

THE STUDY OF MECHANICAL STRESS OF THE THORACIC APPENDICULAR SKELETON IN DOG

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The bone as a complex system with several levels of organization, anatomical, molecular, cellular is influenced by many biomechanical factors which determines its adaptation to the different mechanical stress (1, 3, 4).

The healing of fractures is different, caused by the bone's structures and composition (2).

Due to the features of the bones the type of bone behaviors under the mechanical stress applied static and dynamic are very different (2, 5).

Key words: mechanical longitudinally stress, dog, bone.

Materials and methods

Have been used flat and long bones from 5 dogs, the thoracic appendicular skeleton, scapula, humerus, radius and ulna.

The tests were done in the "**Laboratorul de încercări de certificare a implantelor și distractoarelor utilizate în chirurgie osoasă și stomatologică**" from the University of Polytechnic Timisoara.

Equipment

The equipment used for testing the mechanical characteristics of bones was composed by:

- UltraTest stand;
- Forcing cell;
- Torsion cell;
- The blending measurement unit;
- National Instruments software;
- Fixation system;
- PC.

Instructions

- ✓ The bones are fixed in the forcing cell;
- ✓ It is checked out the connection between forcing cell and pc;
- ✓ Turn on the Ultra test machine;
- ✓ Turn on the computer and the **Emperor** soft (Force);
- ✓ The forcing cell is positioned on zero;
- ✓ The speed and the force is setting up;
- ✓ It is created the folder where the document will be saved as text.

- ✓ Press the "Rulare program" button and automatically will be created the folder named and where the data of the testes will be inserted.
 - ✓ The value of the program has to be the same with the value of the forcing cell.
 - ✓ Press "Start" button to save the data;
 - ✓ Press the button to start the test and keep pressed until the force is set up. The value of the force do not exceed 1000N/5000N;
 - ✓ During the mechanical stress action the parameters of the stand must be supervised. "Emergency Stop" button is pressed if the problems occurs and the test is reloaded from the beginning;
 - ✓ Press "Stop" button at the end of test and automatically the data will be saved;
 - ✓ Copy the folder on the „D" partition of pc.
- Closed the program and stop the stand and the forcing cell.

Results and discussions

The thoracic appendicular skeleton was undergone to mechanical longitudinal stress with universal stand machine and variable speed in the condition of the statically stress. The speed of test was set up to 2-6 mm, and the action force 5000 N.

Scapula

The solicitations through compression over the scapula have been made longitudinally on the lateral surface of the bone, on the spine of scapula and both supraspinous and infraspinous fossae.

The compression force which led to the fractures of the spina scapularis was variable, 520-720 N, at different speed 2.61-6.40 mm (Fig. 1, Graph 1, Graph 2).

The continues mechanical solicitation forces of 280-1684 N on the scapula made the fissure and fractures in the caudal border of the bone.

In only one test the caudal angle of the scapula was broken by compression forces of 350 N and 2.61 mm the displacement speed.

Humerus

The bone was automatically positioned in the stand, dorso-lateralis and also ventro-dorsalis (Fig. 2, Fig. 3).

The forces selected during the testes were ranged between 0-5000 N, the speed 3.99-6.57 (Graph 3, Graph 4).

Disto-dorsalis compression forces of 1367-1497 N have made fissures and fractures in the proximal extremity and also to the articular head and great tubercle of humerus.

There are no registered results in the distal extremity of humerus.

In only one test was recorded the fissure and fracture of the humeral body (Fig. 2, Fig. 3)

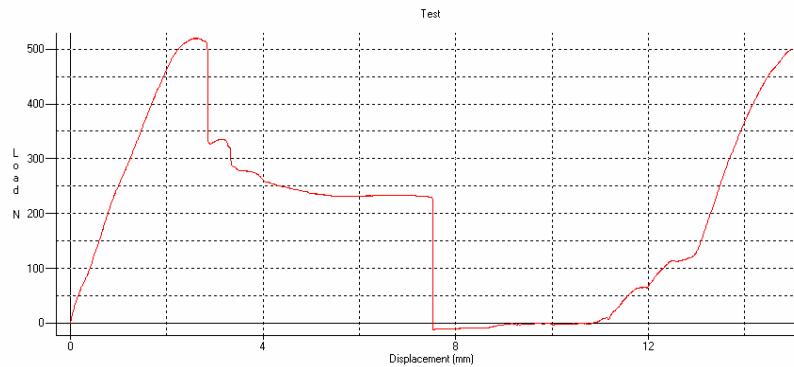
Radius and Ulna

The forearm bones were positioned both, proximo-distalis and disto-proximalis.

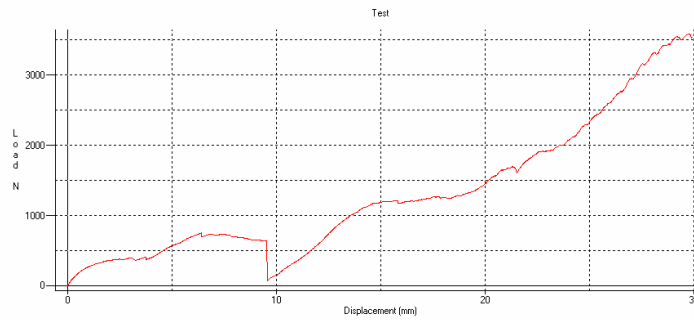
The compression longitudinally forces of 539.2-2620.5 N and displacement speed of 2.61-4.77 mm have induced the fissures and fractures of the proximal extremity of radius in 4 cases (Fig. 4, Graph 5, Graph 6).



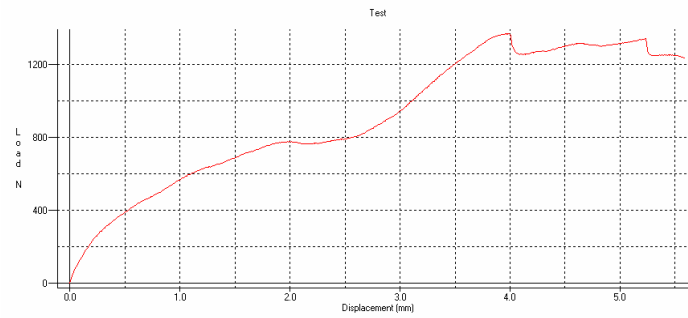
Fig.1. Caudal border of scapula



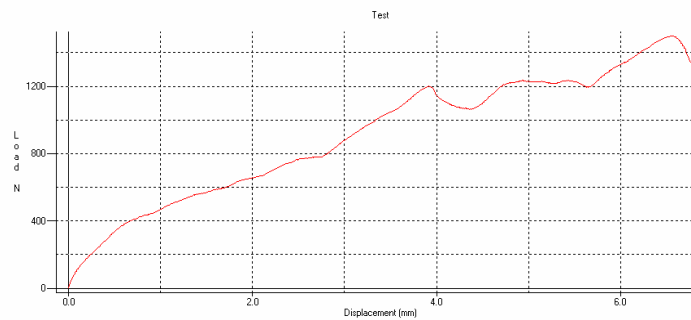
Graph 1
Maximum forces = 520.0 N
Displacement = 2.61 mm



Graph 2
MAXIMUM FORCES = 750.5 N
Displacement = 6.40 mm



Graph 3
Maximum force = 1367.4 N
Displacement = 3.99 mm



Graph 4
Maximum force = 1497.8 N
Displacement = 6.57 mm



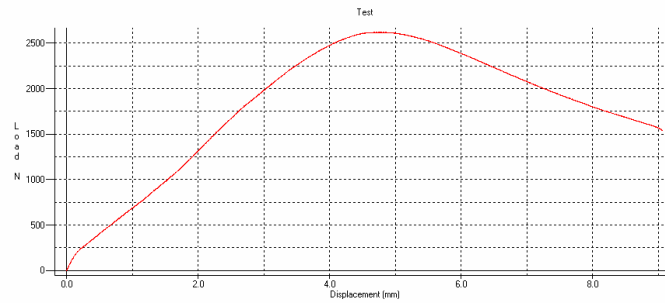
Fig. 2 Humerus, longitudinally stress of the neck



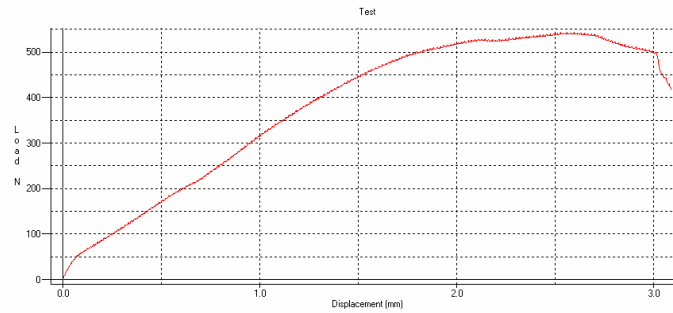
Fig. 3 Fissures of lateral tubercle of humerus



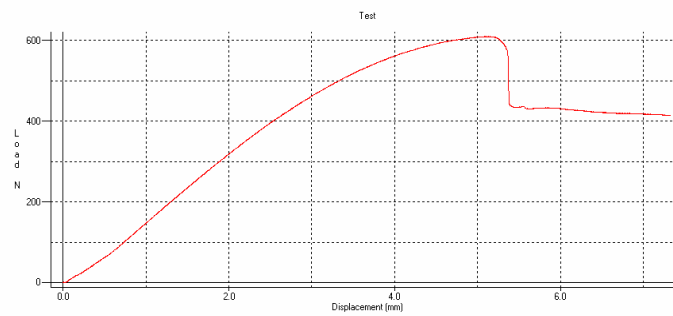
Fig. 4 Radius positioned in the stand



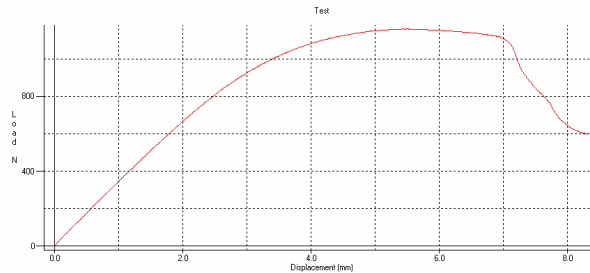
Graph 5
Maximum force = 2620.5 N
displacement = 4.77 mm



Graph 6
Maximum force = 539.2 N
displacement = 2.61 mm



Graph 7
Maximum force = 610.4 N
displacement = 5.13 mm



Graph 8 Maximum force = 1160.4 N; displacement = 5.47 mm

The body of radius performed the fractures at forces of 3550 N.

Over the ulna the forces have made fissures of the styloid process at range between 610.4-1160.4 N and the displacement speed of 5.13-5.47 mm (Graph 7, Graph 8).

The cranial extremity and the body of ulna have not suffered fractures or fissures during mechanical longitudinally stress.

Conclusions

The bones, which have been studied, had a different mechanical behavior during induced stress.

Depending on the bone's region mechanical stress performed different.

The most affected part of the scapula was the spina scapularis.

Caudal border, caudal angle and glenoid cavity of scapula are less affected during the longitudinally mechanical forces.

The head of humerus and the great tubercle are mostly affected during the mechanical stress.

In the conditions of longitudinally stress the body of humerus was broken once.

Proximal extremity of the radius has been registered in 4 cases from 5.

The body of radius was broken in only one test.

The mechanical stress on the ulna conducted to the fractures of styloid process.

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