THE VALIDITY AND RELIABILITY OF THE GAITRITE® SYSTEM'S MEASUREMENT OF THE WALKING DOG

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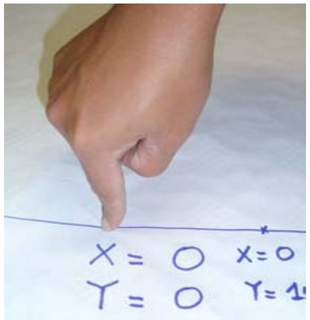
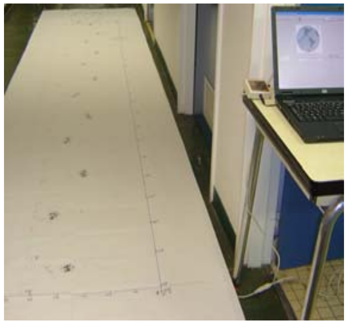
INTRODUCTION

Many gait analysis systems have been developed for humans and dogs. However, in veterinary medicine, we need to have a system that is able to quickly analyze the spatial and temporal parameters and relative pressure of the four paws through multiple strides. We have modified a human device: the GAITRite® system for a canine application.
Our intention was to verify the validity and reliability of its use for dogs.

MATERIALS AND METHODS

The GAITRite® system was developed to measure and record temporal and spatial parameters of gait by using a 4.3 meter walkway with grids of 16,128 embedded pressure-sensitive sensors connected to a personal computer with software developed for animals (GAITFour). Twelve dogs (3 to 60 kg) were used for the experimental validation, ten for the sensitivity of the system and 2 dogs (6 and 10 years, 11 and 13 kg) for the validation of the spatial parameters.
Validation of the spatial parameters was done by marking directly on the walkway, the method of paper-pencil on a sheet of paper and the method of inking the paws. For the validation of the temporal parameters, a watch chronometer was used. These data were collected simultaneously by the GAITRite® system (measured automatically by computer) and by the operator (measured manually with a tape-measure and watch chronometer) and were compared to each other. Statistical tests (correlation coefficient) were performed by the software Microsoft Excel.





RESULTS AND DISCUSSION

Table 1. Three methods of spatial validation

Measures in axes X and Y Error and correlation	Measure in X axis				The measure in Y axis		
	Method 1	Method 2	Method 3		Method 1	Method 3	
			Dog 1	Dog 2		Dog 1	Dog 2
Error (mm)	**7.7**	**4.4**	**4.4**	**5.9**	**6.**	**5.4**	**5.6**
Intra-class correlation coefficient (ICC)	**0.999**	**0.999**	**0.999**	**0.999**	**0.999**	**0.995**	**0.998**

This walkway was able to record and analyze gaits of dogs from 3 to 60 kg.
The number of activated sensors, at walk, range from **2** (Yorkshire terrier **3** kg) to **31** (Newfoundland 60 kg).
The values obtained from our spatial tests (paper-pencil, direct and paper-ink) in the X and Y axes and temporal tests were correlated with GAITRite® measurement at more than 98% (intraclass correlation coefficient for spatial test > 99 with an average error of six millimeters [half of a sensor]). For a 40 cm stride, equivalent to the stride of a small dog, we calculated a relative error less than **1.6%.**
A part of the error with inking the paws comes from the quality of the footprint on the paper sheet.

Table 2. Temporal Validation

	Error (sec)	**Relative Error** (%)
Mean	**0.15**	**3**
Standard deviation	**0.08**	**1.8**
Intra-class correlation coefficient (ICC)	**0.984**	

For the temporal test, the values obtained from chronometer and GAITRite® system are >98% with an average error of 3 milliseconds. The error is due to the manual acquisition more than the electronic acquisition.
The 80 Hertz acquisition frequency allows us to measure the walk and the trot of dogs.
Performances obtained with dogs are similar to the recent results of McDonough (2001) and Webster (2005).

CONCLUSION

The correlation of spatial and temporal parameters between the GAITRite® system and manual measurements were excellent. Based on these data, GAITRite® is a valid and workable tool to measure the temporospatial gait parameters of different sized dogs.

Ref: Webster, K.E.. *Gait and Posture,* 2005
McDonough. *Archives of Physical Medicine and Rehabilitation,* 2001