Introduction
Sciatic nerve palsy is a troublesome complication of total hip arthroplasty. It has been reported that the incidence of sciatic nerve palsy ranges from 0.7% to 2.9% in primary arthroplasty and from 2.6% to 7.0% in revision arthroplasty. It may be caused by direct injury or over-traction at the time of the operation. Several reports suggest that the most significant factor is stretching by over-lengthening. However, to the best of our knowledge, effects of traction due to the position of the hip and knee joint have not been reported. We investigated effects of the position of the hip and knee on the blood flow of the dog’s sciatic nerve.

Materials and Methods
Twenty hip joints of 10 adult mongrel dogs weighing 10 to 18 kilograms were examined. The animals were placed lateral position on the specially made operating frame. Using a posterior surgical approach, the sciatic nerve was exposed and a site 1 cm distal to the greater trochanter was selected for blood-flow measurement. The base line was defined as a line passing through the shoulder joint and the hip joint. We defined a hip joint flexion angle of 90° as a right angle with the base line. We defined a knee joint flexion angle of 0° as full extension of the knee. The blood-flow in the sciatic nerve was measured using a Laser Doppler Flowmetry, at varying angles of flexion (90°, 120°, 150°) and internal rotation (0°, 30°) of the hip joint and angles of flexion of the knee (0°, 30°, 60°, 90°).

Results
Blood flow decreased as flexion angle increased and internal rotation angle of the hip joint increased, and decreased with as flexion angle of the knee joint decreased. When we positioned the hip joint at 150 degrees of flexion and 30 degrees of internal rotation and the knee joint at 0 degrees of flexion, we found that the mean blood-flow decreased by 69% from the value measured when the hip joint was at 90 degrees of flexion and the knee joint was 90 degrees of flexion. When knee flexion was 90 degrees there was no significant difference in average blood flow between 30 degrees of internal rotation of the hip and 0 degrees internal rotation. When knee flexion was 0 degrees there was a significant difference in average blood flow between 30 degrees of internal rotation of the hip and 0 degrees of internal rotation (Figure 1).

Discussion
Several studies confirm that the most significant risk factor in total hip arthroplasty is stretching by over-lengthening. When tension is applied to a nerve, both the extrinsic and the intrinsic vascular supplies are affected. Nerve ischemia has been reported to occur at 15% elongation. However, several reports suggest that there is no statistical correlation between the amount of lengthening and the incidence of sciatic nerve palsy. This study has shown that the blood flow in the sciatic nerve decreases with increasing flexion angle and increasing internal rotation angle of the hip joint, and that decreases in flexion angle of the knee joint result in especially pronounced decreases in blood flow. We consider that the position of the hip and the knee is a significant risk factor when total hip arthroplasty performed with over-lengthening. Our results suggest that surgeons should pay attention to extension of the knee and the flexion and internal rotation positions of the hip to prevent sciatic nerve palsy as a complication of total hip arthroplasty. In addition, once sciatic nerve symptoms have developed, it may be beneficial to control the position of the hip and knee, in order to promote early recovery of intraneurial blood flow.

Figure 1: Mean blood flow of dog’s sciatic nerve (ml/min/100g)

A: hip joint was at 90 degrees of flexion and the knee joint was 90 degrees of flexion.
B: hip joint was at 90 degrees of flexion and the knee joint was 0 degrees of flexion
C: hip joint was at 150 degrees of flexion and the knee joint was 0 degrees of flexion