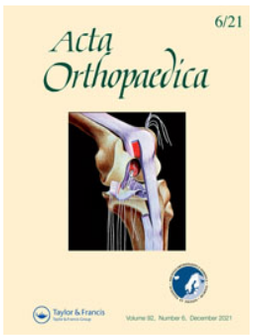

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# Uniformity in mechanics of long bones at torque: A dog experiment

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# Uniformity in mechanics of long bones at torque

## A dog experiment

Entire and fresh pairs of tibiae and femora from dogs have been tested with a computerized torsion machine. No differences were observed within the pair for several structural parameters, ensuring a right-left congruence of the load deformation curves of the tested bones.

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Any study on the mechanical properties of long bones using one of the paired bones as a control must be based on similarity of the properties of right and left bones (White et al. 1974, Paavolainen 1978). The similarity between the right and left tibiae of adult dogs with respect to maximum torque capacity and stiffness has previously been shown (Strömberg & Dalén 1976, Netz et al. 1978). We have now studied whether right-left similarity also exists with respect to other parameters characterizing the load-deformation curves of long bones of dogs.

## Material and methods

Ten pairs of tibiae and ten pairs of femora from 20 adult, long-legged dogs (mixed breeds, weight 8–18 kg) were studied. The dogs were sacrificed with Pentothal-Natrium®. Immediately after sacrifice, the paired bones were dissected free from all soft tissue and were kept in saline-soaked gauze until testing, which was performed within 20 min.

A specially designed method and apparatus has previously been described for recording the torque of long bones as a function of deformation (Strömberg & Dalén 1976); this test method and the mode of recording have been further developed. The test bone and the two cylinders in which each bone is fixed by casting were attached to the torsion machine in a manner that avoids false readings of the deformation due to play in the machine. A microcomputer was connected to the torsion machine, and programmed to control the test procedure and to record and save data. The data calculated were presented digitally and as a torque-twist curve.

All the bones tested in this study were twisted inwardly, i.e. in the same geometrical direction. A twist velocity of 6 degrees per second was chosen.

### Calculations

The differences in the parameters measured between right ($X_1$) and left ($X_2$) bones in per cent of the mean value for one animal were calculated using the formula:

$$d = \frac{(X_1 - X_2) * 100}{(X_1 + X_2) * 0.5}$$

The statistical significance of the difference between right and left bones was calculated by means of the paired *t*-test. Before the experiments were started, we decided to consider $p > 0.05$ as nonsignificant.

## Results

No significant right-left difference between the paired bones was recorded with respect to the following parameters: maximum torque capacity; stiffness; ultimate deformation; linear deformation; energy required to ultimate fracture; or energy released at ultimate fracture.

## Discussion

In rabbits and frogs, Singh (1971) has observed a one-sided dominance in bone weight. Experiments in dogs have shown similarity in maximum torque capacity and stiffness of right and left bones (Strömberg & Dalén 1976, Netz et al. 1978). However, other parameters than these two also reflect the load-bearing characteristics of long bones. The parameters studied in this investigation individually express a property of strength which is not fully dependent on any other parameter.

The similarity between the right and the left bones of the same dog regarding the parameters measured in this study will set aside any further objections to using paired diaphyseal long bones, one as a test bone and the other as a control bone, for experimental studies in the dog.

## Acknowledgement

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