The Efficacy of Two Thermal Modalities and the Effect on Hip Flexion

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Abstract

PURPOSE: To investigate the relationship between the use of diathermy and thermal ultrasound modality treatments and the effects on hamstring flexibility range of motion (ROM) in healthy college-aged participants.

METHODS: Twenty-two healthy college age participants' bi-lateral hip flexion ROM was evaluated by a Certified Athletic Trainer prior to treatment. The participants then received diathermy @ 48 W continuous for 15 minutes on one hamstring group and thermal ultrasound @ 3.3 Mhz 1.5 W/cm2 for 7 minutes to the other hamstring group. Following the treatments, hip flexion ROM was re-assessed at the following intervals: immediately following treatment, 2 minutes, 5 minutes and 10 minutes post treatment.

RESULTS: The effects of diathermy and thermal ultrasound were analyzed utilizing a two-way analysis of variance (time x groups) indicated a significant relationship of time. Mauchly;'s sphericity was significant at the p<.05 level therefore Huynh-Felt correction was utilized. F(3.553,149.232)= 9.100 p<=.000. However, there was no significance between the type of treatment F(3.553,149.232)=.574;p=.661

CONCLUSION: Results demonstrated that the use of both thermal ultrasound and shortwave diathermy produced a statistically significant effect on hamstring flexibility ROM over a period time. Specifically regardless of treatment intervention, the results suggested that flexibility exercise should be initiated immediately up to 2 minutes following the modality treatment for maximal benefit.

Intro

Proper extensibility of the human body's musculature is important for the reduction of injuries. The hamstring muscle group is especially important when discussing flexibility since even a slight decrease can be detrimental to an athlete's performance. Increasing the core temperature above four degrees Celsius will increase collagen tissue extensibility and decrease tissue viscosity (Draper, et al., 2002). High intensity pulsed shortwave diathermy can heat areas vigorously, inducing muscle relaxation and reducing muscles spasms and joint stiffness. These two deep heating modalities can provide immediate increases in range of motion. The use of Diathermy should be more effective than ultrasound since the hamstrings are large and it can increase temperature in larger areas, but research shows very minute benefits (Draper, et al., 2002). Studies completed by Ahmed, et al., (2014) and Akbari, et al., (2006) resulted in increased range of motion within the hamstrings due to ultrasound usage combined with stretching. However, there is a gap in the literature comparing the effectiveness of these two modality treatments on large muscle groups.

Research Question

Was there a difference between hamstring flexibility ROM following diathermy versus thermal ultrasound modality treatments. The null hypothesis (Ho) suggested there was no difference in ROM when comparing thermal ultrasound treatments to diathermy treatments on flexibility. The Ha (alternative hypothesis) suggested there was a significant difference between the two treatments (p<.05).

Methods

Twenty-two healthy college students aged between 19 and 25 participated in this study.

1. The participant were given instructions and more information about the study, and the modalities being used in this study while the researchers measure baseline ROM with a goniometer. The participant were instructed to tell the researchers measuring hip flexion when to stop the stretch.(4 min)
2. The participant was positioned supine.
3. The skin was prepped for ultrasound with an alcohol pad and then conductive gel was placed on the treatment area (distal hamstring tendons). (3 min)
4. Diathermy treatment was performed on one leg while ultrasound was completed on the other leg.
5. Diathermy parameter: continuous, 800 microsecond bust duration, 800 bursts per second, 800 microsecond interburst interval, and root mean output average of 48 W.
6. Ultrasound parameters: 3 MHz, 1.5 W/cm2 , for 7 minutes.
7. At the end of the treatment, range of motion was measured immediately after treatments. (30 sec)
8. The participant were tested with a goniometer by a certified Athletic Trainer after 2minutes, 5 minutes and 10 minutes post treatment.
9. The participant then rested in the supine position in between testing.

All testing was conducted in Sports Medicine Lab. Each participant attended data collection for 45 minutes. The testing consisted of modality treatments and then goniometric measurements to evaluate hamstring flexibility. Participants were informed to wear a T-shirt, loose fitting athletic shorts, and running shoes.

References

1. Akbari A, Moodi H, Moein A, Nazok R. The effect of therapeutic ultrasound and duration of stretching of the hamstring muscle group on the passive knee extension. *J Med Sci,* 2006;*6*(6), 968-973.
2. Draper D, Castro J, Feland B, Schulthies S, Eggett D. Shortwave diathermy and prolonged stretching increase hamstring flexibility more than prolonged stretching alone. *J Orthop Sports Phys Ther.* 2004;*34*(1), 13-20.
3. Ahmed E, Alghamdy M, Almalky M. Comparative effect of the ultrasound therapy versus static stretching on the extensibility of hamstring muscles. *Int J Med Sci Public Health.* 2014;*3*(4), 468-471.
4. Draper D, Knight K, Fujiwara T, Castel C. Temperature change in human muscle during and after pulsed short-wave diathermy. *J Orthop Sports Phys Ther,* 1999;*29*(1):13-22
5. Draper D, Miner L, Knight K, Ricard M. The carry-over effects of diathermy and stretching in developing hamstring flexibility. *J Athl Train,* 2002;*37*(1), 37-42.
6. Brucker J, Knight K, Rubley M, Draper D. An 18-day stretching regimen, with or without pulsed, shortwave diathermy, and ankle dorsiflexion after 3 weeks. *J Athl Train.* 2005;*40*(4):276-280
7. Martinez-Rodriguez A, Bello O, Yanez-Brage I. Effect of a Single Pulsed Shortwave Diathermy Treatment on Extensibility of the Hamstrings. *Int J Athl Ther Train*. 2014;*19*(1):6-10
8. Gajdosik RL, Bohannon RW. Clinical measurement of range of motion. Review of goniometry emphasizing reliability and validity. *Phys Ther*. 1987; 67(12):1867-72
9. Konor MM, Morton S, Eckerson JM, Grindstaff TL. Reliability of three measures of ankle dorsiflexion range of motion. *Int J Sports Phys Ther*. 2012; 7(3):279-87

Results

The effects of diathermy and thermal ultrasound were analyzed utilizing a two-way analysis of variance (time x groups) indicated a significant relationship of time. Mauchly;'s sphericity was significant at the p<.05 level therefore Huynh-Felt correction was utilized. F(3.553,149.232)= 9.100 p<=.000.

Mauchly's Test of Sphericity[a]

Measure: ROM

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.	Epsilon[b] Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Time	.521	26.968	9	.001	.795	.865	.250

Tests of Within-Subjects Effects

Measure: ROM

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Time	Sphericity Assumed	395.027	4	98.757	9.100	.000	.178
	Greenhouse-Geisser	395.027	3.180	124.212	9.100	.000	.178
	Huynh-Feldt	395.027	3.553	111.177	9.100	.000	.178
	Lower-bound	395.027	1.000	395.027	9.100	.004	.178
Time * Group	Sphericity Assumed	24.936	4	6.234	.574	.682	.013
	Greenhouse-Geisser	24.936	3.180	7.841	.574	.643	.013
	Huynh-Feldt	24.936	3.553	7.018	.574	.661	.013
	Lower-bound	24.936	1.000	24.936	.574	.453	.013
Error(Time)	Sphericity Assumed	1823.236	168	10.853			
	Greenhouse-Geisser	1823.236	133.572	13.650			
	Huynh-Feldt	1823.236	149.232	12.217			
	Lower-bound	1823.236	42.000	43.410			

Tests of Within-Subjects Contrasts

Measure: ROM

Source	Time	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter
Time	Linear	12.784	1	12.784	.869	.357	.020	.869
	Quadratic	310.015	1	310.015	23.966	.000	.363	23.966
	Cubic	58.182	1	58.182	5.347	.026	.113	5.347
	Order 4	14.047	1	14.047	2.880	.097	.064	2.880
Time * Group	Linear	9.020	1	9.020	.613	.438	.014	.613
	Quadratic	11.183	1	11.183	.865	.358	.020	.865
	Cubic	4.400	1	4.400	.404	.528	.010	.404
	Order 4	.332	1	.332	.068	.795	.002	.068
Error(Time)	Linear	618.095	42	14.717				
	Quadratic	543.302	42	12.936				
	Cubic	457.018	42	10.881				
	Order 4	204.821	42	4.877				

However, there was no significance between the type of treatment F(3.553, 149.232) = .574 p = .661. Results demonstrated that the use of both thermal ultrasound and shortwave diathermy produced a statistically significant effect on hamstring flexibility ROM over a period time.

Conclusion

The results of this study demonstrated that the use of both thermal ultrasound and shortwave diathermy produced a statistically significant effect on hamstring flexibility range of motion over a period time. Although range of motion increased, there was no significant difference between the increases in range of motion when comparing the two modalities; shortwave diathermy and thermal ultrasound. Regardless of which treatment intervention is used, the results suggested that flexibility exercise should be initiated immediately up to 2 minutes following the modality treatment for maximal benefit. This is shown through the decreases in flexibility when measured five minutes post modality treatment.