are more absorptive and some are more reflective. For example, in subcutaneous fat, relatively little energy is converted into heat, but in muscle tissues there is a much higher rate of conversion to heat. The therapeutic ultrasound apparatus generates a high-frequency alternating current, which is then converted into acoustic vibrations. The apparatus is moved slowly across the surface of the part being treated. Ultrasound is a very effective agent for the application of heat. It is used for many types of musculoskeletal sprains, strains, and fractures.

Patients undergoing ultrasonic diathermy have a cream or gel applied to the affected area. In ultrasound diathermy, a therapist moves a wand continuously over the affected area.

### **MICROWAVE DIATHERMY**

Microwave diathermy uses radar waves, which are of higher frequency and shorter wavelength than radio waves. Most, of the therapeutic effects of microwave therapy are related to the conversion of energy into heat and its distribution throughout the body tissues. This mode of diathermy is considered to be the easiest to use, but the microwaves have a relatively poor depth of penetration.

Microwaves cannot be used in high dosage on edematous tissue, over wet dressings, or near metallic implants in the body because of the danger of local burns. Microwaves and short waves cannot be used on or near persons with implanted electronic cardiac pacemakers. Microwave diathermy-induced hyperthermia produced short-term pain only.

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## SURGICAL DIATHERMY

Electrosurgery (diathermy) is defined as the cutting and coagulation of body tissue with a high frequency (ie,radio frequency) current.

### *Monopolar Diathermy*

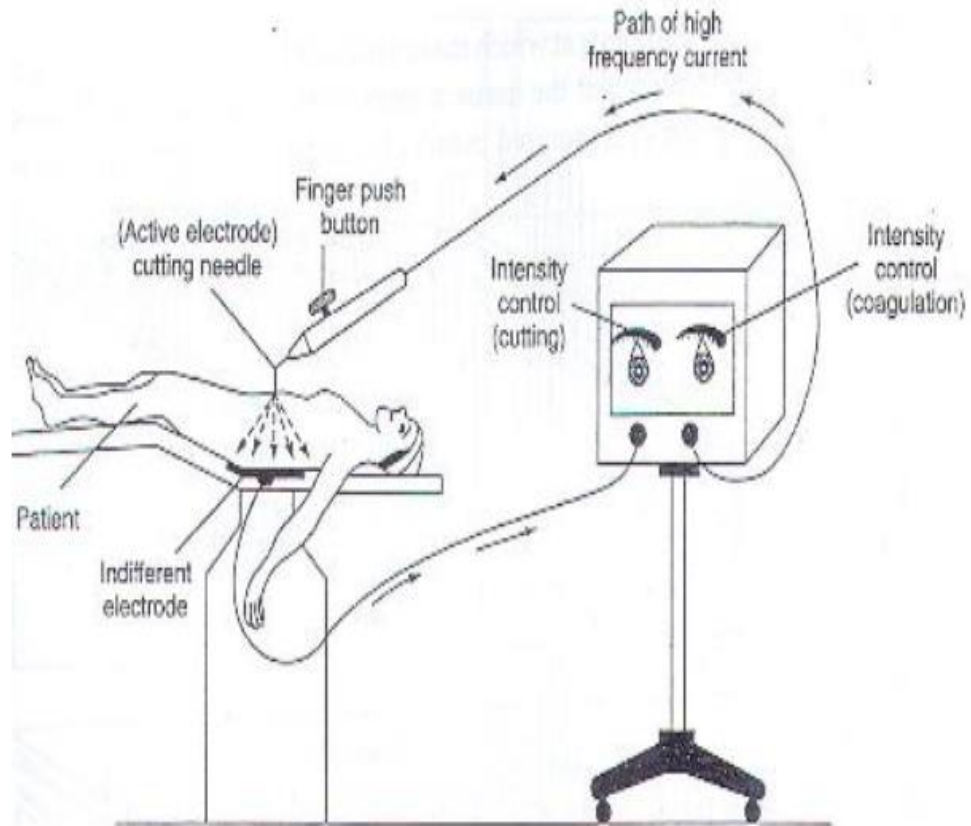
The passage of a high frequency current which passes through the patient from the live or active electrode (diathermy forceps or pencil) to the return electrode. Return electrode is also known as indifferent electrode, patient electrode or diathermy pad. Where the flow of the current is resisted in body tissue, there is a localised rise in temperature which will create a high enough temperature to produce the relevant effect of coagulation or cut.

### *Bipolar Diathermy*

In bipolar diathermy, the active and return electrodes are combined within the diathermy forceps and the current passes between the two points which are both separated with insulating material. Bipolar diathermy is perceived to be safer as the current pathway is much shorter than that utilised in monopolar diathermy. Bipolar diathermy is generally utilised in the following situations:

- When coagulation only is required
- When coagulation is required in peripheral areas of the body such as hands or feet or other areas where 'channelling' may occur
- In procedures where pinpoint or micro coagulation is required
- When a patient has a pacemaker in situ

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### *Working Principle*

Electrosurgery requires an electrocautery generator which produces the radio frequency current, cable and active electrode and a return plate or indifferent electrode for the use of monopolar diathermy.

The electrocautery generator or unit can produce three distinct surgical effects, known as fulguration, desiccation and cutting. The electrocautery generator creates different wave forms which are determined by the setting on the machine, universally known as COAG, CUT and BLEND.

The settings and desired effects are given as follows:

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1. Dessication and COAG: The COAG waveform consists of bursts of radiofrequency, which when used on low power create the effect known as Dessication. Dessication is defined as a relatively slow drying out of tissues by current that does not produce sparks which in turn leads to coagulation
2. Fulguration and COAG: When the COAG waveform is used at a high power setting it will create the effect known as fulguration. The high power generates sparks which create intermittent heating of tissue causing cells to dry out quickly rather than explode into steam.
3. Cutting: The CUT waveform is a continuous waveform at a lower voltage but higher current than COAG. This creates a high density of current in a specific tissue area within a short period of time. This results in cell explosion due to the localised but intense heat.
4. Blend: This is a combination of CUT and COAG and is used where haemostasis is required as tissue is cut.

