Product Design Specifications for BME 301 Group 8: Measurement of tibial translation in dogs with anterior cruciate ligament rupture (tibial_measurement)

Group Members: Alex Bloomquist, Graham Bousley, James Madsen, Mike Nonte

Problem Statement:
Arthritis in canines often leads to joint degeneration and rupture of the Anterior Cruciate Ligament (ACL). Diagnosis of this condition is often difficult because the current methods used are non-quantitative. The aim of this project is to quantify the amount of tibial translation in a canine's leg caused by a known applied force in order to determine the severity of an ACL rupture. Preliminary parts for a device that can accomplish this have been developed and it is the goal of this team to create and test a working model.

1. Design Requirements:

The device must meet all of the client requirements

a. Performance Requirements: The device must be able to secure to the anatomical landmarks of a canine's leg and measure the amount of displacement in the tibia effectively. The Hall effect sensor and magnet system must stay in the same plane during the measurement.
b. Safety: The device should not cause any serious harm to a canine's leg.
c. Accuracy and Reliability: Data obtained from testing should be repeatable so that the device may be accurate when used in clinical testing. Hall effect sensor should be accurate at 15V of input voltage.
d. Life in Service: The device should last for 10 years.
e. Shelf life: The device should have a shelf life of 5 years.
f. Operating environment: The device should withstand room temperature and be easily cleanable so that it can be as sterile as possible.
g. Ergonomics: A trained veterinarian should operate the device.
h. Size: The device should not be big so that it will not cause injury to the canine.
i. Weight: The device must not weigh more than 15 grams.
j. Materials: The device must be made of sterile and lightweight materials so that the canine will not be injured when the ACL rupture test is performed with the device.
k. Aesthetics, Appearance, Finish: The device must have an internalized system to increase accuracy.

2. Production Characteristics:

a. Quantity: One working unit is necessary to quantify tibial translation.

b. Target Product Cost: As cheap as possible for mass-production.

3. Miscellaneous:

a. Standards and Specifications: Approval from a medical organization.

b. Customer: Veterinarians should be able to use this easily.

c. Patient-Related Concerns: The device should be sterile and the system must be properly internalized so the canine is not caused any harm.

d. Competition: The model is similar to an arthrometer for humans. X-ray is a good qualitative method but it is expensive and non-quantitative.