Compression Testing of Deer Femora as an Animal Model for Automobile Accidents

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Introduction

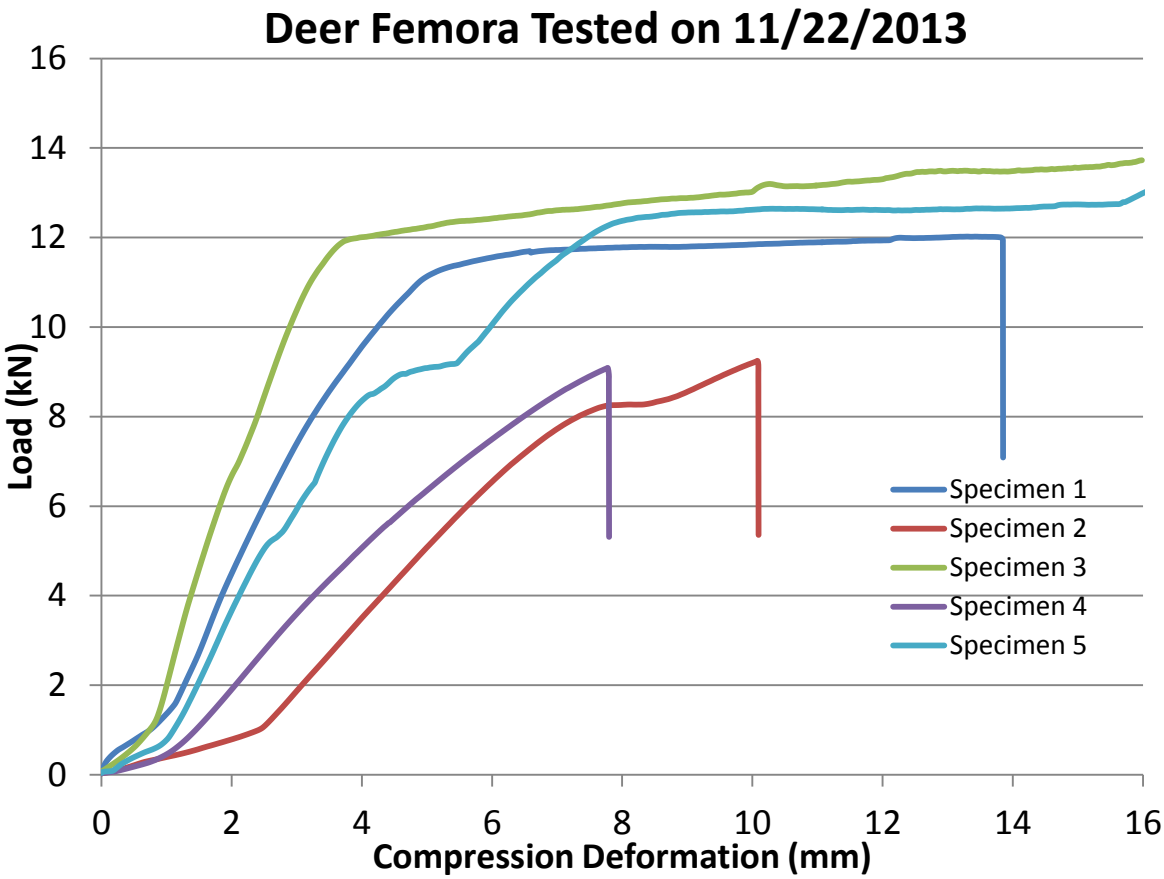
The femur is the strongest bone in the body. Did you know that car accidents are the number one cause of femur fractures? Due to the high strength of the femur, the femur will need to be intensely impacted for this type of fracture to occur. Animal models are often used to gain a better understanding of humans. Testing animal bones is easier that humans because they are more easily obtained and the risk of contracting a disease is greatly reduced across species. The main objective for this research is to determine how much force deer femora can withstand before the stress in the bone cause it to fracture.

Methods

The axial compression strength of 5 deer femora was measured. Two the specimens (1 & 3) were macerated by boiling the bone to fully remove tissue. Tissue was removed from the other three specimens using knives and these specimens were kept moist and cool. The distal end of the bone was positioned in short sections of PVC pipe and epoxy was poured into the end of the cup to stabilize the bone. Once the epoxy hardened, the bone was flipped and the proximal end was secured in a similar manner. The bones were placed in bags and refrigerated until the day of testing. As a safety precaution, each bone was placed in a hazardous material bag during testing. The bones were placed into an Instron universal testing machine and axial loaded at a rate of 10 mm/min. Upon fracture, bone splinter burst forth but were contained by the bag. Load and deflection were recorded during the test.

Results

All specimens showed a low stiffness region at the beginning of the load deflection curve. This was followed by a region of increased stiffness. Specimens 2 and 4 were fresh refrigerated specimens and fractured at a load of approximately 9 kN in a brittle manner. The other fresh refrigerated specimen (5) showed a long region of deformation with little increase in load. The test was ended prior to fracture because the specimen began to tilt out of a vertical alignment. The macerated bones showed greater stillness than the fresh refrigerated specimens. One specimen fractured (1) prior to ending the test and the other did not (3).



Discussion

This shows that although macerated bones are easier to work with, they may not be a good representation of bone strength in a living subject. Overall, an effective method was developed for testing dear bones and the fracture strength was generally consistent over all specimens.