**Purpose**

The purpose is to determine if the literature supports the use of Short-Wave Diathermy (SWD) to increase tissue extensibility.

**What is Short-Wave Diathermy?**

SWD is a high frequency electromagnetic current modality that generates thermal energy. The thermal energy increases the lengths of tissues by relaxing viscosity, decreasing compressibility, and increasing collagen extensibility.

**Methods**

assess 1

- skin supported 48

D. Shortwave diathermy and prolonged motion changes in ankle dorsiflexion.

- Assess

- ROM and ankle dorsiflexion

- For 2 group

- 15 minutes

- Posters

- Warmer

- Analgesia

- Posters

- Warmer

- Analgesia

**Subjects**

44 students (21 males, 23 females)

- Mean Age: 22.5 ± 2.0 years

- Evaluation Criteria:
  - Active participant in flexibility training for the day
  - Active participant in strength training for the day
  - Recent ankle injury
  - History of ankle injury with precautions for static stretching
  - Metal plates or screws in their right lower extremity
  - Pregnancy
  - Medications to cold injury side

- Measurements of dorsiflexion ROM with digital goniometer over 3 week duration. Measurement 6 days after for retention trial

- Group 1: Control 1 - Followed primary ROM measurement protocol

- Group 2: Control 2 - Measurements only on day 1 and 14

- Group 3: SWD and Strengthening (Photo 1)
  - 10 minutes of pulsed SWD
  - 400 Hz burst per second, 400 microsecond burst duration, 600 microsecond interburst duration
  - 10 Hz – peak root mean square amplitude
  - 40 Hz – average root mean square output
  - 10 minute cycle, the 15 minute stretching routine began

- Group 5: SWD, Stretching, and ice
  - Control SWD and stretching protocol as group 4
  - At the end of 20 minutes of SWD, a 1 kg ice bag was applied for 5 minutes

- Control group assessed 6 and 24 days after final treatment

- Experimental Group: PSWD and Strengthening
  - Area of induction coil: 200 cm²
  - Frequency: 27.12 MHz
  - 480 Hz burst duration
  - 480 microsecond interburst duration
  - Peak root mean output 150 W
  - Average root mean output 50 W
  - 400 Hz burst duration
  - 400 microsecond interburst duration
  - Stretches/movements applied after 15 minutes

**Methods**

- The intervention measurements were taken at 45° range of motion on patients preferred kicking leg.
- Post-intervention measurements were taken after 15 minutes of each intervention condition.

- Superficial heating
  - Post-heated at 54°C degrees Celsius
  - 6 layers of withdrawal were used (cover + 2 layers of towels)
  - 30 second pulse applied on the end of the leg for 1 minute
  - 30 second pulse applied on the end of the leg for 1 minute
  - Analog heating
  - 10 minutes
  - Heated
  - 10 minutes
  - 10 minutes

- Groups received treatment for 5 consecutive days
  - ROM measured with a goniometer in supine with knee flexed
  - Max-slim applicable to maintain torque extension
  - Diaphyseal drum was placed on distal posterior thigh for 10 minutes, then calf width was applied to ankle and diaphyseal was reapplied for 3 more minutes
  - The drum was removed and the ankle width was applied for an additional 4 minute cycle

- Group 1: Dorsiflexion with 10 minute stretch
  - Time: 15 minutes
  - Pulse width: 400 milliseconds
  - Pulse Rate: 600 bursts per second
  - Mode: Rapid
  - Average Watts: 48W

- Group 2: Sham Dorsiflexion with 10 minute stretch
  - Time: 15 minutes
  - Pulse width: 400 milliseconds
  - Pulse Rate: 600 bursts per second
  - Mode: Rapid
  - Average Watts: 48W

- Group 3: Control
  - Goniometric measurements taken for 5 consecutive days. No treatment

**Results**

- All retention trial, ROM changes were significant:
  - Heat and stretching group (7.25 ± 4.5) vs
  - Control (1.29 ± 2.07) *p < 0.05*

- SWD, stretching, and ice group (4.99 ± 3.27, *p < 0.05)

- Greater ROM increase for SWD and Strengthening (group 4) versus stretching alone (group 3) at the end of 14 days and at the retention trial.

- Daily ROM changes in the three treatment groups are not significant, although the change in control group was significantly less (P = 0.001).

**Analysis**

A stretching regimen in conjunction with the use of SWD treatment resulted in a greater increase of tissue extensibility and range of motion (Photo 1). SWD was also found to produce greater increases in tissue extensibility than sham diathermy and superficial heating modalities such as moist hot packs. Immediately following the treatment program, SWD produced a statistically significant short-term increase in range of motion.

The combination of SWD and stretching improved range of motion long-term; however, this was statistically insignificant compared to stretching alone (Figure 1). In the research reviewed, the sample sizes studied were not large enough to generalize the findings to a larger population and the current research fails to recognize the need for inclusion of therapeutic intervention following the application of SWD. Additionally, research does not assess the long-term affects of SWD on tissue extensibility.

**Conclusion**

SWD is effective for increasing tissue extensibility in the human body. The current projectile agent results in an increase in range of motion and flexibility of soft tissue. Further research should include larger sample sizes, assess the effect of stretching combined with modality on the concentration of subjects who have connective tissue changes due to aging or pathologic conditions, and compare the length of diaphyseal treatment and number of treatment sessions to determine which combination yields the greatest extensibility gains.

**Bibliography**

1. Peres, Steven E; Diaper, David O; Draper, Kenneth L; Knight, Mark O; Ricard, Paul Shewani. Diaphyseal and Proximal Dorsiflexion Stretching Increases Dorsiflexion Range of Motion More Than Isometric Stretching Without Diaphyseal. Journal of Athletic Training. 2010; 45(2): 280.
4. Draper OG, Castron J, Costil D, Rubley RF, Diaper RG. Pulsed Shortwave Diathermy and protracted motion changes in ankle dorsiflexion range of motion with the hip flexed to 90°.

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**Authors and Purpose**

- Steven E. Peres, David O. Diaper, Kenneth L. Knight, Mark O. Ricard

The effects of long duration stretching, SWD, and ice were examined for immediate and long-term changes in ankle dorsiflexion.

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**Subjects**

- 23 subjects (8 males, 15 females)

- Mean Age: 22.7 ± 2.1 years

- Evaluation Criteria:
  - Those involved in a flexibility or strength training of the hips were excluded
  - Recent ankle injury or history of an ankle that would be negatively affected by the static stretch into dorsiflexion
  - Metal plates or screws in their right lower extremity
  - Pregnant
  - Medications to cold injury side

- ROM assessed 6 and 24 days after final treatment

**Methods**

- Experiment: Group: PSWD
  - Area of induction coil: 200 cm²
  - Frequency: 27.12 MHz
  - 480 Hz burst duration
  - 480 microsecond interburst duration
  - Peak root mean output 150 W
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- Stretches/movements applied after 15 minutes

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**Results**

- Deep heating increased the range of ankle dorsiflexion by 1.8° ± 1.0°

- The change in ankle dorsiflexion after superficial and no heating was 0.7° ± 1.1° and 0.6° ± 1.7°, respectively.

- Deep heating. In the absence of stretching, increases tissue extensibility more than superficial heating or no heating. Superficial heating is more effective than no heating, but the difference was not statistically significant.

- The ankle and foot: significant increase in ankle dorsiflexion.

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**Conclusion**

- The group that received SWD had a mean increase of 15.8° ± 2.2° in hamstring flexibility which was significantly higher than the sham diaphyseal group (5.2° ± 2.2°) and the control (15.5° ± 2.2°).

Conclusion: Short wave diathermy is more effective than sham diaphyseal in increasing hamstring extensibility.