ISB

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PRESIDENT
Dr. Robert W.K. Norman
Dept. of Kinesiology
University of Waterloo
Waterloo, Ontario
Canada N2L 3G1
(519) 885-1211 ext. 2205
Fax (519) 746-6776

PRESIDENT-ELECT
Dr. Aurelio Cappozzo
Istituto Di Fisiologia Umana
Università Degli Studi 'La Sapienza'
00185 Roma
Italy
39-6-490673
Fax 39-6-445-2303

PAST PRESIDENT
Dr. John P. Paul
Dept. of Bioengineering
University of Strathclyde
Glasgow, Scotland
(041) 552-4400 ext. 3029 or 3030
Fax (041) 552-6098

SECRETARY-GENERAL
Dr. Donald B. Chaffin
Centre for Ergonomics
1205 Beal St. 10E Bldg.
The University of Michigan
Ann Arbor, Michigan
USA 48109
(313) 763-2245
Fax (313) 763-0455

TREASURER
Dr. Richard C. Nelson
Biomechanics Laboratory
The Pennsylvania State University
University Park, Pennsylvania
USA 16802
(814) 865-3445
Fax (814) 865-2440
(Membership Information)

NEWSLETTER EDITOR
Dr. Graeme A. Wood
Dept. of Human Movement Studies
The University of Western Australia
Nedlands, WA 6009
Australia
61-9-380-2361
Fax 61-9-380-1039

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XIIIth ISB Congress and Satellite Symposia Update

Whilst the ISB Congress is shaping up very well, interest in some of the satellite symposia has been not as good. For this reason the organisers of the Symposium on Occupational Electromyography and the Workshop on Isokinetic Dynamometry have decided to *cancel* their respective events. For those who were planning to attend those events (but perhaps had not as yet declared their intentions) we urge you to consider one of the other events that are being held in association with the XIIIth Congress (see past issues of this Newsletter). Alternatively, you may still wish to arrive in Western Australia a few days early and just do some sightseeing. If this is the case then you will find the enclosed material prepared by ORBA Travel on pre- and post-Congress tours of great interest. Included with this material are also details of the XIIIth Congress Social Program. If you aren't yet convinced that the XIIIth Congress is an event not to be missed then maybe this will sway you !

For those who regrettably aren't able to make it this year -don't despair. Extra copies of the *Book of Abstracts* will be available for independent purchase, either through a colleague who is able to attend the Congress, or by mail order from the Congress secretariat. To help the organising committee anticipate demand for these purchases you are urged to write now to the Congress office (same address as Editor's) expressing your interest in obtaining an extra copy (either for yourself or your institutional library) and you will be informed of purchasing arangements in due course. Remember that the traditional two-volume hardbound series is no longer being published. The volume of 'extended' (two-page) abstracts, however, contains almost as much scientific detail of current biomechanics research and therefore serves as an important and enduring source of information. (Also note the availability of the UCLA Congress volume in the accompanying column).

From the Editor

This edition of the Newsletter is devoted almost exclusively to short abstracts of a past conference of the French Société de Bioméchanique, which took place in Cluny (near Dijon - France in September of last year. Normally a *special edition* of the Newsletter would be required for such purposes but the shortage of copy on this occasion has allowed a regular issue to be used. However, while the short abstracts make good reading, it is a clear sign of ISB members not supplying the editor with an abundance of material ! For your information,

the Newsletter is published quarterly: February-March for the Spring Issue; May-June for the Summer Issue; August-September for the Autumn Issue, and November-December for the Winter Issue. Deadlines for material and articles are the first day of each first named month, and the Newsletter is mailed to members at sometime during the second named month.

Regular topics for the Newsletter include:

- Editorial
- Letters to the Editor
- Special Articles
- I.S.B Membership and Council News
- Laboratory Features
- Book Reviews
- Calendar of Scientific Events
- Thesis Abstracts
- Conference Announcements and Reports

So let's hear from you folks ! (see Editor's Note on page 14 regarding format of submissions).

In Memorium - Andrzej J. Komor

Dr. Andrzej J. Komor was killed in an aeroplane crash in Colorado Springs, Colorado on March 3, 1991. He was returning to the US Olympic Training Center from a trip to Texas A&M University devoted to wind tunnel testing for competitive cyclists. The sports science community and the International Society of Biomechanics, especially, have lost a remarkable individual. His intellect, energy, vitality, and commitment and dedication to the understanding of human sport performance will be impossible to replace.

Dr. Komor was extremely active in ISB. He first attended the VII ISB Congress as a student in Warsaw in 1979. He was a Charter member of, and had served as Secretary for, the Polish Society of Biomechanics. In the intervening period he became an elected member of the Executive Committee of ISB. He also had been a founding member and a tireless prime mover and Chairman of the ISB Working Group on Computer Simulation. He was one of the main organizers of the First International Symposium on Computer Simulation in Biomechanics, held in Warsaw in 1987, and had guided the WGCS through its difficult formative years.

Andrzej's formal education began at the Technical University of Warsaw where his combined B.S. and M.S. program culminated in a thesis on design of aircraft simulators. He received the Ph.D. from the Academy of Physical Education in Warsaw, submitting a thesis which dealt with the optimization of human motion in sports applications. His rare blend of training in Engineering

and Physical Education made him unusually able in the physical analysis of sport problems, and he was equally at home interpreting the differential equations of optimal control or communicating training techniques to athletes and coaches. He was especially effective at "bridging the gap" between theory and practice, so difficult in the field of sport biomechanics.

He began his professional career at the Institute of Sport in Warsaw where he served during 1981-85 as head of the Department of Biocybernetics. During this time he directed an unusual team of Ph.D. physicists and engineers tackling a creative and wide ranging set of problems in sport (from archery to gymnastics, pole vaulting and judo strategy). Usually fiercely independent, he sometimes clashed with the Party-appointed Director of the Institute and resigned on a matter of principle regarding a rule which he claimed was designed more to reinforce the power structure than to enhance productivity. Later Andrzej held visiting positions at the Institute of Sport in Rome, at two campuses of the University of California (Davis and Los Angeles) and with the U. S. Olympic Committee in Colorado Springs, Colorado.

In September 1990 he took a permanent position in the Sports Science Division at the USOC and had been an energizing and catalytic influence for change during his brief tenure there. One of his pet projects had been the envisioning and championing of a sport biomechanics wind tunnel which will be included in the future expansion and renovation of the USOC complex, to facilitate the optimization of aerodynamic performance for athletes and equipment. Only days before his death Andrzej had organized and attended a meeting at NASA Ames Research Center devoted to its planning and design.

Those of us who knew Andrzej personally held him in great regard. He was impatient with mediocrity, especially mediocre effort. He had an exceptional mind and spoke five languages well enough to communicate his ideas technically. He was a remarkably eclectic synthesizer and an exceptional information collector and processor whose mind seemed never at rest. He believed that research, especially in sport, should be outside the political arena and that new research knowledge should belong to all peoples. His uncommon ability to make friends seemed to emanate from his genuine respect for the rest of humanity.

Andrzej's intensity, enthusiasm and gusto extended to the more personal parts of his life as well. He had the ability to be childlike, especially in his relations with children, and once spent an entire Christmas Day sprawled on the rug making Lego construction projects with a young friend.

Through all his very full life Andrzej was extremely devoted to his parents and friends and to his native land. When we sometimes asked him if he wouldn't prefer to move to California, his reply was always that he would be most happy "making his own California in Poland." He often said that he believed that one should live one's life at full speed, so that there could be no regrets at the end. In virtually all the facets of his life, he epitomized the Olympic ideal of "Being the best that he could be." Andrzej Komor, a valued international colleague and friend to many of us, will be missed.

Mont Hubbard
Department of Mechanical Engineering
University of California at Davis

ISB CONGRESS PROCEEDINGS AVAILABLE

The Proceedings from the XIIth International Congress of Biomechanics held at UCLA in June, 1989 in Los Angeles, California USA are now available. The 850-page volume contains two-page abstracts of 413 free communications (oral and poster sessions) presented at the ISB Congress. Since the two-volume hardbound series will not be published as for previous ISB Congresses, these proceedings are an important literature source.

The cost of the Proceedings is as follows:

$30.00 (U.S.) for ISB members
$40.00 (U.S.) for non members

plus postage and handling:

$2.50 (U.S.) for US and Canada
$10.00 (U.S.) for all other countries

To order the Proceedings write to the Treasurer enclosing payment and postage:

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SHORT ABSTRACTS OF THE XV CONGRÈS DE LA SOCIÉTÉ DE BIOMÉCANIQUE

(Held in Cluny, France, September 1990)

FUNCTIONAL ANATOMY OF THE EQUINE INTERPHALANGEAL JOINTS

J.-M. Denoix

Service d'Anatomie, Ecole Nationale Vétérinaire d'Alfort 7, avenue du Général de Gaulle, 94704 Maisons-Alfort Cedex France

The purpose of this study was to evaluate the extent and repartition of contact articular surfaces within the distal interphalangeal joints of the horse under different circumstances of loading, limb attitude and foot orientation reproducing physiological sollicitations during natural gaits, jump and sport exercises. It was also to correlate experimental findings on isolated limbs with clinical applications and corrective shoeing. Forty-nine isolated thoracic limbs of adult horses and foals were used. For each experimentation, limb attitude (landing, support or propulsion) and foot orientation (horizontal or oblique surface) were carefully chosen in order to reproduce one of the physiological circumstances of the horse locomotion. The load was applied with a hydraulic workshop press and ranged between 200 and 1000 daN. As soon as the limb was placed and loaded, radiographs of the digit were taken and a colored solution of methyl violet (dilution: 1%) was injected within the articular cavities. Then an extensive rinsing of the joints was performed in order to eliminate all the excessive colored solution. After joints desarticulation under water, the synovial membrane, joint capsule and ligaments were removed and non colored articular surfaces of contact for the precise experimental conditions used were identified and photographed. On 7 live horses, radiographs of the digit were taken on unilaterally weight-bearing forelimbs. This study put forward some functional datas about the associated movements that take place within the digital joints of the horse. During asymetrical bearing of the foot, a forced association of lateroflexion and rotation movements was demonstrated within the interphalangeal and metacarpo-phalangeal joints. These displacements must be considered for correct shoeing of sound as well as lame horses.

MECHANICAL BEHAVIOR OF THE TENDONS OF THE HORSE'S HAND UNDER TRACTION

Crevier N.[*], Denoix J.-M.[*] and Geiger D.[**]

[*]Service d'Anatomie - Ecole Nationale Vétérinaire d'Alfort, 94700 Maisons-Alfort FRANCE
[**]Laboratoire de Mécanique-Physique - Université Paris-Val de Marne, 94000 Créteil, France

The purpose of this study was to evaluate the biomechanical behavior of the deep digital flexor tendon (DDFT), the superficial digital flexor tendon (SDFT), and the III interosseous muscle (III IO m.) in the Horse, when these anatomical elements are put separately under tension. Fourteen forelimbs of adult horses were tested with a tensile strength testing machine. Each tendon was fixed by its proximal and distal bone insertions. Pins were placed at different levels along each tendon and the strain of these morphologically distinct sites was determined by measurements on video recordings. Measurement of the cross-sectional area allowed further computation of the regional stress and modulus of elasticity (E). The III IO m. ruptured at a much higher average strain (14,7 %) than the SDFT (8,4 %) and the DDFT (6,6 %). This tendon was also characterized by the lowest average E (789,6 MPa) and relatively homogenous mechanical properties. As for the flexor tendons, the DDFT appeared to be stiffer than the SDFT (respectively 961 and 875,4 MPa); in both tendons, the metacarpophalangeal region was the most elastic one. This local increase of elasticity may be correlated with the histological features and the mechanical stresses undergone by the tendons in this region, under physiological conditions.

NUMERICAL APPROXIMATION AND EXPERIMENTAL COMPARISON IN MECHANICS OF BIOLOGICAL POROUS MEDIA

S. Naili, O. Le Gallo, D. Geiger

Laboratoire de Mécanique Physique, Université Paris Val de Marne 94010 Creteil - France

Taking into account the diphasic characteristic of biological tissues, which can be modelized, in a rough approximation, as a solid elastic matrix embedded in an interstitial viscous fluid, the theory of poroelasticity seems to be adequate. From the basic concepts of the mechanics of continuous media, constitutive equations were established. where characteristic parameters are: the Young's modulus and Poisson's ratio for the isolated structure (supposed to be constant with pressure and deformation), the dynamic viscosity of the fluid and the permeability of the medium as defined by Darcy's law. For a cylindrical sample subject to creep, relaxation or elongation tests, an analytical method of resolution was made up, based on the superposition of transient and permanent phenomena. This analytical solution is compared with experiments for the compression of a cylindrical sample, at a constant speed.

NUMERICAL INVESTIGATION OF BLOOD FLOW THROUGH SMALL BIFURCATIONS

M. Tazi, P. Schmitz

Institut de Mécanique des Fluides, URA 0005. Avenue C. Soula 31400 Toulouse

In order to improve the knowledge of atherosclerosis phenomenon our concern is to investigate steady flow through symmetric bifurcations. A finite element method has been used to solve the complete Naviers-Stokes equations. The results are presented as pressure and velocity plots at differents Reynold's numbers and various bifurcation angles (15, 30, 45 degrees). A shape factor F, related to Poiseuille profile, is defined to compare all the results. This special parameter allows characterization of the recovery length and the magnitude of the profile deformation. We have shown that the Reynold's number has an influence on the deformation of the axial velocity profiles and a high pressure gradient occurs at the inner corner of the daughter branch, near the apex.

INFLUENCE OF PULSATILITY IN A MODEL OF INTRACARDIAC JET

A. Delouche, B. Diebold, E. Abergel, Ph. Delouche, Ph. Dumee, P. Peronneau
Unité INSERM 256, Hôpital Broussais, 96, rue Didot, 75674 Paris Cédex 14 -France

So far, it has been hypothesized that numerical data obtained in steady flow conditions ("sf") apply to pulsatile flows ("pf"). The velocity fields was measured using laser Doppler anemometry with a "pf" and compared to the values obtained in "sf": at peak velocity, the longitudinal velocity profile is made of a plateau followed by an hyperbolic velocity decay in the turbulent area. The comparison of "pf" data with "sf" data demonstrated similar diameters at the origin of the jets, but significant differences both for laminar core and turbulences. Thus, pulsatility modifies velocity fields and the results obtained in steady flow conditions do not apply to pulsatile jets.

THE DEFLECTION OF A JET BY A CROSS FLOWING VELOCITY STREAM AND ITS APPLICATION TO RESPIRATORY GAS FLOW MEASUREMENT

N. Venuti and D. Isabey
Laboratoire de Physiologie Respiratoire Inserm U. 296
Hôpital Henri Mondor 94010 Creteil - France

Monitoring of ventilation requires to develop respiratory gas flow transducers capable to operate in difficult environments (water vapor, aerosols, mucus...). We thus examined the applicability of cross flowing velocity sensors classically used in free streams to measure gas flow in tubes. Theoretical and experimental investigation of total pressure in turbulent jets have shown that deflection of pressure profiles and therefore the total pressure difference measured at symmetrical sites in front of the nozzle, remained proportional to the cross flowing velocity over a wider range of velocity when total pressure was measured at a distance from the wall larger than 20% of the tube radius. In these conditions, this linear flow transducer can be installed in a tube to measure respiratory gas flow. Asymmetries due to the tridimensional character of the total pressure profile resulted in discrepancies of 10% maximum with the linear theory.

A THEORETICAL MODEL FOR NONINVASIVE ASSESSMENT OF TRANSMITRAL PRESSURE-FLOW RELATION USING ULTRASOUND TECHNIQUE

K. Isaaz
Service de Cardiologie A, C.H.R.U de Nancy-Brabois, Allée du Morvan, 54511 Vandoeuvre-les-Nancy, Université de Nancy, France.

Doppler echocardiography has been shown to be accurate for the assessment of the time course of the pressure drop (PG) across a stenotic valve using a simplified Bernoulli equation that allows only for the convective flow acceleration. However, in the absence of obstruction, the local acceleration effect cannot be neglected, and considering only the convective component for determining the time course of PG may introduce substantial error. Based on the linear momentum equation in its integral form, PG was calculated noninvasively with the use of M-mode, two-dimensional and Doppler echocardiography in a patient with atrial pacing and non obstructive mitral valve. The results show that PG is almost in phase with flow local acceleration. PG reaches its peak value (PGmax=9.3 mmHg) at the time of peak early flow local acceleration, well in advance to the attainment of peak flow velocity. At the time of peak flow velocity PG has already fallen to 46% of its peak value. These results are in close agreement with published experimental data in term of PG time course and magnitude. Computer simulation of early diastolic left atrium and left ventricle pressure curves based on reported constants of left ventricular relaxation, left atrial and ventricular chambers stiffness combined with sine waveform simulated mitral flow verifies the time course and the magnitude of PG as predicted from the present theory. This report provides a theoretical method for the noninvasive assessment of transmitral pressure-flow relationship using ultrasound technique.

180 ELASTIC BUTEL HIP PROTHESIS: CLINICAL AND BIOMECHANICAL STUDY - A REVIEW OF 85 CASES

S. Plaweski, J. Butel, B. Landjerit

The authors analyze in this study the clinical results of Butel iso-elastic prosthesis in 85 patients. The follow up is 5 years. 92 % of good results and more were observed. There is no stress shielding and any cortical atrophy. Radiological results were compared with biomechanical study (experimental and finite element analysis).

AORTIC BLOOD VELOCITY AND + GZ ACCELERATION

C.C. Tran*, O. Langeron*, F. Paillard*, F. Laborde***, D. Payen***, P. Gallix** et P. Quandieu*
*LCBA-Division de Biomécanique (Paris)
**CERA-Fondation de l'Avenir (Paris)
***Hôpital Lariboisiére (Paris)

Under high sustained + Gz acceleration, grey and blackout precede loss of consciousness. The aim of this work was to study, in awake primate, this brain hypoxia phenomena by ascending aortic blood velocity measurements under hypergravitation (until + 6 Gz) with pulsed doppler. Materials and method were previously described and discussed. Several parameters were obtained: mean velocity (Vmean), peak velocity (Vmax) and peak blood acceleration (MA). Results showed that Vmean and Vmax decreased with G level increase but MA was not changed. Left ventricular function decrease under hypergravitation seems to be due to changes of load conditions and not to inotropic decrease.

THEORETICAL AND EXPERIMENTAL SIMULATION OF CARDIAC CATHETERIZATION.

P. Médéric*, R. Gaudu*, J. Mauss**, M. Zagzoule***
*Institut de mécanique des fluides de Toulouse, avenue Camille Soula. 31400 Toulouse, France.
***Université Paul Sabatier, 118 route de Narbonne. 31062 Toulouse cedex, France.

The unidimensional modelling of an unsteady flow through a flexible axisymmetric pipe can only be considered right as far as the unidimensional approximation of the wall shear stress corresponds to the problem in question. When applying to cardiac catheterization (blood pressure taking), we use asymptotical approximations achieved for small values of Womersley number $\beta_\Box$ and for a Newtonian fluid. Our theory can be validated by an experiment for which we had to make a periodical signalling generator used in low frequencies. Theoretical results agree with experimental ones concerning Womersley's small numbers but also Womersley's numbers around the value of 10

MODEL OF THE RAT NASAL CAVITY ANATOMY BY A CAD CODE

E. Jaillardon[1,3], M. Cattarelli[2], B. Gay[1,3], L. Astic[2]
[1]Laboratoire de Mécanique des fluides et acoustique UA CNRS 263 ECL 69131 Ecully
[2]Laboratoire de Physiologie Neurosensorielle UA CNRS 180 UCBL 69622 Villeurbanne
[3]Centre de Mécanique UCBL 69622 Villeurbanne

The purpose of the present summary is to obtain a geometric modeling of the rat nasal cavity, in order to generate a finite element net of the cavity volume. To obtain a geometric modeling of the rat nasal cavity, the CAD code CATIA was employed in order to obtain a representation of the cavity surface. This representation was obtained as follows: (i) acquiring data in frontal sections, (ii) smoothing the points characterizing every sections, (iii) constructing the surfaces supported by smoothed curved.

3-D STUDY OF IDIOPATHIC LUMBAR AND THORACO-LUMBAR SCOLIOSIS BEFORE AND AFTER V.D.S. PROCEDURE

P. Roussouly*, V. Fiere*, L. Cheze**, J. Dimnet**
*Centre des Massues A. Bonjean. 92 E. Locard, 69322 Lyon
**Universite C. Bernard 43 Bd. du 11 novembre 69622 Villeurbanne

Thirty thoraco-lumbar and lumbar idiopathic scoliosis are analysed by a 3-D computerized method of best fit planes described by DIMNET and all. This analyse is done before and after V.D.S. procedure. The 3-D structure of preoperative spine may be either continue or discontinue in adolescent scoliosis. In adult scoliosis with dislocations we always find discontinuity. These discontinuities can be quantified by the angulations between two planes. After V.D.S. procedure we can control the alignment of the different planes and the vertebral segmental derotation into the plane.

OSTEOPOROSIS AND MECHANICS: AN "IN VITRO" DENSITOMETRICAL AND MECHANICAL STUDY OF THE PROXIMAL FEMUR

J. Cordey, M. Schneider, C. Belendez, W.J. Ziegler, B.A. Rahn, S.M. Perren
Laboratory for Experimental Surgery, CH-7270 Davos, Switzerland

Proximal femur fractures of the elderly are a major problem. In studying the fracture treatment, it is prerequisite to have a sound knowledge about the relationship between the morphology of the bone and its mechanical properties. The objective of this study was to analyze these factors 'in vitro'. X-rays and quantitative computed tomography were carried out on pairs of human cadaveric femora; 8 of them were instrumented by strain gauges and submitted to an eccentrical load. High correlation was found either between bending stiffness and cross-sectional size; however, unexpectedly low correlation was found between bone mass or density and stiffness.

CAD/CAM OF A PERSONALISED HIP PROTHESIS

H. Razian, N. Levy

This project deals with the computer aided design (CAD) and manufacturing (CAM) of a personalized hip prothesis, used with a set of adapted rasps. Our process covers: C.T. cross-section digitization, tri-dimensional reconstruction, computerized data processing, homogenous points distribution, mathematical approximation, closed adapted CAM processing and interactive stress analysis. A very valuable contact between prothesis and bony parts and so a reliable stress distribution is assured by the aide of this conception.

FIABILITE DE LA PROTHESE FEMORALE ISOELASTIQUE DE BUTEL PAR L'ETUDE DES CONTRAINTES SELON LA METHODE DES ELEMENTS FINIS

D. Mainard, J.P. Delagoutte, M. Gueury, N. Recho, V. Kromer
Service de Chirurgie Orthopédique et Traumatologique - CHU brabois - 54500 Vandoeuvre les Nancy

Stem of BUTEL's hip prosthesis is a cementless isoelastic implant formed by four rods jointed in pairs at the distal end. Because of the occurrence of clinical fractures of the stem, we studied by the finite element method, the critical locations around the roots of the rods. Fatigue fracture mechanics analyses provided fatigue life predictions. An initial flaw shall be assumed to exist in one of the rods in the critical locations. We performed the finite element stress analysis using an original program DIAGUE developed on a simple micro-computer. Fracture surfaces analysis of two extracted prostheses revealed fatigue striations and a crack initiation due to a flaw. Fracture occurred in the other rods successively because of a general stress field redistribution. Finite element stress analysis provided a peak stress from 30 % to 70 % of the yield stress in the critical locations. The progression rate of

the crack, (Paris' equation) and the linear cumulative damage rule of Miner showed and estimated durability of about 3 years for the AISI 316 L prosthesis (according with clinical observation; initial flaw of 0.1 mm length). The breaking of the second rod happens after 3 x 10 cycles, 4 to 8 x 10 cycles for the third rod and 10 cycles for the last rod. The estimated durability of the TA6V prosthesis was greater than 6 years.

A THREE-DIMENSIONAL MODEL OF THE CERVICAL SPINE

F. Lavaste, N. Maurel, M.Noat, W.Skalli, Y. Lothore, D. Drevet
Laboratoire de biomécanique, Ecole Nationale Supérieure d'Arts et Métiers, 151 Bd de l'Hôpital, 75013 PARIS.

The aim of this study is to make a three-dimensional mechanical and geometrical model of the cervical spine, using finite elements. For this study, we first measured the coordinates of 140 points on each cervical vertebra with a machine allowing a three dimensional measure. Then, we approached these points to surfaces or curbs which parameters are determined. These parameters will be reduced by correlating them to each other after a statistic study. Finally, we made a first geometrical model with a mesh of finite elements of a motion segment C5-C6. A cervical vertebra is modelized with 386 nodes and 178 elements.

THREE DIMENSION RIGIDITY OF THE ILIZAROV EXTERNAL FIXATOR APPLIED TO THE FEMUR - AN EXPERIMENTAL STUDY

Ph. Merloz, N. Maurel, D. Marchard, F. Lavaste, J. Barnole, C. Faure, J. Butel
ENSAM Laboratoire de Biomécanique 151, Bb de l'Hôpital, 75640 Paris Cedex 13

The application of the Ilizarov device to the femur creates several problems: anatomical (transfixion of the thigh), mechanical (asymetrical assembly) and clinical (patient acceptability and duration of treatment). Geometric modifications of the original fixator are proposed. These comprise the use of threaded pins proximally and special connecting pieces. Two large fixators were tested under load and after the introduction of certain variables led the authors to experiment with 18 different assemblies. Four loads were used (compression, flexion in the sagittal and coronal planes and torsion) and stiffness calculated in three dimensions. Three linear and three angular displacements were defined for each type and magnitude of external load. The following sequence of analysis was followed to select the best type of assembly; increased rigidity in torsion; moderate displacement in flexion and axial elasticity. These considerations also apply to the mechanics of fracture healing. After testing under load we conclude that the original assembly gave the best compromise. The modified assemblies gave a slightly inferior mechanical performance but their geometrical configuration should give better patient tolerance if the following items are used: a proximal arc of 120°, 5 mm diameter threaded pins for the adult and 4 mm diameter for the child.

C.A.D. OF HIP PROSTHESIS : 3D DEFINITION OF BONE IMPLANT

C. Jacob, F. Dujardin, R. Mollard, A. Coblentz
Laboratoire d'Anthropologie Appliquée
URA 220 CNRS, 45 rue des Saints Péres 75006 PARIS

Our research team, composed both by engineers and surgeons, is to solve the two main difficulties created by CAD of hip prosthesis : 3D cortical bone definition and conception of an implant that fit as most as possible the femur. First, we use scanner and a self-developed software to obtain bone cortical lines. The software takes in account the differences of hardness in the femur. Second, we simulated the implantation kinematic of a 3D prosthesis in a bone. So, we obtained an implant that filled the bone as near as possible, without creating problem during surgery. The method can preserve the essential contact zones. After in vivo experiments, we will be able to modify, if necessary, the softwares developed so as to obtain an implant useable, even for young patients.

MODELES MATHEMATIQUES DE PIECES ANATOMIQUES. APPORT DES B-SPLINES A LA REALISATION D'UNE PROTHESE

J. Bauchat, A. Defretin, G. Caignaert, A. Gallet, J. Decaux
Centre de Lille de l'Ecole Nationale Supérieure des Arts et Métiers 8, Boulevard Louis XIV 59046 Lille Cedex

This paper presents a general survey of the various geometrical tools available to describe curves and surfaces, in order to model anatomical objects, e.g. skeleton pieces. The benefits and the disadvantages of some current techniques (Bezier curves and patches, B-splines curves, Non-uniform Rational B-splines, Rational curves and surfaces) are discussed according to the aims expected from solid modeling in connection with machining technics and work concerning the realization of a hip prosthesis. The objects (prosthesis and rasp) to be produced are described by a B-spline representation and machined on a 2.5 axes N.C. milling machine.

ULTRASONIC MEASUREMENTS OF THE ELASTIC PROPERTIES OF TIBIAL CORTICAL BONE

M.C. Hobatho, R.B. Ashman*, R. Darmana
INSERM U305, Hôpital Hôtel Dieu, 31052 Toulouse cédex
*Texas Scottish Rite Hospital, DALLAS, USA.

Elastic properties of human tibial cortical bone were investigated to optimize finite element studies and to characterize the degree of inhomogeneity of the tibia. Ultrasonic method was used to measure the velocities, then elastic properties were calculated. The tibial cortical bone was found significantly orthotropic with $E1 < E2 < E3$ & $E3 \approx E1$, $E3 \approx E2$. The values of $E1$, $E2$ and $E3$ were respectively 8.8, 9.6, and 17.6 GPa. The preliminary results of the spatial variational studies seemed to show a non-significant variation of elastic properties along the length and a lowest value on the posterior side.

DEFORMATION OF THE PELVIC RING AND OF THE ACETABULUM IN MONOPODAL STANCE

P. Massin, B. Landjerit, R. Roy-Camille

Measurements of pelvis deformation using strain gauges had been performed in bipodal stance or unipodal stance for low load, inferior to the body weight. We were able to simulate unipodal stance under loads of 70 kilogrammes, similar to an average body weight. An experimental model was realized using fresh cadaver pelvis and synthetic gluteus muscles fastened to the iliac crest. The one was connected to an Inströn machine in an unconstrained fashion. Results are given before and after implantation of metal-backed acetabular component.

TRIDIMENSIONNAL CHARACTERIZING AND CLUSTERING OF SCOLIOTIC SPINES

T. Dupont, A.P. Godillon, F.X. Lepoutre*, D. Chopin, P.Y. Plais**
*LAIH URA CNRS 1118 - Université de Valenciennes - 59326 Valenciennes Cedex France
**Institut CALOT- 62608 Berck-sur-Mer Cedex France

Clustering scoliosis can often be made from angular global datas which synthetize the spine. This article gives us an analytic approach based on choice of local variables related to each vertebra or intervertebra disc. It is possible to distinguish: - Absolute local variable (definition of position or angle against the base frame when the patient is standing). - Relative local variable (linear or angular varyings between vertebras). - Intrinsic variable (geometric description of a disc or vertebra body). A typological study was carried out on absolute local variables, which tally with the centre of gravity's coordinates of each vertebra of spine. As regards the 37 patients who have been studied, 4 globally independent factors appeared. The first factor makes a difference between the soft and large curvatures which follow mainly between T7 and T12. The second represents the height of the lumbar spine. The third factor defines the back lateral deformations and the fourth one defines the lumbar lateral deformations.

MESURE SIMULTANEE DE LA PRESSION INTRANUCLEAIRE CHEZ LE CADAVRE ENTRE LES 3ᵉᵐᵉ ET 4ᵉᵐᵉ LOMBAIRES

A. El-Khatib, P. Laporte, G. Somenzi, F. Pignolet, F. Guillon, C. Tarriere, J. Proteau

To prove the validity of the measurement of the intradiscal pressure, we introduced two pressure transducers (P1 and P2) in the nucleus of the lumbar disc L3/L4. A cadaver is submitted to sinusoidal vibrations of ±1 & 2 mm in amplitude, at a frequency of 3 to 15 Hz. The subject is tested in a right sitting position on a rigid chair, and a driving position on a car seat. The maximal variation of the intra-nuclear pressure is calculated. The author compares P1 and P2 measurements and shows a high degree of correlation between these two values.

AN EXPERIMENTAL BIOMECHANICAL STUDY OF THE PATELLOFEMORAL JOINT BEFORE AND AFTER TIBIAL TUBEROSITY ADVANCEMENT

J.L. Retaillaud*, R. Darmana**, P. Bonnevialle*
M. Mansat*, J.P. Morucci**

*Service de chirurgie orthopédique et traumatologique,
C.H.U. Purpan, place du docteur Baylac
F 31049, Toulouse
**INSERM U. 305, centre hospitalier hôtel-dieu
F 31052, Toulouse

A measuring system using a pressure sensitive film has been developed to measure the contact areas and pressures in joints. In this study we have analysed the patellofemoral contact before and after tibial tuberosity advancement. In 1963 P. Maquet suggested tibial tuberosity advancement as a biomechanical solution for patellofemoral arthrosis and chondromalacia. Experiments were performed on fresh human cadaver knees which were tested with flexion ranging from 10 to 70 degrees. The contact area ranged from 0.7 to 4 cm², from 10 to 70 degrees of flexion, and the contact pressure ranged from 0.9 to 3.5 MPa. The patello-femoral contact was not modified to any significant extent by advancing the tibial tuberosity. Results have been compared with those of other publications, and with Maquet's theory. These results have shown that the indication of this operation should be limited in orthopedic surgery.

REGIONAL ORGANIZATION OF ADULT SCOLIOTIC SPINES

J. Dimnet, L. Cheze, V. Djordjalian, P. Roussouly
Laboratoire d'Anatomie et de Biomécanique Clinique BP 12
69921 Oullins Cédex

The spine of a normal subject is structured so that the set of vertebral symmetry planes belongs to subject's sagittal plane. In case of adult scolioses, the patient's spine is organized in plane separate regions bounded by discontinuities. In each region each local vertebral plane symmetry belongs roughly to a plane. An orthopaedic correction or surgical operation has two separate actions: reintroduce each local symmetry plane into its regional plane, and bring as near as possible each planar region into the patient's sagittal plane. A software has been defined for this study. First, it locates precisely each local vertebral frame from frontal and sagittal standard X-ray images. Second: the regional planes are located in space and discontinuities between successive zones are displayed. Third: each vertebral local frame is projected onto the corresponding regional plane showing the maximum regional curvatures. The results allow a better understanding of reduction mechanisms of adult scolioses. Presently numerous medical files are gathered in purpose of clinical use.

MEASUREMENT OF THE ELASTIC MODULUS OF TIBIAL CORTICAL BONE

R. Darmana, M.C. Hobatho, R.B. Ashman[*]
J.P. Cahuzac[***], A. Autefage[****]
Inserm U305, Hôtel Dieu, Toulouse
[*]Texas Scottish Rite Hospital, Dallas
[***]Service d'orthopédie pédiatrique, CHU Purpan, Toulouse
[****]Service de pathologie chirurgicale, ENVT, Toulouse

A mechanical method using compressive test and strain gages has been developed to measure the elastic properties of the human tibial cortical bone. Results have been compared with those of measurements performed with an other method using ultrasonic measurements. The same samples have been used with both methods and the results were similar. The size of the samples has been optimized by a finite element analysis. The study of the circumferential and longitudinal variation of the elastic moduli has shown no significant relation. The mean values were 21,3 GPa for axial modulus, 11,5 GPa for circumferential modulus and 9,5 GPa for radial modulus.

A SIMPLIFIED SIMULATION METHOD OF LIMB MOVEMENT FOR 3D HUMAN GEOMETRICAL MODELS

J.P. Verriest
INRETS/Laboratoire Ergonomie Santé Confort 109 Av. S. Allende, Case 24 - 69675 Bron Cedex - France

Human geometrical models can help the ergonomic design of workstations. The simulation of limb movements with these tools can be very difficult depending on the way the user has to define the motion, as regards to the number of axes of motion involved. This paper presents a simple method, based on implicit axes coupling definition, to compute the angular values for the 7 motion axes of the upper limb from position constraints imposed on one or two points of the hand.

SPRINT START: BIOMECHANICAL ANALYSIS OF THE ANTICIPATORY MOVEMENTS

F. Natta, Y. Breniere, C. Rega
Laboratoire de Physiologie du Mouvement, URA CNRS 631,
Université Paris-Sud, 91405 Orsay Cedex, France

The study dealt with a biomechanical analysis of the anticipatory movements in sprint start. Six international level sprint women executed sprint starts on a large force plate. Three initial postures, which differed by the antero-posterior distance of the center of gravity (CG) to the starting line, were examined. In the most backward initial CG position the velocity of CG resulting from the impulse on the starting-blocks and the duration of the anticipatory movements were higher than in the two other situations. In the most forward initial CG position, the amplitude of the backward shift of the vertical force barycenter and the magnitude of the push-forces on the blocks were higher than in the other situations. The optimal starting position in sprint was discussed.

PHENOMENES ANTICIPATEURS DU LEVER DU TALON DANS L'EXECUTION DU PAS SIMPLE: ETUDE COMPAREE DES MODULES DES ACCELERATIONS GLOBALES ET LOCALES

G. Dietrich, Y. Breniere
Laboratoire de Physiologie du Mouvement. U.A - C.N.R.S 631. Université de Paris-Sud. 91405 Cedex Orsay, France.

The aim of this work was to study the local movements at hips and shoulders, at heel-off time, i.e. when step execution began during the gait initiation movement. The heel-off was considered as a perturbation induced by the self gait movement. The analysis was carried out by accelerometers recordings of triaxal accelerations at joints of the upper body, and simultaneously, by measuring the triaxal accelerations of the center of gravity. The resultant vectors were considered in order to established and to compare the magnitude of these accelerations at different joints at heel-off, and to distinguish the respective roles of the pelvis and the scapular girdle.

BIOMECHANICAL ANALYSIS OF GAIT IN CHILD: WHY DO THE CHILDREN WALK IN FALLING ?

Y. Brenière and B. Bril

Some posturo-dynamical features of gait movement, and especially vertical acceleration of the center of gravity ($\ddot{Z}G$), have been studied, longitudinally, in 5 children observed longitudinally during the first three years after onset of their independent walking. The results show that for the child, and contrary to adult, $\ddot{Z}G$ is negative during all the swing phase. At foot contact, $\ddot{Z}G$ which is still negative become positive and remains positive during the double support phase, while for the adult the value of $\ddot{Z}G$ become positive before foot contact. A mathematical model which computes the net moment of the internal forces at the hip, strongly suggests that the child cannot display the necessary muscular strength to allow a good control of the vertical fall of pelvis during unipodal phase.

POSTURAL ADJUSTMENTS ASSOCIATED WITH VOLUNTARY LEG MOVEMENTS: INFLUENCE OF THE PURPOSE OF THE MOVEMENT

P. Beraud, Y. Gahery and J.C. Fabre
CNRS, Laboratoire de Neurosciences Fonctionnelles, U3 31, Chemin Joseph Aiguier, 1300 Marseille
France

The movements considered in this biomechanical and electromyographical study of the postural adjustments associated with leg movements were the low level kicks used in French Boxing. The results show that considerable anticipation of the postural phenomena occurs. First a decrease was observed in the vertical force exerted by the postural foot, linked to an increase in the thrust of the other foot. When the purpose of the movement was the force to be exerted, the beginning of the leg displacement was delayed, which corresponds to a lengthening of the preparation phase.

VARIATIONS OF POSTURAL SWAY IN DIFFERENT BI- OR UNIPODAL STATIONS

M. Dessalle-Foidart, R. Debeche,
V. Markiewicz-Bartsch, L. Delhez
Laboratoire d'Analyse des Mouvements et de Biomécanique,
Université et Province de Liège, 4 quai du Barbou 4020
Liège Belgium

In 40 male and 40 female subjects aged 16 to 29 we quantify frontal (Dy) and sagittal (Dx) postural sway using a computerized posturographic technic in different bi- or unipodal stations: parallel separated feet, joined feet, aligned (feet left heel before right forefoot and vice-versa), left and right unipodal standing. Dx and Dy are significantly lower in female subjects; they do not significantly differ when left or right foot precedes the other one and in right or left unipodal standing. Dy and Dx increase significantly in both sexes from separated to joined feet (Dx: + 14-22%, Dy: 100-130%) to aligned feet (Dx: + 130-158%, Dy + 168-172%) and to unipodal standing (Dx: + 250-299%, Dy 513-518%) as the sustentation basis decreases mainly in the frontal plane. These quantified data can be useful reference values. The frequency/amplitude spectrum (0,05-3,2 Hz) is similar in all positions with most ample oscillations in the low frequency range (0,05-0,75 Hz).

COMPARISON OF POSTURAL SWAY BETWEEN OLD VALID SUBJECTS AND YOUNG ADULTS UNDERGOING A ROMBERG TEST

L. Delhez, C. Moyaerts, M. Dessalle-Foidart
Laboratoire d'Analyse des Mouvements et de Biomécanique,
Université et Province de Liège, 4 quai du Barbou 4020
Liège Belgium

In order to collect reference data for old patients with unsteadiness, we compare posturographic computerized investigation of the Romberg test in 30 old valid people aged 77,8 ± 3,4 y (15 men, 15 women) practicing regularly gymnastics in groups and 30 students in physical training aged 20,2 ± 2 y (15 male and 15 female). In each group, sagittal (Dx) and frontal (Dy) potural sway and its amplitude/frequency spectrum (0,05-3,2 Hz) are measured. In all groups Dy varies more than Dx reflecting higher frontal instability; Dx and Dy increase in the same range with closed eyes. Dx and Dy are higher but still satisfactory in old patients x2, x2,4 for women; x1,2, x1,4 for men). Dx and Dy are the lowest in young and the highest in old women. The amplitude/ frequency spectrum has a majority of amples oscillations in the lower frequency range (0,05 to 0,75 Hz) in four groups and only rare oscillations in the high frequency range in old subjects. We conclude that postural stability is still good in valid old patients.

MODIFICATIONS OCCURRING DURING ACQUISITION OF FAST ELBOW EXTENSION: EFFECT OF ANTAGONIST MUSCLE FATIGUE

S. Le Bozec, J. Zouhri, M. Gentil
Laboratoire de Physiologie de la Motricité, UA CNS 385,
91, Boulevard de l'Hôpital, 75634 Paris Cedex 13, France

Five subjects practiced accurate, fast elbow extension of 20° to a 3° wide target in two conditions: before and after a local muscular fatigue in the antagonist muscle. 1-Whatever the experimental condition, no changes were seen in the integrated EMG or the latency of the initial agonist burst. 2-Both the IEMG and latencies of antagonist burst were similar during first movements. On and after the 5th movement, the activity of the antagonist burst was larger after fatigue. The onset of antagonist activity took place earlier in the braking process. 3-The perturbations of movement tend towards an over-estimation of the desired amplitude after fatigue during first movements. Subjects learn progressively over the practiced distance on and after the 5th movement by refining their neural commands.

IS IT BODY POSTURE OR EQUILIBRIUM WHICH IS PROGRAMMED ?

P. Nouillot, M.C. DO and S. Bouisset
Laboratoire de Physiologie du Mouvement, U.R.A.
C.N.R.S 631, Université de Paris-Sud, 94105 Orsay France

The analysis of two voluntary movements involving transient or definitive modification of the postural basis was used to determine what of the final body posture or the equilibrium was taken into account by the motor programming. The task was a flexion-extension (FE) of a lower limb executed at maximal velocity. The initial posture was bipedal but the final body posture was bipedal (FEbb) of unipedal (FEbu). The biomechanical results showed significant differences between parameters of the two movements. Discussion suggested that the final body equilibrium was one of the relevant parameters taken into account by the motor programming.

KINEMATICS MODELS OF HUMAN BODY

F.X. Lepoutre and M. El Abbari
Laboratoire d'Automatique Industrielle et Humaine - UA
CNRS n o 1118 Université de Valenciennes et du Hainaut
Cambrésis Le Mont Houy 59326 Valenciennes Cedex -
France

Ergonomics design of man-machine system is facilitated by use of anthropomorphic man-models. These ones are often computerized and include an increasing number of geometric, kinematic and mechanical parameters which produce heavy manipulation and limit their applications. The aim of this paper is to present two contributions to improve the use of kinematic man-models. The first one shows the interest of the good interactivity of robot simulation software (ROBCAD on

Silicon Graphics Workstation) for design and animate man-model. The second part describes a control rule simulation method for all the man-model joints, based on inverse kinematic theory of redundant robots.

DYNAMICAL SIMILITUDE AND MUSCULAR SHORTENING

H. Vandewalle
Laboratoire de Physiologie, 91 bd de l'Hôpital, 75013 Paris

Time scale is generally considered as equal to length scale since the theory of biological similitude (1927). This is false because of the relationship between force and velocity. Let the relation between sarcomere intrinsic velocity (VI) and length L to be : $VI = k.L^x$, dynamical similitude corresponds to the scales of masses $\underline{m}$ and time $\underline{t}$ which are related to length scale $\underline{l}$ according to the following equations: $\underline{t} = \underline{l}^x$ and $\underline{m} = \underline{l}^{1-2x}$. In presence of gravity forces, dynamical similitude corresponds to x = 0.5 and $\underline{m} = \underline{l}^2$. The theory of biological similitude is only valid in the case of inertial forces and provided that x = -1.

EVALUATION DES POSSIBILITES D'UN APPAREIL DE REEDUCATION

M. Louis[*] and B. Raucent[***]
[*]Université Catholique de Louvain, Institut d'Education
Physique et de Réadaptation 1,
Place Pierre de Coubertin, 1348 Louvain-la-Neuve Belgique
[***]Faculté des Sciences Appliquées (MECA - PRM)
Université Catholique de Louvain, Département de
Mécanique Place du Levant, 2 1348 Louvain-la-Neuve
Belgique

The study sought to show some characteristics of the use of the Giroplan apparatus. In rehabilitation, firmly established and precise criteria must guide the choice of exercise sequences. The precision of the experimental parameters selected made it possible to evaluate the advantages of the Giroplan in functional rehabilitation. It is clear that a strategy guided by quantitative criteria such as measurement of dissipation of energy allowed steady improvement in the patient's condition throughout the period of convalescence.

POSTURAL REACTIONS DURING VOLUNTARY SEGMENTAL DISPLACEMENT FOR TESTING ARTIFICIAL CLIMBING HOLDS COUPLES

P. Rougier and J.P. Blanchi
Laboratoire RE.S.ACT SPORT-UFR APS-BP53X-F38041
Grenoble Cedex

This paper presents an original dynamometric device for a vertical quadripodal stance on an artificial climbing wall. It consists of a fixed and movable vertical wall-mounted rigs to which adjustable hands and feet holds are instrumented by means of load cells. Five male rock climbers of level 5.10c/d carried out 10 trials for several hand/feet hold couples. This device is used to characterize climbers posture during voluntary foot displacement. It can also be used for testing in a more objective way artificial climbing hands and feet hold couples.

MODELISATION D'EXERCICES AVEC LACHER ET REPRISE EFFECTUES PAR DES GYMNASTES SUR UNE BARRE HORIZONTALE DEFORMABLE.

M. Canal[*], G. Coffignal[***], J.J. Brochot[****], M. Bon[****]
[*]Laboratoire d'étude et de recherche sur la performance sportive. U.F.R.-S.T.A.P.S., Université de Bourgogne, B.P. 138, 21004-Dijon-Cedex
[***]Ecole Nationale Supérieure des Arts et Métiers de Paris (Département des structures) 151, Bld. de l'Hopital 75640-Paris-Cedex 13
[****]Ecole Nationale Supérieure des Arts et Métiers de Cluny (laboratoire de Mécanique) Place de l'Abbaye 71250-Cluny

A mathematical model of the gymnast's skill on an horizontal bar has been produced, with the help of a micro-computer. The exercices analysed are giant swing movements at the bar including fall and recovery. The model proposes a system of three mobile links (arms, head and trunk, legs) revolving around a deformable axle (horizontal bar), and the movement of which is governed by Lagrange's equations. Validation of the model using strain gauge recordings and digitalisation of a film-camera picture raises a few problems, which are presented here. Yet, hypothesis concerning the regulation and command of the sport's movement can be put forward, and these are closely related to the current theories about the muscular power control.

BYDYNAMICAL ANALYSIS OF THE HOOF-TRACK INTERACTIONS ON TROTTING HORSES

E. Barrey[*] and B. Landjerit[**]
[*]Laboratoire de physiologie sportive INRA, ENVA, 94704 Maisons-Alfort cedex, France
[**]Laboratoire de biomécanique de l'ENSAM, 151 Bd de l'Hôpital, 75013 Paris, France

The purpose of this study was to measure the normal dynamic hoof parameters of 5 trotting horses on asphalt. A force measuring hipposandal provided continuous recording of the vertical hoof force in four locations under the hoof wall. A uniaxial accelerometer was fixed laterally on the hoof wall and provided measurements of shocks and vibrations. The impact shock (-708 m/s^2 ± 67) and vibrations (592 Hz ± 141), duration of the vibrations (32.5 ms ± 12.2), maximum vertical hoof forces (3655 N ± 621) and stance phase duration (276.4 ms ± 28.5) were measured on the acceleration-time curves and force-time curves. The vertical component often shows successively two dynamic processes: high frequency forces immediately after the hoof impact and low frequency forces in the latter part of the stance phase. The impact forces reach a large magnitude and vibrate at high frequencies. These vibrations were considered to have only damaging effects on the locomotor system of the human athlete and the performance horse. These impact forces could be minimized by using damping pads and a suitable track.

ETUDE PAR ELECTROMYOGRAPHIE TELEMETRIQUE DE LA MODELISATION EN "ARCS MOTEURS" CHEZ LES VELIPLANCHISTES DE COMPETITION

B. Meurgey

Laboratoire d'etude et de recherche sur la performance sportive, U.F.R.S.T.A.P.S. Campus Montmuzard B.P. 138. 21004 Dijon cedex

This study consists in an electromyographic analysis of 16 muscles or muscular groups of competition windsurfers. There were the subjects of recording *in situ* by telemetry. The electromyographic signals were collected in synchronizatlon with the video image and stored on the sound track of the cassette. They were then stripped and treated with a computer to obtain the integrated E.M.G. It appeared that the power of the wind in the sail is transmitted to the float according to a model expressed in "motors arcs" (98.28% of the cases; n=6720). The "bilateral arc" is characteristic of close hauled reaching and wind free running. The "mixed arcs" (2 hands-back leg) are used specifically for bearing away and luffing up. The absence of modelisation in a competitor is significant of this difficulties of a technical nature.

A REALISTIC MODEL OF THE HUMAN HAND-ARM EXPOSED TO SINUSOIDAL EXCITATION

R. Gaertner, F. Bermond and J. Dimnet

Groupe de Biomécanique Université Claude Bernard LYON I, 43, boulevard du 11 Novembre 1918, 69622 Villeurbanne Cédex - France

The aim of the present work is to study the internal effects of vibrations on the hand-arm constituents. The model is grounded on the modelisation methods of structural mechanics. Mass, stiffness and structural damping matrices are computed for bones and muscles according to their shape and constitution by means of individual finite element discretisations. Their rank is then reduced by using Guyan condensation and truncated modal analysis techniques. Owing to the complexity and variable angulation of the joints, their stiffness and damping matrices must be determined experimentally on cadaveric parts. This model is suitable for any ergonomic condition of posture and static loading. The response to a sinusoidal excitation transmitted to the hand is calculated. Calculated dynamic mass and phase at the excitation point are in good agreement with experimental results. The dynamic internal forces acting on the joints and tendinous insertions as well as the dynamic stresses in muscles and bones are available at any excitation frequency.

COURBURES RACHIDIENNES ET BASSIN DE PROFIL: Etude Barycentremétrique

G. Duval-Beaupere

Unité 215 de l'INSERM Hôpital R. Poincaré F92390 Garches

Standing posture of 17 young men and women were studied using Barycentremetre measurements and fullspine radiograph with a single referential system. This procedure provides *in vivo* measurements of the weight and center of weight supported by each vertebra and the coxofemoral joints. The relationship between the vertebra, the sacrum or the coxofemoral rotation axis and the center of weight they support, is displayed. Using this method, we have studied the center of weight supported by the coxofemoral joints, its anatomical connections with the thoracic vertebra in standing position and those of its vertical projection with the sacral plate and the bicoxofemoral axis. These data were used to examine the causes of variations between them using the anatomical parameters of the spine and pelvis. Partial correlation, indicated a single range of interrelations between these factor. Individual anatomical shapes of the pelvic parameters induce corresponding specific sagittal curves of the spine.

PRESENTATION D'UN APPAREIL DE MESURES INSTANTANEES DES COURBURES VERTEBRALES DANS LE PLAN SAGITTAL

B. Levet[*], A. Thevenon[**], R. Depreux[***], D. Loriol[*], J.P. Flusin[*], M. Leleu[*]

[*]Centre de Recherche et d'Enseignement, ENSAM, 8 Bd Louis XIV, 59046 Lille Cédex
[**]Unité de Rééducation, CHR de Lille, 59037 Lille Cédex
[***]Faculté de Médecine, I, Place de Verdun, 59045 Lille Cédex

The authors present an apparatus defining spine sagittal curvatures in static position or during motion, with at least 2 pictures per second, or collecting the data during several minutes for an ulterior exploitation. The device consists of a chain of 16 links placed on the back by a special vest with an elastic back. Measurement of the angles between 2 links, one of them having a vertical reference, allows, after computing, to give on a screen the picture of the spine in the sagittal plane or the characteristics of angle curvature or inflexion points. This apparatus can be used in postural evaluation, in rehabilitation as a biofeedback device, and in the study of working stations.

ULTRASOUND ASSISTED OSTEOTOMY: PRELIMINARY EXPERIMENTAL RESULTS

J.Y. Giraud[*], S. Villemin[**], R. Darmana[*], R. Durroux[***],
J.Ph. Cahuzac[****], A. Autefage[**], J.P. Morucci[*]
[*]INSERM U305, Hôtel Dieu, 31052 Toulouse, France
[**]Service de pathologie chirurgicale, ENVT, Toulouse
[***]Service d'orthopédique pédiatrique, CHU Purpan,
Toulouse [****]Service d'anatomo-pathologie, CHU Rangueil,
Toulouse

The osteotomy is a very important surgical task and few improvements of instruments are proposed. An ultrasound assisted osteotome is studied in comparison with a pneumatic conventional saw, on the basis of in-vivo experiments. The advantage of the ultrasonic instrument is the handiness which limits the risks of damaging adjacent tissues and permits to perform surgical tasks from a small incision. An infra-red camera visualizes and quantifies the temperature fields of the cutting areas. Thermographic images, obtained during osteotomies performed by the two instruments, are compared. After one and two weeks, samples are taken off around the osteotomy for anatomo-pathological examinations. The anatomo-pathological results don't permit to differentiate the two techniques. Now, other experiments have to be performed to demonstrate the reliability of this ultrasound assisted osteotome.

FLOW OF A CAPSULE THROUGH A CONSTRICTION: INTERPRETATION OF FILTRATION EXPERIMENTS ON RED BLOOD CELLS

A. Drochon, D. Barthes-Biesel
Université de Technologie de Compiègne, UA CNRS 858.
BP649 60206 Compiegne France

A numerical model of the flow of a capsule (a liquid drop surrounded by a deformable elastic membrane) can be used to predict pressure drop versus flow rate curves for an individual cell moving through a pore. The role of the different cell intrinsic parameters (membrane properties, sphericity index, capsule to pore diameter ratio) can thus be assessed. It is then possible to use this model on filtration experiments on dilute red blood cell suspensions, and to infer information regarding the properties of the suspended particles. The values of the membrane shear elastic modulus thus obtained are quite in agreement with the commonly accepted value measured with the micropipette technique.

IMPEDANCE OF LAMINAR OSCILLATORY FLOW SUPERIMPOSED ON A CONTINUOUS TURBULENT FLOW: PHYSIOLOGICAL APPLICATIONS

B. Louis and D. Isabey
Unité de Physiologie Respiratoire, INSERM U. 296
Hôpital Henri Mondor, Créteil, France

Measurement of airway impedance (Z_{aw}) is often performed by superimposing a small amplitude forced oscillatory flow, whose pressure-flow relationship is assumed to be linear, to normal spontaneous breathing, which behaves like a quasi-steady flow component. We have examined the validity of the assumption of linearity when a laminar compressible oscillatory flow in a tube is superimposed on a developed turbulent continuous flow. It was found that the linear model of laminar oscillatory flow remained valid even when the steady flow component was turbulent, provided the criterion ($ls^+ = u^* /(\pi.f.v)^{1/4} < 10$) was found to apply, where ls^+ is the ratio of viscous wall-length to Stokes length, v kinematic viscosity, u^* the wall friction velocity in the tube; f the frequency. We concluded that the forced oscillation flow technique is appropriate to measure Z_{aw} provided oscillatory frequency is high when respiratory airflow is high.
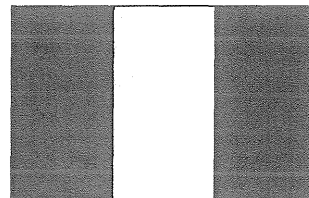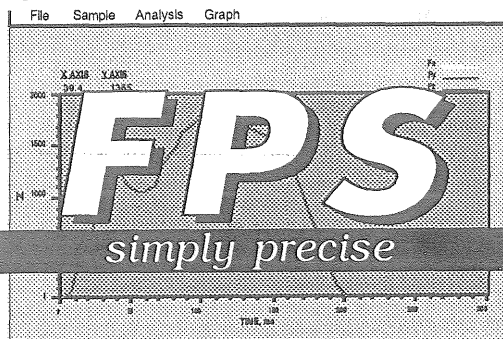
Thesis abstract corner

MAGNETIC RESONANCE IMAGING (M.R.I.) OF THE KNEE JOINT
Particular application: Three-Dimensional Kinematic Study of the Screw-Home Movement of the Knee Joint using MRI.

by

Peter Van Roy

Laboratory of Biometry and Human Biomechanics,
H.I.L.O.K., Vrije Universiteit Brussel, Pleinlaan
2, 1050 Brussel

Promoters: Prof.Dr. M. Hebbelinck, Prof.Dr. M. Osteaux, and Prof.Dr. L. Verbruggen

A first part deals with the methodology of Magnetic Resonance Imaging (MRI) of the knee joint : MRI provides non-invasive imaging of normal knee anatomy and pathologic features, with excellent soft tissue contrast and scanning possibilities in arbitrary planes.

In the second part, after searching the roots of clinical goniometric techniques, the methodology of joint motion measurement is reviewed, including an overview of different types of goniometers. Despite an international standardisation in 1965, the validity of clinical joint measuring techniques remains restrained in view of the actual needs of arthro-kinematical research. Especially the 3-D motion characteristics of many human joints call for 3-D measuring techniques, which are more common used in biomechanics. Therefore a plea was made for integrating biomechanical arthro-kinematical principles into clinical techniques of joint motion measurement.

With the increasing interest of Nuclear Magnetic Resonance Imaging (MRI) for investigating the musculoskeletal system, an attempt was made to introduce this new imaging technique into the field of 3-D-joint kinematics (part III). To realise a kinematic study of the screw home movement of the knee joint, MR-images were collected from three healthy volunteers and three patients with rheumatic diseases. The knee joint was carefully positioned in the scanner on a specially build supporting device, allowing passive knee extension in a progressive fashion. From two or three subsequent motion steps in the last phase of extension, sets of 5 and 10 mm thick, contiguous MRI-slices in the axial, coronal and sagittal planes were collected. A TI-weighted RF-pulse sequence was used on superconducting MR-systems operating at 0.5 T[*].

An original method was developed for digitizing 3D co-ordinates from five anatomical reference points in both the femur and the tibia. The data were submitted to rigid-body calculus, based on the work of Woltring et al. (J. Biomechanics, 18, 1985, 379-389), and Veldpaus et al. (J. Biomechanics, 21, 1988, 45-54), with the use of the angular concept of the Finite Helical Axis (FHA). Special attention was drawn to the use of an algorithm with integrated rigid-body constraints and adapted error propagation analysis. It has been shown in this study that 3D joint kinematics can be elaborated from co-ordinates of anatomical reference points, visually identified on MRI-slices. By the use of redundant measurements and cleaned data, angular representations could be obtained through the FHA-concept, with sufficient accuracy in terms of standard deviations, RMS fitting errors and scale factor errors. The commonly described pattern of the screw-home movement - a lateral rotation in the knee joint - was confirmed in every subject, with an interindividual variability concerning the range of rotation (4° - 12°) and the way how to reach the close-packed position. Even a lateral rotation of the femoral segment, preceding the closing medial rotation of this segment (leading to lateral rotation of the knee joint) could be found in three subjects, confirming the observation described in Braune and Fischer (1891). Moreover, a remarkable difference in varus- and valgus components was noted between normal and pathological knee joints.

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[*]Gyroscan, Philips Medical Systems, Best, The Netherlands and Magnetom, Siemens, Private Service of Radiology Dr. Breunsbach, Cologne, Germany.

Announcements

Positions Available

RESEARCH POSITION REHABILITATION ENGINEERING AND SCIENCE

The VA Medical Center and the Departments of Orthopaedics, University of New Mexico invites applicants holding an advanced degree in engineering or physical science, for a research position in musculoskeletal biomechanics, neuromuscular control, and rehabilitation. The candidate is expected to become involved in ongoing, founded projects and to develop new research areas. Extensive interaction with students and research and medical colleagues at the VA Medical Center and University of New Mexico is involved. Targeted start date is approximately November 1, 1991. Please send a resume and names and phone numbers of three references to:

> Richard V. Worrel, M.D.
> Chief, Orthopaedics Section, VA Med. Cntr.
> 2100 Ridgecrest Dr. S.E.
> ALBUQUERQUE, NM 87108, U.S.A.
> Tel. +1(505)265-1711 (switchboard)
> FAX +1(505)256-2882 (comm. div.)

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Wollongong. New South Wales, Australia

Position: Lecturer/Senior Lecturer in Motor Control/Learning (position titles commensurate with Assistant/Assoc. Professor in the US and Canada).
Starting Date: January, 1992.
Job Description: Teach undergrad/grad subject in motor learning/control and team teach undergrad. subject in neurophysiology of behavior. Supervise master's and Ph.D. students. Excellent opportunities for external funding and conducting research in areas of interest.
Salary: Commensurate with experience. Lecturer salary range: $A38,500.-47,500.; Sr. Lecturer salary range: $A47,500.-56,500.
Applications: Vita, 3 letters of reference and statement of research interest and professional goals must be received by October 31, 1991. For more information please contact:

> Prof. Tony Parker, Head of HMS Dept.
> University of Wollongong
> Wollongong, New South Wales 2500
> AUSTRALIA

Conferences

European Conference on
JOINT REPLACEMENT IN THE 1990s

Organised by the IMechE Engineering in Medicine Group and co-sponsored by ISB.

Dates and Venue:
May 18-19, 1992; East Midlands Conference Centre, Nottingham, UK.

Theme:
The aim of this conference is to focus on the introduction of new joint replacements into Europe during the 1990s, at a time when health services are undergoing considerable change and affected by increasing financial constraint.

Scope:
With the Single European Market as a background consideration will be given to:
- Organisation of clinical trials
- ISO standards and European regulations
- Financial implications to health services in Europe
- Bulk buying contracts for hospitals & health services
- Marketing strategies
- How to choose your implant

Speakers:
Speakers will talk about the use of joint replacement implants in the 1990s, highlighting the changing market and the reasons why change is taking place. In particular, the difference in the cost of implants in the UK and Europe will be compared and contrasted, and as the purchasing of implants across national boundaries is likely to become much more common, this will be explored in some depth.

Call for Papers:
Those wishing to present papers should contact:
> Ms Alison Elgar
> Conference Department C441
> Institution of Mechanical Engineers
> 1 Birdcage Walk
> London SW1H 9JJ
> Tel: (071) 973-1281; Telex: 917944;
> Fax: (071) 222-9881

Calendar of scientific events

December 5-6, 1991
Symposium on Human Propulsion - An integration of Man and Machine, Cumberland College of Health Sciences, Sydney, Australia, c/o Rehabilitation Centre, PO Box 170, Lidcome, NSW 2141, Australia. Tel: 61-2-646 6403; Fax: 61-2-646 4853.

December 5-6, 1991
Third International Symposium on Computer Simulation in Biomechanics, Perth, Western Australia. Congress Secretariat: Ms Rosemary Ingham, Department of Human Movement Studies, The University of Western Australia, Nedlands, WA 6009, Australia.

December 9-13, 1991
XIIIth ISB Congress on Biomechanics, Perth, Western Australia. Congress Secretariat: Ms Rosemary Ingham, Department of Human Movement Studies, The University of Western Australia, Nedlands, WA 6009, Australia. Tel: 61-9-380 2360; Fax: 61-9-380 1039.

December 16-17, 1991
The Teaching of Biomechanics, University of Wollongong, NSW, Australia. Contact: Dr Peter D. Milburn, Department of Human Movement Studies, The University of Wollongong, P.O. Box 1144 (Northfields Avenue), Wollongong, NSW 2500, Australia. Tel: 61-42-27 0881; Fax: 61-42-27 0486.

January 30-February 1, 1992
Annual Meeting of the Southeast Chapter of the American College of Sports Medicine, Auburn University, Auburn, AL, USA. Contact: Ronald Bos, 113 Memorial Hall, Virginia Tech, Blackburn, VA 24061-0326. Tel: (703) 231-8286.

February 2-7, 1992
International Scientific Congress associated with the 1992 Winter Olympic Games and devoted to sport sciences related to mountain sports. Enquiries to: CERNA, B.P. 35, 73202 Albertville Cedex, France.

May 18-19, 1992
European Conference on Joint Replacement in the 1990's, East Midlands Conference Centre, Nottingham, UK. Contact: Ms Alison Elgar, Conference Department C441, Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1H 9JJ. Tel: (071) 973-1281; Fax: (071) 222-9881.

May 12-14, 1992
International Scientific Conference on Prevention of Work-Related Musculosketal Disorders, Stockholm, Sweden. Conference Secretariat: Ms Gun Carlsson, National Institute of Occupational Health, S-17184 Solna, Sweden. Tel: +46-8-730-9100: Fax: +46-8-730-1967.

May 23-27, 1992
XIth International Symposium on Posture and Gait: Control Mechanisms, Yvonne Miller-Ross, Good Samaritan Hospital and Medical Center, 1015 N.W. 22nd Avenue, N300 Portland, OR 97210 USA, Tel: (503) 229-7348; Fax: (503) 790-1201.

June 2-6, 1992
International Conference on Computer Applications in Sport and Pysical Education, Wingate Institute, Israel. Conference Secretariat: Int. Conf. on Com. Appl. in Sport and Pys. Ed., Wingate Institute, Netanya 42902, Israel. Tel: 972-53-29548; Fax: 972-53-54374.

June 7-10, 1992
Canadian Medical and Biological Engineering Society (CMBEC), CMBEC Secretariat, Room 305, Building M-50, National Research Council of Canada, Montreal Rd., Ontario, Canada K1A 0RO.

June 10-14, 1992
Annual International Industrial Ergonomics and Safety Conference '92, Holiday Inn, Denver, Colorado, USA. Contact: Dr S. Kumar, Conference Chair, Department of Physical Therapy, University of Alberta, Edmonton, Alberta, T6G 2O4 Canad. Tel: (403) 492-5979; Fax: (403) 492-1626.

June 21-24, 1992
Eighth Meeting of the European Society of Biomechanics, in association with the European Society of Biomaterials. Conference Secretariat: ESB92, Istituto di Fisiologia Umana, Università 'La Sapienza', Piazzale Aldo Moro 5, 00185 Rome, Italy. Tel: 39-6-490673; Fax: 39-6-4452824.

August 3-8, 1992
Eighth International Congress of Biorheology, Yokohama, Japan. Executive Secretary: Dr. Takuo Yokose, 3rd Dept. of Internal Medicine, Jikei University School of Medicine, 3-25-8 Nishi-Shinbashi, Minato-ku, Tokyo 105, Japan. Fax: +81-3-3578-9753.

August 24-28, 1992
Second North American Congress on Biomechanics, combining the 16th Annual Meeting of the American Society of Biomechanics (ASB) and the 7th Biennial Conference of the Canadian Society for Biomechanics/Société Canadienne de Biomécanique (CSB/SCB), at the McCormick Center Hotel, Chicago, USA. Conference Co-Chairman: Dr Louis Draganich, Dept. of Surgery, University of Chicago, 5841 South Maryland Avenue, Box 421, Chicago, IL 60637, U.S.A. Tel: +1-312-702-6839.

September 4-5, 1992
International Conference on Experimental Mechanics: Technology Transfer Between High Tech. Engineering & Biomechanics, University of Limerick, Ireland. Conference Secretariat: BSSM'92, Dept. Mech. Eng., University of Limerick, Plassey Technological Park, Limerick, Ireland. Fax: 353-61-330316 (Ireland, Eire) or e-mail at LittleT@ul.ie

December 2-4, 1992
Seventh International Conference on Biomedical Engineering, National University of Singapore. Secretary: 7th ICBME 1992, Dept. Orthopaedic Surgery, National Hospital, Lower Kent Ridge Road, Singapore 0511. Tel: (65) 772 4424; Fax: (65) 778 0720.

Please note that the International Symposium on Occupational Electromyography which was to be held on December 4-5 aboard the Trans-Australian railway has been cancelled.

ISB membership news

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Memphis, TN 38163
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McLEAN, SCOTT
Arizona State University
PEBE 107A
Dept. of Ex. Sci and P.E.
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Tsu Mie 514
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Kagoshima-shi 890
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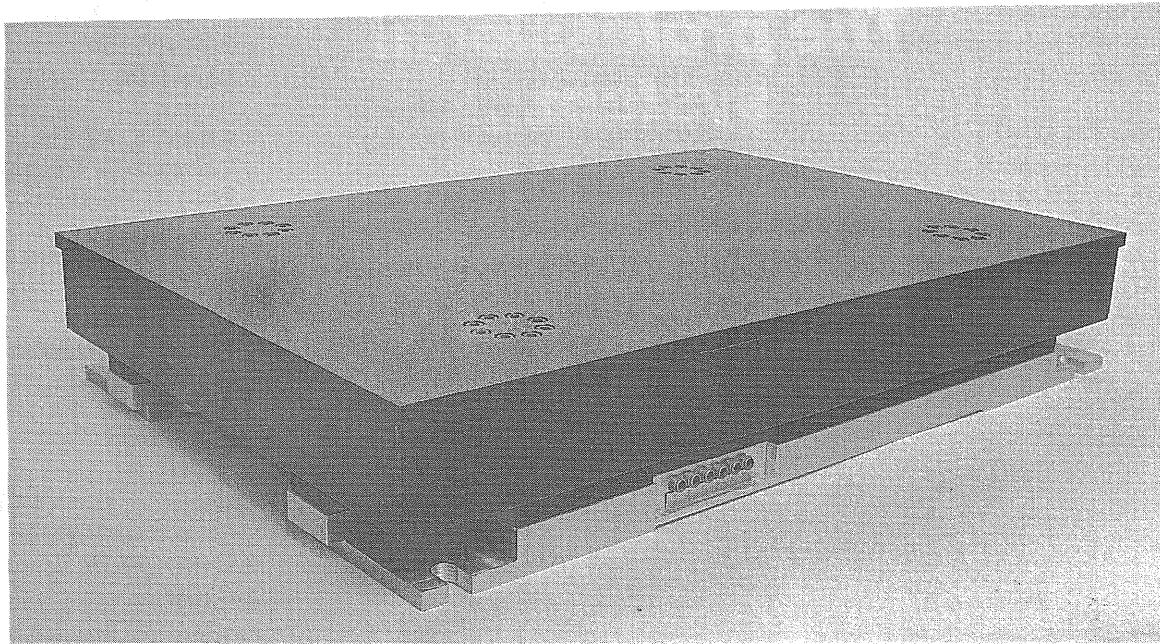State College, PA 16803
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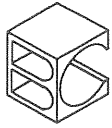
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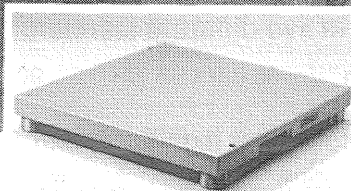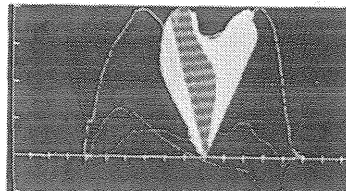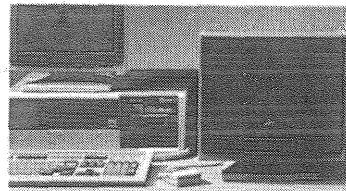
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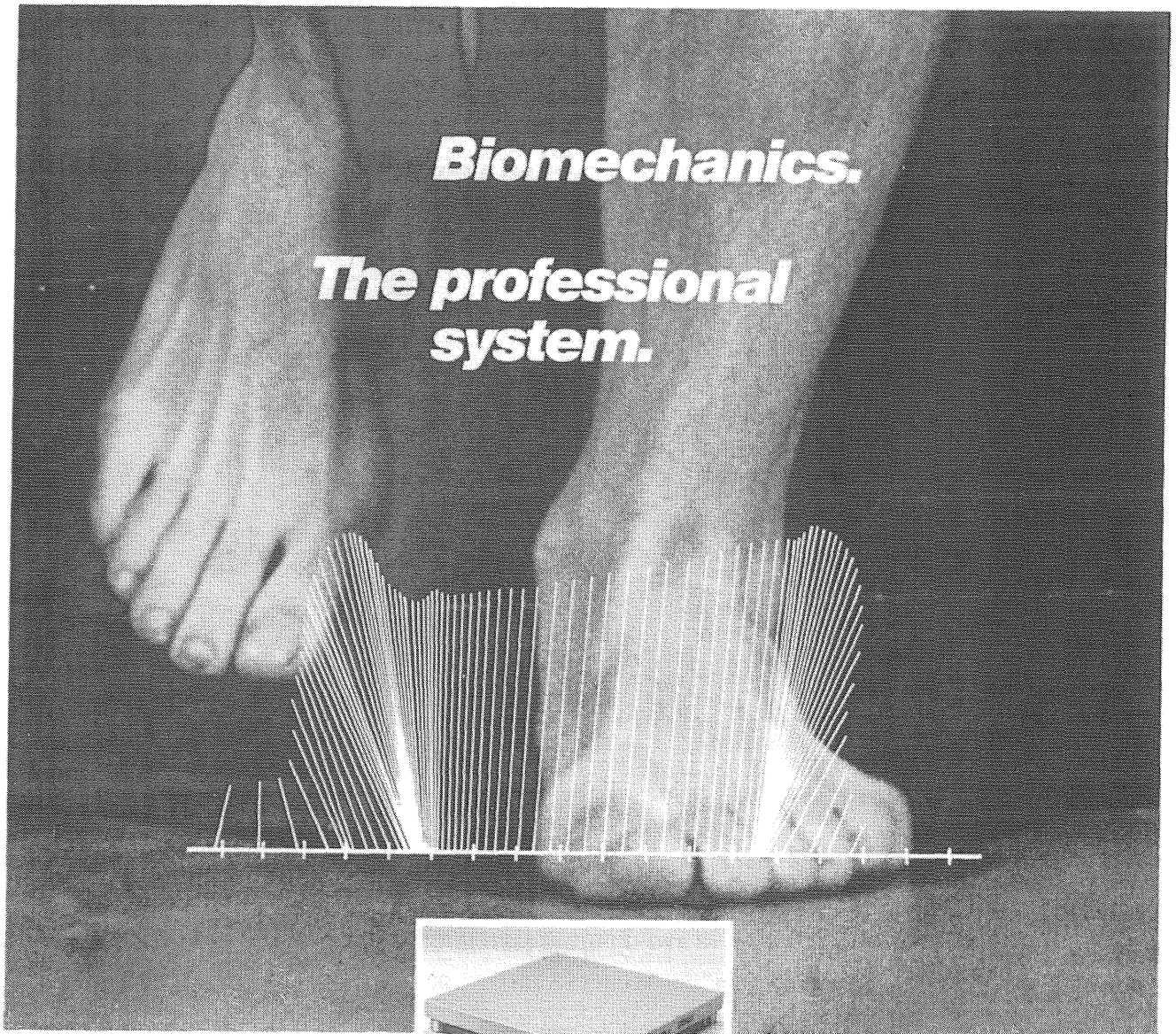
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