

## Strain of carpal ligaments during wrist-joint motion

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## VIDEO ANALYSIS OF TAKE-OFF ACTIONS IN SKI JUMPING

Tsutomu Sasaki, Kazuhiko Tsunoda and Hidetsugu Nishizono  
Biomechanics Laboratory, Hokuseigakuen Women's Jr. College, Sapporo, 064, Japan

The purpose of this paper is to find the optimum parameters for predicting the flight length in ski jumping using the video analysis. When the World Cup Ski Jump Competition was held in Sapporo in 1987, we analyzed the take-off actions of six jumpers with video. Its frame speed was sixty frames per second. A video analysis system was made using a personal computer. The feature of take-off action was indicated in the moment of jumper's body above the knee joints. We found differences in the motion of the upper half of the body. In the three jumpers who gave the best performances, we found that they had less upward movement than other jumpers. We predicted influence on the jump performance because the upward movement makes an increased in the air resistance. It is the concern of each jumper to be in the position which creates the least drag force. The acceleration vectors indicate a different style for each jumper. We searched for a way to predict flight length (Y) using the multiple regression. We found two parameters which were peak of acceleration strength ( $X_1$ ) and timing ( $X_2$ ) on the horizontal axis. The equation of regression is as follows :  $Y=97.65+1.45X_1+192.86X_2$  and multiple correlation (R) is 0.9808. So we thought their parameters were suitable for predicting the flight length.

## STRAIN OF CARPAL LIGAMENTS DURING WRIST-JOINT MOTION

H.H.C.M. Savelberg\*, J.G.M. Kooloos\*, R. Huiskes\* and J.M.G. Kauer\*.

Department of Anatomy and Embryology\* and Institute of Orthopaedics\*,  
University of Nijmegen, P.O.Box 9101, 6500 HB Nijmegen, The Netherlands.

To obtain a more accurate apprehension of the mechanics of the wrist-joint, the kinematical behaviour of the carpals and the length changes of the ligaments during hand-motions are determined. These structures are represented by radio-opaque markers. Using Röntgenstereophotogrammetric principles the 3D coordinates of those markers are calculated at some fifty positions of a movement-cycle. Clear differences are observed between these 3D, experimentally obtained data and prevailing concepts on ligament-behaviour, based on 2D kinematics of the carpal bones. For instance, it is shown that the ligament RadioLunatum Palmare does not shorten, but on the contrary lengthens during ulnar deviation of the hand. Larger ligament length changes can be determined in flexion relative to deviation. This implies higher ligamentous stresses during flexion. Ligaments tend to lengthen during either palmar or dorsal flexion and during either ulnar or radial deviation. It is suggested, based on results, that during some motions the carpal joint is not stabilized by one of the tested ligaments. Hence other mechanisms must be active.

## ON THE BIOMECHANICAL NONSENSE OF PRIMARY ARTHROSCOPIC ACL-SUTURES

MA Scherer, R Ascherl\*, Th Brunner, HJ Früh, Th Brill, W Siebels, G Blümel

Institut f. Exp. Chir. and \*Chir. Klinik der TUM, Ismaningerstr. 22, D-8000 München 80/FRG  
Objectives: An increasing number of papers deal with the unfortunate late results of primary suture of the ACL. Today the majority of orthopedic surgeons use some augmentation techniques "except in certain cases..". It is these exceptions that matter: Young, otherwise healthy pts., active in sports. Regardless of the known problems (vascular/neural supply, biomechanical aspects of the reconstruction) there has to be a basic misconception—as conservative and operative treatment both produce a comparable clinical outcome.

Material and methods: The following in vitro-experiments were performed: I) Knot holding capacity of 3 suture materials: nylon, steel, vicryl (n=21) II) Primary suture retention of 3 ACL suture techniques: Marshall/Insall, Müller, lateral trap; primary fixation of pedicled patellar tendon grafts (PT) (n=27). Parameters for evaluation: stiffness, knot holding capacity, primary suture retention, maximum load to failure, mode of failure.

Results: From a merely biomechanical point of view the suture techniques given in the textbooks almost inevitably lead to an insufficient result, because the primary suture retention is extremely weak: 82.8, 33.7 and 35-50 N respectively for the Marshall-, Müller- and anchor-technique (Schmid). Only the lateral trap technique shows values that make sense and correspond to the results obtained with the PT: 204.5 vs. 161.2 N. The use of steel sutures with a high stiffness is unfavorable, the knot holding capacity with the lateral trap technique is lowered to 119.1 N. In primary ACL reconstruction the use of an augmentation technique is mandatory, arthroscopic placement of efficient sutures is impossible.