UNDERWATER TREADMILL (UWT) THERAPY IN DOGS:
Finding the Evidence to Create a Protocol for its Use.
A small-scale sample literature review.

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Introduction – Hydrotherapy, in the form of swimming or underwater treadmill walking, has become increasingly popular in animal rehabilitation. Very little literature exists on the subject of hydrotherapy protocols for dogs and anecdotal recommendations are widely propagated in the industry. Where can a practitioner find the information that would be helpful in making an informed decision on what parameters would be appropriate for use with this modality as it pertains specifically to dogs? Is there enough evidence to make specific recommendations for its use?

Methods - Three English-language textbooks on animal physiotherapy possess chapters on aquatic therapy/hydrotherapy were reviewed. Two were well referenced.(Monk 2007; Levine et al. 2004) One was not referenced at all and hence the information contained within should be considered as opinion.(Bockstahler et al. 2004) The symposium proceedings from the 1st to 4th International Symposia on Rehabilitation and Physical Therapy in Veterinary Medicine and the Royal Veterinary College 2nd and 3rd Annual Veterinary Physiotherapy Conference were reviewed. This search yielded 12 studies. On further examination of these studies, only 5 provided data that would be useful in selecting appropriate parameters for use of this therapy.(Jackson et al. 2002; Dunning et al. 2004; Hudson and Hulse, 2004; Hamilton, 2002; Tragauer et al. 2002) A pubmed search was conducted utilizing the terms dog or canine and hydrotherapy or underwater treadmill, or water or water walking or water exercise. (http://www.ncbi.nlm.nih.gov/sites/entrez) This resulted in only 2 applicable abstracts.(Gandini, 2003; Millis and Levine, 1997) A Google Scholar search identified 3 additional studies, 2 of which were useable for this purpose.(Monk, 2006; Marsolais, 2003) The International Veterinary Information Service website (www.ivis.org) allowed free access to abstracts from veterinary conference proceedings and selected books. None of the conference proceedings were original research but one book chapter did provide a small amount of information on hydrotherapy and procedural recommendations.(Steiss 2003) Reviewing the reference list from the two referenced textbooks, produced only two additional canine-specific papers.(Tangner 1984, Marsolais 2002) (Note: all papers were obtained via this authors access to 2 university library websites.) A review of the human literature was limited to that presented in the two well-references textbooks.

Results –

Scientific studies pertaining to water parameters in the UWT

Jackson et al. 2002

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- Joint flexion was greatest when the water is filled at or higher than the joint of interest (pertaining to the hip, stifle, shoulder and elbow). The flexion obtained was comparable to flexion ranges achieved during swimming.
- With water height at the greater trochanter, end stage propulsion (extension in the hip, stifle and shoulder) was reduced.
- Full active joint extension of the hip, stifle and hock was achieved during full limb cycles when compared to walking on land at the levels of the lateral malleolus and stifle

Tragauer et al. 2002

- Land weight bearing ratio of front legs: hind legs was 64:36. This same ratio was maintained with water heights at the lateral malleolus and lateral femoral condyle at the stifle. However, the ratio changed to 71:29 with water at the height of the greater trochanter.
- Table 1 describes the percentage of land weight resultant from partial water immersion at varying depths in the dog.

Table 1. Percentage of body weight on land during partial immersion at various water depths in dogs

Water Height	*% of land body weight*
Lateral malleolus	91%
Lateral femoral condyle	85%
Greater trochanter	38%

Dunning et al. 2004

- There was no significant difference in heart rate, respiratory rate, rectal temperature and perceived exertion score in dogs exercising for 10 minutes in an underwater treadmill at temperatures of 30, 31.1, 32.2, 33.3, 34.4 °C.

Parameters used or suggested for canine water exercise

A compilation of scientific papers was attempted and results are contained within table 2. Very few studies looked at underwater treadmill specifically, and so two studies that utilized swimming were also included. Many studies did not report all variables. Anecdotal recommendations for hydrotherapy exercising are recorded in table 3.

Table 2. Parameters used for aquatic exercise studies in dogs

Study	*Condition for which water therapy was choosen*	*When started on water therapy*	*Type of exercise*	*Water height*	*Water temp.*	*Exercise time*	*Frequency*
Marsolais et al. 2002	Post operative cruciate repair	3 weeks post-op	Swimming	N/A	32.3 – 33.3°C	10 – 20 mins	2x/day 5days/wk
Hamilton 2002	Osteoarthritis	Immediately upon referral	UWT walking	Not reported	Not reported	Up to 40 mins	2x/day 2 - 3days / wk
Marsolais et al. 2003	Post-operative cruciate repair	3 weeks post-op	Swimming	N/A	32.2 – 33.3°C	10 – 20 mins	2x/day 5days/wk
Gandini et al. 2003	Fibrocartilaginous embolus	As soon as possible	UWT	Not reported	Not reported	10 minutes	2x/day
Hudson et al. 2004	Osteoarthritis	Immediately upon referral	UWT walking	Greater trochanter	94°F (appx 34 °C)	2 x 3mins with 10 mins of	2days/wk

						standing in water btwn sessions	
Monk et al. 2006	Post operative cruciate repair	After suture removal day 10 post op	UWT walking	Greater trochanter	32 °C	Wk 2 - 3x3min Wk 3 – 2x5min Wk 4 - 2x7min Wk 5 - 1x15min Wk 6 - 1x20min	1x/day

Table 3. Anecdotal recommendation from literature sources for aquatic exercising in dogs

Source	*Type of exercise*	*Water parameters*	*Exercise time / frequency*
Tangner 1984	Swimming	Warm water	10 – 20 mins, 2 x / day
Millis et al 1997	Swimming	Not reported	Start 1 – 3 mins, 1x / day 3 – 7 days / week
Steiss 2003	Swimming or UWT	Tissue relaxation at 95 °F (36 °C) Lower temp for swimming or exercise	5 – 10 mins Only a few minutes if animal is deconditioned or debilitated
Bockstahler 2004	UWT	25 – 35 °C	Start 3 x 2 mins Increase by 10% weekly 2 – 3 days / week Adjust according to fitness levels Include warm up and cool down for 2 mins each either in or out of the water

Variables for water exercising from human literature

Exercise prescriptions for water-work may not be as clear as one would expect and cannot be transferred directly from land. Energy expenditure in water may be increased when exercising in cold water due to shivering which occurs in humans at temperatures of 28 - 34°C. (Curtain 1997) Evans (1978) found that ½ to 1/3 of the speed was needed to walk or jog across a pool in waist deep water at 31°C to achieve the same energy expenditure as walking or jogging on a dry treadmill. Monitoring of heart rate may yield invalid conclusions, as it has bee shown to be lower by approximately 10 beats per minute with strenuous exercise in water.(Craig & Dvorak, 1970; Evans 1978) This same phenomena was observed in dogs walking in water as compared to land treadmills at the same velocity and length of time.(Levine, 2004) Resting heart rate is also affected in water. Resting heart rates in humans are lower in water but were increased with temperature increases to 36°C as compared to 28°C.(Johnson et al 1977; Hall et al 1998) Optimal water temperatures for exercising for humans is reported between 28 - 30°C.(Edlich et al. 1987)

Discussion and Conclusion

Literature is lacking in the area of water exercising and therapy in canine literature. Within the existing literature, huge variability exists as to hydrotherapy parameters and recommendations. (Note: without library access to the full texts of the specific journal

articles, even the above literature recommendations would not be obtainable. Clinicians would have difficulty making informed recommendations without this access.) To further the knowledge-base within this area of practice, it would be interesting to survey a wide base of practitioners that utilize swimming or UWT therapy currently with their canine rehabilitation practices to determine individually-acceptable parameters. Additionally, controlled studies that evaluate the effectiveness of different hydrotherapy parameters are needed to make evidence-based decisions on its usage.

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