* Shortwave and Microwave Diathermy

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* Diathermy
* Application of High-Frequency Electromagnetic Energy
* Used To Generate Heat In Body Tissues
* Heat Produced By Resistance of Tissues
* Also Used For Non-Thermal Effects
* Physiologic Responses To Diathermy
* Not Capable of Producing Depolarization and Contraction of Muscles
* Wavelengths Too Short
* Physiologic Responses To Diathermy
* Physiologic Effects Are Those of Heat In General
* Tissue Temperature Increase
* Increased Blood Flow (Vasodilation)
* Increased Venous and Lymphatic Flow
* Increased Metabolism
* Changes In Physical Properties of Tissues
* Muscle Relaxation
* Analgesia
* Diathermy Heating
* Doses Are Not Precisely Controlled Thus The Amount of Heating Cannot Be Accurately Measured
* Heating= Current2 X Resistance
* Non-Thermal Effects
* Pulsed SWD Used To Treat Soft Tissue Injuries and Wounds
* Related To Depolarization of Damaged Cells
* Loss of Cell Division
* Loss of Proliferation
* Loss of Regenerative capabilities
* Repolarization Corrects Cell Dysfunction
* Shortwave Diathermy
* Radio Transmitter With FCC Assigned Frequencies
* 27.12 MHz at 11 M
* 13.56 MHz at 22 M
* 40.68 MHz at 7.5 M
* Shortwave Diathermy Unit
* Power Supply Powers Radio Frequency Oscillator (RFO)
* RFO Provides Stable Drift-Free Oscillations at Given Frequency
* Power Amplifier Generate Power To Drive Electrodes
* Output Resonant Tank Tunes In The Patient for Maximum Power Transfer
* Shortwave Diathermy Unit
* A=Power Switch
* B=Timer
* C=Power Meter(monitors current from power supply not current entering patient-volume control)
* D=Output Intensity(%max power to patient)
* E=Tuning Control(tunes output from RFO)
* Shortwave Diathermy Unit
* Power Output Should Provide Energy To Raise Tissue Temp To Therapeutic Range (40-45 deg C) (80-120 watts)
* Should Exceed SAR-Specific Absorption Rate (rate of energy absorbed /unit area of tissue mass)
* Adjusting SWD Unit
* Manual vs Automatic Tuning
* Manual Tuning (adjusts patient circuit)
* Set Output Intensity at 30-40%
* Adjust Tuning Control Until Power Output Meter Reaches Max
* Then Adjust Down to Patient Tolerance Which Is About 50%
* If More Than 50% Patient Is Out of Resonance
* Shortwave Diathermy Unit
* Generates Both an Electrical and a Magnetic Field
* Ratio Depends on Characteristics of Both The Generator and the Electrodes
* SWD Units at 13.56 MHz= Stronger Magnetic Field
* SWD Units at27.12 MHz = Stronger Electrical Field
* SWD Electrodes
* Capacitor Electrodes
* Inductor Electrodes
* Selection of Appropriate Electrodes Can Influence The Treatment
* Capacitor Electrodes
* Create Stronger Electrical Field Than Magnetic Field
* Ions Will Be Attracted Or Repelled Depending on the Charge of the Pole
* Capacitor Electrodes
* Electrical Field Is The Lines of Force Exerted on Charged Ions That Cause Movement From One Pole To Another
* Center Has Higher Current Density Than Periphery
* Electrical Field
* The Tissue That Offers The Greatest Resistance To Current Flow Develops The Most Heat
* Fat Tissue Resists Current Flow
* Thus Fat Is Heated In An Electrical Field
* Typical With Capacitor Electrodes
* Capacitor Electrodes  
  (Air Space Plates)
* Two Metal Plates Surrounded By Plastic Guard
* Can Be Moved 3cm Within Guard
* Produce High-Frequency Oscillating Current
* When Overheated Discharges To Plate Of Lower Potential
* Air Space Plate Electrodes
* Area To Be Treated Is Placed Between Electrodes Becoming Part of Circuit
* Air Space Place Electrodes
* Sensation Of Heat In Direct Proportion To Distance Of Electrode From Skin
* Closer Plate Generates More Surface Heat
* Parts Of Body Low In Subcutaneous Fat Best Treated
* Capacitor Electrodes  
  (Pad Electrodes)
* Greater Electrical Field
* Patient Part of Circuit
* Must Have Uniform Contact (toweling)
* Spacing Equal To Cross-sectional Diameter of Pads
* Part To Be Treated Should Be Centered
* Pad Electrodes
* Increasing The Spacing Will Increase The Depth Of Penetration But Will Decrease The Current Density
* Induction Electrodes
* Creates A Stronger Magnetic Field Than Electrical Field
* A Cable Or Coil Is Wrapped Circumferentially Around An Extremity Or Coiled Within n Electrode
* Induction Electrodes
* Passing Current Through A Coiled Cable Creates A Magnetic Field By Inducing Eddy Currents (small circular electrical fields) That Generate Heat
* Induction Electrodes
* Patient In A Magnetic Field Not Part Of A Circuit
* Tissues In A Parallel Arrangement
* Greatest Current Flow Through Tissue With Least Resistance
* Tissue High In Electrolytic Content Respond Best To A Magnetic Field
* Induction Electrodes  
  (Cable Electrode)
* Two Arrangements:
* Pancake Coils
* Wraparound Coils
* Toweling Is Essential
* Pancake Coil Must Have 6” in Center Then 5-10cm Spacing Between Turns
* Induction Electrodes  
  (Drum Electrode)
* One Or More Monopolar Coils Rigidly Fixed In A Housing Unit
* May Use More Than One Drum Depending On Area Treated
* Toweling Important
* Heating With Continuous SWD
* Patient Sensation Provides Basis For Recommendations Of Continuous SWD Dose I (Lowest) - No Sensation of Heat Dose II(Low) - Mild Heating Sensation Dose III(Medium)- Moderate or Pleasant Heating Sensation Dose IV(Heavy)-Vigorous Heating Within Pain Threshold
* Pulsed SWD
* Referred To By Different Names
* Pulsed Electromagnetic Energy (PEME)
* Pulsed Electromagnetic Field (PEMF)
* Pulsed Electromagnetic Energy Treatment (PEMET)
* Pulsed SWD
* Interrupted Output Delivered In Series Of High-Frequency Bursts (20-400usec)
* Pulse Rate Selected With Pulse Frequency Control
* Off-Time Longer Than On-Time
* Low Mean Power Output
* Uses Drum Electrode
* Shortwave Diathermy vs.Ultrasound
* Pulsed SWD Produces The Same Magnitude And Depth Of Muscle Heating as 1MHz Ultrasound (Draper, JAT 1997)
* Treatment Time
* Most Typically SWD Treatments Last For 20-30 Minutes
* Remember As Skin Temperature Rises Resistance Falls
* Microwave Diathermy
* Two FCC Assigned Frequencies-2456 MHz and 915 MHz
* MWD Has Higher Frequency and Shorter Wavelength Than SWD
* Generates Strong Electrical Field and Relatively Little Magnetic Field
* Depth Of Penetration Is Minimal In Areas With Subcutaneous Fat > 1 cm
* Microwave Diathermy Unit
* A= Power Switch
* B=Timer
* C=Output Meter (indicates relative output in watts
* D= Power Output Level Knob
* E= Amber Light-Warming up / Red Light- Ready
* MWD Applicators (Electrodes)
* Circular Shaped Applicators
* 4” or 6”
* Maximum Temperature At Periphery
* Rectangular Shaped Applicators
* 4.5 x 5” or 5 x 21”
* Maximum Temperature At Center
* Microwave Applicator Set-Up
* Microwave Applicator Beams Energy To Patient
* Must Pay Attention To Cosine Law
* In 915 MHz Units Applicators Placed 1 cm From Skin
* 2456 MHz Units Have Manufacturer Recommended Distances and Power Outputs (Uses Antenna)