### Mechanical pull of the peroneal tendons on the fifth ray of the foot

The purpose of this study was to measure the deflection angle of both peroneal tendons as they turn around the lateral malleolus. A reduction of the angle occurs when the subject stands on tip-toes, in the manner of dancers and sprinters. This reduction of deflection angle leads to higher mechanical efficiency.

Female subjects were found to be superior to males in their ability to plantarflex the ankle, straightening out their tendons more than do men.

The traditional approach to exercising muscles around the ankle ignores the varied mechanical situations which occur during the practice of sports. The data presented should provide guidelines for rehabilitation programs of the injured ankle and lateral border of the foot.

Viel ER, Desmarets JJ. J Orthop Sports Phys Ther 1985; 7: 102–6.

### Objective evaluation of peroneal response to sudden inversion stress

The purposes of this paper are to describe an objective technique developed to assess the dynamic response of the peroneal muscles to a sudden inversion motion and to report the results obtained from testing injured and noninjured ankles. A platform was constructed to drop the ankle into a controlled degree of inversion while measuring the time to peroneal response and the angular rotation. Thirty volunteers were tested, 15 of whom had experienced a unilateral ankle sprain 3–10 months prior to testing. Results show a trend toward delayed peroneal response and greater angular displacement at the time of peroneal response in injured ankles but analysis of variance showed no significant difference. The total angular displacement in the injured ankles was significantly greater. This objective technique could be used to evaluate treatment regimens and, by testing ankles soon after injury and serially, to evaluate readiness to return to activity.

Nawoczenski DA, Owen MG, Ecker ML, Altman B, Epler M. J Orthop Sports Phys Ther 1985; 7: 107–9

### The influence of spine geometry on the coupling between lateral bending and axial rotation

A biomechanical model study was undertaken to examine to what extent facet joint orientation and inclination of the motion segments influence the coupling between lateral bending and axial rotation that occurs in the human spine. The results show that there is an opposite influence of the inclination of the motion segments and the orientation of the facet joints on the axial rotation associated with lateral bending. As one moves in a rostrocaudal direction along the spine there is a decrease of the axial rotation associated with lateral bending. At the upper part of the thoracic spine there is a reinforcement of the axial rotation due to the ventrally inclined orientation of the vertebrae. In the lower thoracic and upper lumbar spine the axial rotation during lateral bending will oppose that due to the dorsally inclined orientation of the vertebrae. In a flexed position of the spine, this coupling is stronger than in an extended spine.

Scholten PJM, Veldhuizen AG. Engng Med 1985; 14: 167–72

### Poroelastic dynamic structural models of rhesus spinal motion segments
### 1985 Volvo Award in Biomechanics

Finite element models (FEMs) and analytical and experimental models based on poroelastic constitutive laws were developed for rhesus spinal motion segments (SMSs). Long-time creep, transient creep, and impact were studied for SMSs with normal and simulated degenerated discs. The results suggested that long-time creep observed in excised SMSs may be reduced in the *in vivo* SMS. The fluid phase included in these FEMs was shown to play a significant role in the mechanical response of SMSs. Relative fluid motion fields predicted in the SMS could be related to nutritional paths to the avascular interior of the disc and were found to be very sensitive to changes in discal stiffness. Reduced disc height, increased discal bulge, altered fluid motion, and stresses were quantified and may be related to mechanical failure, disc degeneration, and low-back pain.

Simon BR, Wu JSS, Carlton MW, Kazarian LE, France EP, Evans JH, Zienkiewicz OC. Spine 1985; 10: 494–507

### EMG and force production of some human shoulder muscles during isometric abduction

Surface EMG was recorded in four subjects on three different occasions from the three parts of the deltoid, the clavicular part of the pectoralis major and from the infraspinatus muscles at different angles of abduction, in the frontal and scapular plane. The integrated EMG was related to the maximum values found for each muscle or muscle part during test contractions (%*EMG*). Linear relations can be seen for abduction angle vs %*EMG*. During abduction in the scapular plane the middle and posterior parts of the deltoid muscle showed significantly less activity than in the frontal plane. A simple two dimensional model to calculate the deltoid force out of total external moment at the shoulder is presented. For the middle part of the deltoid an EMG–force relation is presented. The maximal deltoid forces found during test contractions are compared with the absolute muscle force. Also, the length–force relation for the middle part of the deltoid muscle is given between 30° and 90° of abduction.

Ringelberg JA. J Biomech 1985; 18: 939–47

### Dynamically and statically determined low back moments during lifting

Assessment of the effects of lifting on the low back has most frequently been done with the aid of static models. Many lifting movements appear to have substantial inertial components. It was of interest, therefore, to determine the size of the difference between statically and dynamically calculated lumbar moments during a demanding but not unusual manual lift observed in a metal fabrication industry.

The results of several trials by four young men showed that the dynamic model resulted in peak L4/L5 moments 19% higher on average, with a maximum difference of 52%, than those determined from the static model. The technique adopted in the lift could minimize the difference. When the inertial forces of the load itself and the load weight were incorporated into an otherwise static model (quasi-dynamic) then the resulting L4/L5 moments exceeded those of the fully dynamic model by 25%.

In many industrial tasks static analyses may severely underestimate the demands of dynamic lifts. These results show that a reasonably inexpensive approach in lifting task analysis is to measure the dynamic forces of the load on the hands and to use these in an otherwise static model. This results in a conservative assessment of the injury risk of lifts at least of the type reported in this study.

McGill SM, Norman RW. J Biomech 1985; 18: 877–85