Analysis of Separation Distance that Accompanies the Traction of Normal Knee Joints using Ultrasound Imaging: The Influence of the Different Joint Angles and Traction Forces

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Purpose: The purpose of this study was to examine the influence of the different joint angles and traction forces, especially to indicate the maximally loose-packed position by analyzing the change of joint space width (separation distance) that accompanies the traction of knee joint.

Method: The subjects were 18 healthy adult subjects (9 male and female, average age of 25.1 years old). The method was to tug their right knees toward long axis direction of the right lower leg with 7 levels of joint angle (completely extended position, 25, 35, 45, 55, 70, 90 degrees) and 2 levels of traction force (100 x 200 N), and analyzed the separation distance by examining the ultrasound images of the joint spaces.

Result: With 100 N, 55 degrees flexion angle showed greater separation distance than completely extended position. With 200 N, the distance are larger with 25, 35, 45, and 55 degrees than completely extended position, and 45 and 55 degrees showed greater separation distance than 90 degrees. Based on the regression formula of the relationship between the joint angle and separation distance with 200 N, the knee angle that shows the maximum separation was estimated as 51 degrees.

Conclusion: The study showed that separation distance is larger with 200 N than 100 N. It also suggested that maximally loose-packed position of a normal knee joint is about 51 degrees.