

**Canadian Society for Biomechanics /
Société Canadienne de Biomécanique**

**Proceedings of the North American Congress on Biomechanics
combined with the Tenth Annual Conference of the American
Society of Biomechanics and the Fourth Biannual Conference of
the Canadian Society for Biomechanics, Montréal, Québec, 1986**

**Human Locomotion IV
La Locomotion Humaine IV**

MONDAY 25 AUGUST 1986

Micheline Gagnon, Conference Chair
Savio Woo, ASB President
Gavin Reid, CSB/SCB President

Keynote:

Donald S. Chaffin, Low Back Muscle Models for Lifting Evaluation

Chairpersons: I.A.F Stokes, S. Naumann, Joint Mechanics

S. Desjardins, C.L. Richards, M. Fillion, D. Gravel, V. Piette, Differentiation of Components of Resistance to Passive Movement Using Voluntary Maneuvers

M. Vrahas, T. Brown, J. Andrews, R. Brand, D. Pederson, In Vivo Measurements of Passive Moments of the Human Hip

H. Tsumura, S. Himeno, K.N. An, E.Y.S. Chao, Load Transmission of the Wrist Joint and Pathomechanism of Kienböck's Disease

T.B. Hoshizaki, H. Sveistrup, G. Vagenas, Asymmetrical Knee Laxities: An Objective Evaluation

T.J. Pratt, D.F. James, Analysis of Squeeze-film Lubrication in Human Joints Based on Non-newtonian Properties of Synovial Fluid

A.E. Engin, S.M. Chen, In-vivo Kinematic Properties of the Human Shoulder Complex

Chairpersons: S. Olney, P.E. Martin Human Locomotion IV: Walking and Running

A.E. Patla, S.D. Clouse, Visual Assessment of Human Gait: a Reliability Study

Keynote:

Denis Bramble, Mechanical And Physiological Issues Underlying Locomotor and Respiratory Coupling in Mammals.

Chairpersons: F.E. Zajac, M. Lamontane, Muscle I

R.P. Mikosz, Physiological and Mechanical Factors Influencing the Prediction of Muscle Forces About the Knee Joint During Gait

G.A. Wood, K.P. Singer, A.G. Cresswell, Electro-mechanical Adaptation to Muscular Strength Training

S.J. Olney, M.P. Griffin, P.A. Costigan, U. P. Wyss, Prediction of Ankle Moments in Gait Using Calibrated EMG-force- Joint Angle Relationships

M. Solomonow, R. Chuinard, R. D'Ambrosia, The Effect of the Muscles Moment Arm on Its EMG-force Relationships

B. McFadyen, D. Winter, B. Day, F. Burkowski, Computer Graphics of Muscle Kinematics and Electromyography in Gait

Chairpersons: G.A. Valiant, K.R. Williams, Human Locomotion IV: Foot Dynamics

A.S. Voloshin, Biomechanical Aspects of Shock Absorbing Devices

T.S. Gross, R.P. Bunch, Discrete In-shoe Plantar Stress Variations With Running Speed

B.M. Nigg, J. Denoth, R. Glover, The Influence of Lateral Heel Flare on Pronation and Impact Forces

J. Hamill, B.T Bates, M.D. Ricard, M.K. Miller, Evaluation of Shoe-orthotic Interactions Using an In-shoe Pressure Sensor System

P Allard, W. Loa, H. Tannenbaum, Effects of Foot Inserts on The Gait Parameters of Rheumatoid Arthritic Patients

Chairpersons: G. Drouin, T. Brown: Human Locomotion IV: Poster Sessions I

D.A. Schieb, Performance Characteristics of the Biomechanics Force Plate

C.D. MacKinnon, C.M. Godfrey, A Clinically Viable Force Platform Measurement Technique For the Visual And Numerical Assessment of Force Distributions Beneath The Feet

H.U. Motriuk, A Technique for Normalizing Center of Pressure Paths

M.M. Rodgers, P.R. Cavanagh, A Device for the Measurement of First Ray Mobility

J. R. Engsborg, J. G. Andrews, A Kinematic Analysis of Shank Motion Relative to the Calcaneus During the Support Phase of Running

J.P. Holden, P.R. Cavanagh, The Free Moment of Ground Reaction in Distance Running and its Changes with Pronation

R.J. Neal, S.D. Wilson, The Influence of Load on Movement Frequency

J. Denoth, The Wobbling Mass - A Relevant Variable in Gait and Load Analysis

B.T. Bates, P. Devita, J. Hamill, The Effects of Additional Load on Impact Force

M. Hubbard, E.G. Paterson, A.E. Orcutt, Prediction of Optimal Step Length Using Three Simple Dynamic Models of Walking

J.P. Dickey, D.A. Winter, A Computerized Gait Profile System

C. Tylkowski, G. Miller, D. Springfield, N. Williamson, W. Enneking, Gait Patterns and Energy Expenditure of Patients after Resection Arthrodesis of the Knee

D.L. Wheeler, G.J. Miller, C.M. Tylkowski, O₂ Consumption in a Gait Laboratory Setting

J.C. Wall, J. Charteris, G.I. Turnbull, The Diversity of Normal Gait

M.H. Moeinzadeh, S.A. Burns, R.J. Borre, G.J. Pijanowski, A New Technique For The Determination of Body Segment Parameters Utilizing CAT and CAD Procedures

R.K. Jensen, Changes in Segment Mass, Radius and Radius of Gyration, Four Years to Adulthood

M. Mungiole, P.E. Martin, Estimating Segmental Inertial Properties: Magnetic Resonance Imaging Versus Existing Methods

M. Morlock, M.R. Yeadon, Regression Equations for Segmental Inertia Parameters

R.W. Dick, P.R. Cavanagh, An Explanation of The Upward Drift in Oxygen Uptake (U_{do}) During Prolonged Submaximal Eccentric Exercise

D.G.E. Robertson, Contributions of the Ankle And Knee Muscles to Sprint Starting

J.F. Yang, D.A. Winter, Validation of Planar Link Segment Models For The Study of Upright Balance in Walking

D. MacIntyre, D.G.E. Robertson, EMG Patterns of The Quadriceps During Treadmill Running: a Description of Patellofemoral Pain Syndrome

B. McFadyen, D.A. Winter, Integrated Biomechanical and EMG Analysis of Stair Walking

J.J. Dowling, R.W. Norman, The Use of Multiple Regression in The Design And Testing of Dynamic Muscle Models

F.E. Zajac, P.J. Stevenson, E.L. Topp, A Dimensionless Musculotendon Actuator Model For Use in Computer Simulations of Body Coordination: Static Properties

M.G. Hoy, F.E. Zajac, E.L. Topp, C.T. Cady, M.E. Gordon, W. S. Levine, Musculotendon Energetics of Human Jumps

M.R. Shorten, P.T. Mueller, L.B. Cooper, Elastic Energy Storage During Simplified Jumping Movements in Man

A.E. Engin, S.M. Chen, In-vivo Passive Resistive Properties Beyond The Human Shoulder Complex Sinus

Borelli Lecture:

M.R. Yeadon, The Biomechanics of Twisting Somersaults

Chairpersons: J. Sullivan, M.H. Popo, Human Locomotion IV, Rehabilitation

J. Dansereau, I.A.F. Stokes, J.P. Laible, M.S. Moreland, Finite Element Model of Asymmetrical Rib Growth in Scoliosis

S.J. Fleckenstein, R.L. Kirby, D.A. MacLeod, The Effect of Limited Knee-flexion Range on Peak Hip Joint Torques Humans Transferring from Sitting to Standing

F. Malouin, J. Préfontaine, Reliability And Application of a Computerized Triaxial Electrogoniometer for the Evaluation of Head Movements

J. Alexander, A. Bhattacharya, P. Patel, ?. Brooks, Biomechanical Aspects of Preclinical Descriptors of Osteoarthritis

V. Piette, C. Richards, M. Filion, Use of Static Pre-loading in Estimation of Dynamic Strength With The Kin-Com Dynamometer

M.C. Normand, C.L. Richards, M. Filion, Muscle Utilization in Gait Determined by a Physiological Calibration of EMG

Chairpersons: J. Dapena, D.G.E. Robertson, Sport I

R.J. Neal, C.W. Snyder Jr., B.D. Wilson, Three Mode Principal Component Analysis of Arm Segment Velocities in Throwing

M.E. Feltner, J. Dapena, Dynamics of The Shoulder And Elbow Joints of The Throwing Arm During a Baseball Pitch

E. Springs, G. Watson, E. Haseganu, D. Derby, A Model For Optimizing the Timing of the Relative Force Patterns of the Arms, Torso and Legs During Springboard Diving Takeoffs

P.E. Martin, W.L. Siler, An Examination of Mechanical Energy Transfers amongst Lower Extremity Segments During a Kicking Motion

J.A. Miller Jr., J.G. Hay, Kinematics of a World Record in The Triple Jump

A.E. Chapman, Factors Determining Squash Ball Velocity And Implications For The Stroke

TUESDAY 26 AUGUST 1986

Keynote:

David A. Winter, Strategies and Concerns Regarding the Assessment of Pathological Gait

Chairpersons: J.A.A. Miller, M. Lortie, Occupational Biomechanics

N. Hamilton, A Mathematical Model For Neck Tension as Related to Source Document Position

S. Reinecke, G. Weisman, A. Stifter, M.H. Pope, Pressure Distribution in Office Seating

W. Chang., F.J. Bejjani, D. Chyan, Biomechanical Basis of Musculoskeletal Disorders Among Visual Artists

S. Kumar, D. Hill, Arm Lift Strength at Different Reach Distances

M. Gagnon, F. Akre, M. Lortie, A. Chehade, F. Kemp, Work-energy Requirements For Translating and Turning Patients In Bed as Executed by Nursing Aides

N. Halpern, F.J. Bejjani, Postural Kinematics of Trumpet Playing

Chairpersons: R. Wells, M.R. Shorten, Muscle II

W. Herzog, Influence of The Amount of Information About Muscle Properties in The Cost Function on The Estimate of Individual Muscle Forces

N. Evans Stüber, R. Wells, Surface Electromyography of Iliopsoas

T.D. Cahalan, S.H. Liu, E.Y.S.. Chao, Isokinetic And Isometric Strength Analysis of Hip

Musculature

A.V. Sirin, A.E. Patla, Synergistic Behaviour of The Triceps Surae Under Sustained Submaximal Isometric Contractions

S.C. White, D.A. Winter, The Prediction of Muscle Force Using EMG And a Muscle Model

R.H. Rozendal, G.J. van Ingen Schenau, M. Bobbert, L.H.V. van der Woude, Biarticular Muscles in Multisegment Limbs

Keynote:

R. McNeill Alexander, Elastic Mechanisms in the Movement of Mammals

Chairpersons: C.L. Richards et M.G. Hoy, Human Locomotion IV

S. Ounpuu, D.A. Winter, Bilateral Analysis of The Lower Limbs During Walking in Normal Individuals

W. O'Connor, Asymmetry in Loading Times between the Natural and Prosthetic Limbs in the Above-Knee Amputee

H. Barbeau, L. Finch, M. Wainberg, System For Locomotor Rehabilitation

O. Huk, H. Labelle, M. Duhaime, R. Allard, Kinematic Analysis of Gait Patterns in Unoperated Children With Spastic Diplegia

E.H. Furnée, High-resolution Real-time Movement Analysis at 100 Hz With Stroboscopic TV-camera and Video-Digital Coordinate Converter

Chairpersons: G.A. Wood, H. Debruin, Muscle Control

M. Solomonow, B.-h. Zhou, R. Baratta, H. Shoji, R. D'Ambrosia, The Dependence of the EMG-force Relationship on The Muscles Motor Units Recruitment Range

C.L. Riach, K.C. Hayes, Feedforward Postural Control in Children

R. Wells, N. Evans Stüber, Electromyographic Responses of The Lower Limb Musculature in Simulated Postural And Locomotor Activities

K. Schneider, R.F. Zernicke, R.A. Schmidt, T.J. Hart, Modulation of Limb Dynamics During The Learning of Rapid Arm Movements

A.E. Patla, Does Biceps Femoris Response Always Precede Voluntary Arm Raises During Locomotion in Humans?

WEDNESDAY 27 AUGUST 1986

Keynote:

Rik Huiskes, Human Joint Kinematics: a Structure Based Approach

Chairpersons: J. Dansereau, A.H. Ahmed, Spine

G.A. Dumas, M.J. Poulin, S. Roy, M. Gagnon, M. Jovanovic, Quantitative Anatomy of Trunk Muscles

J. Triano, A.B. Schultz, Correlation of Objective Measures of Trunk Motion And Muscle Function With Low Back Disability Ratings

A. Shirazi-Adl, G. Drouin, Effects of Change in Intradiscal Fluid Content on Mechanical Response of a Lumbar Motion Segment in Compression And Extension

M.H. Krag, K.B. Byrne, L.G. Gilbertson, L.D. Haugh, Failure of Intra-abdominal Pressurization to Reduce Erector Spinae Loads During Lifting Tasks

M.H. Pope, D.G. Wilder, L. Jorneus, H. Broman, M. Svensson, G. Andersson, Vibration And Impact Response of The Seated Human

S.A. Gracovetsky, S. Iacono, Energy Transfers in The Spinal Engine

Chairpersons: M. Duhaime, B.T. Bates, Human Locomotion IV: Orthopaedic Gait

C.M. Tylkowski, J. Chase, R.W. Petty, G. Miller, Functional Analysis of Hip Resection Arthroplasty

R. Sherman, M. Pinzur, P. DiMonte-Levine, J. Trimble, Change in Adult Acquired Hemiplegic Gait Pattern Following Surgical Correction of Equinus

B.T. Meller, M.T. Manley, P. Hurley, S. Yoshia, Analysis of Canine Gait With Force Platforms Following Anterior Cruciate Ligament Repair: a Pilot Study

U.P. Wyss, S.J. Olney, I. McBride, T.D.V. Cooke, Gait of Patients With Total Knee Replacements (TKR)

B. Cairns, S. Naumann, P. Tepperman, V. Kekosz, Effects of Proximal Tibial Osteotomy on Knee Joint Loading

M.W. Whittle, R.J. Jefferson, Biomechanical Assessment of the Results of Knee Surgery

Keynote:

Robert Norman, Can Biomechanical Science Be Effective in an Elite Athlete Development

Program?

Chairpersons: C. Putnam, G. Dumas, Poster Session II

I.A.F. Stokes, Joint Surface Geometry and Estimation of Joint Forces

G.T. Yamaguchi, M.G. Hoy, F.E. Zajac, Simulation of Knee Joint Mechanics in Two Dimensions

S. Himeno, K.N. An, H. Tsumura, E.Y.S.. Chao, Pressure Distribution on Articular Surface:
Application to Muscle Force Determination and Joint Stability Evaluation

R. Shiavi, H. Borra, M. Frazer, T. Limbird, EMG Envelopes From Normal And Anterior Cruciate
Ligament Deficient Individuals

J.M. Hollis, M.A. Gomez, M. Inoue, E.M. Burlison, S.L-Y. Woo, The Effect of Degrees of
Freedom on Varus-valgus Knee Laxity

D.J. Morton, J.G. Reid, A Two Dimensional Analysis of the Contribution of The Abdominal
Muscles to Trunk Flexion

M.H. Krag, R. Serouissi, D.G. Wilder, K.S. Byrne, L. Trausch, A Comparison of Actual Internal
Displacements of Human Spinal Motion Segments Produced by in Vitro Loading and
Finite Element Model Predictions

D.G. Wilder, R.E. Seroussi, J. Dimnet, M.H. Pope, The Mechanical Effect of Sustained Simulated
Seating on the Lumbar Motion Segment

J.A.A. Miller, A.B. Schultz, H. Steen, L. Bjerkreim, Paravertebral Muscle Recruitment in Lateral
Spine Curves

V.J. Raso, D.L. Hill, J.B. McIvor, G.G. Russell, The Analytical Measurement of Vertebral
Rotation

S.M. McGill, R.W. Norman, N. Patt, Glen, Estimations of Force and Moment Generating
Capacity of Trunk Musculature from CT Scan Measures

M.H. Krag, L. Miller, K.B. Byrne, L.G. Gilbertson, G.B. Johnson, Objective Determination of
Trunk Muscle Dimensions Using Ultrasound: Implications for Low Back Pain Research

M. Parnianpour, L. Pavlidis, F.J. Beijani, M. Nordin, Effect of Load Height, Weight And Distance
From the Body on Knee And Lumbar Spine Forces During Lifting

R.E. Seroussi, M.H. Pope, The Use of Trunk Muscle Electromyography to Help Validate a
Simple Physical Model for Lifting Tasks

H. Vaillancourt, G. Drouin, G. McIntyre, A 3-D Analytical Model for the Cancellous Bone of Human Lumbar Vertebrae

S.E. Robbins, A. Hanna, The Soft Tissue System at the Heel Region of the Foot: Its Mechanical Behavior and Function

J.L. Ku, S.A. Goldstein, K.W. Choi, S. Stein, L. Degnore, L.S. Mathews, A Mechanical Test For the Modulus of Trabecular Bone Tissue

N. Charbonneau, G. Drouin, G. Dumas, C. H. Rivard, Monitoring System For Harrington Rod In Vivo Stress Evolution

C. Krettek, N. Haas, L. Gouen, Bending and Torque Stiffness of a New Nail With Spreading Mechanism for Femoral Fractures

D.R. Carter, D.P. Fyhrie, R.T. Whalen, Mathematical Models for Predicting Bone Density from Stress History

F. Selker, D. Carter, Scaling of Long Bone Fracture Strength with Animal Mass

T.S. Keller, D.R. Carter, J.A. Main, A.M. Strauss, D.M. Spengler, Scaling of Long Bone Torsion Strength During Growth

R.E. Shadwick, The Role of Collagen Crosslinks in the Age Related Changes in Mechanical Properties of Pig Digital Tendon

Z. Ladin, Evaluating The Dynamic Performance of Position Measurement Systems

L. McCarthy, J. Frank, J. Brown, S. Maki, Anticipatory Postural Adjustments in Children: Developmental Characteristics

M.H. Krag, B.D. Beynon, Mobility of Halo-Vest on Thorax: Comparative Biomechanics of 7 Current and 1 Experimental Vest Design

Chairpersons: M.H. Krag, R. Black, Bone Mechanics

R.T. Whalen, D.A. Carter, C.R. Steele, The Influence of Physical Activity on Bone Density

T.S. Keller, T.H. Hansson, M.M. Panjabi, D.M. Spengler, Regional Variations in The Compressive Properties of Human Lumbar Vertebral Trabeculae: Influence of Tissue Physical Characteristics

S. Shaw, R. Zernicke, A. Vailas, R. Grindeland, Morphological and Mechanical Responses of Long Bone to Weightlessness

K. Cowling, J. Mukherjee, R.W. Soutas-Little, Ft. Hubbard, J. Forsell, Mechanical Properties of Bone Allografts

M. Fondrk, E. Bahniuk, D.T. Davy, C. Michaels, P. Pallone, The Viscoplastic Behavior of Cortical Bone

E. Schneider, R. Weber, B. Gasser, S.M. Perren, Estimation of Mechanical Properties of Bone Using Computed Tomography

Chairpersons: A. Chapman, J. Hamill, Human Locomotion IV: Sport

K.R. Williams, P.R. Cavanagh, Biomechanical Correlates With Running Economy in Elite Distance Runners

E.M. Roberts, J.L. Lin, R.P. Moorman, Muscular and “Mechanical” Moments of Force in Swing Motion

J. Dapena, M.E. Feltner, An Empirical Model to Calculate The Effects of Wind And Altitude on the Times of 100 Meter Sprint Paces

M. Hubbard, H. Fujikawa, Identification of Skateboard Rider Control Strategies

G.A. Valiant, L.S. Cooper, T. McGuirk, Measurements of The Rotational Friction of Court Shoes on an Oak Hardwood Playing Surface

D.J. Sanderson, P.R. Cavanagh, The Use of Augmented Feedback to Modify Pedaling Mechanics

Keynote:

Aurelio Capozzo, Mechanical Loading of The Human Skeletal System

Chairpersons: M. O’Rian, M. Hubbard, Human Locomotion IV: Altered Gait

J.C. Wall, J. Charteris, The Kinematics of Uphill And Downhill Walking

A.W. Smith, D.A. Winter, Electromyographic Patterns During Visually Perturbed Gait

B.D. Wilson, R.J. Neal, J.S. Groenendyk, The Gait of Pacers

J. Charteris, P.A. Scott, J.C. Wall, A Preliminary Study of the Temporal Gait Kinematics of African Occupational Headload Carriers

B.T. Bates, S.T. McCaw, A Comparison Between Forward and Backward Walking

Chairpersons: D.R. Carter, C.H. Rivard, Orthopaedic Fixation

N.R. Williamson, C. Tylkowski, G. Piotrowski, G. Miller, D. Springfield, A Biomechanical Analysis of Graft Fatigue Fracture in a Resection Arthrodesis

T.J. Hein, A. Perissinotto, R.N. Hotchkiss, E.Y.S. Chao, Analysis of Bone Model Material for External Fracture Fixation Experiments

S. Meyer, D. Anderson, M. Jimenez, T. Brown, A. Brand, Mechanical Performance of Prophylactic Knee Braces

S. Fleming, T. Kristiansen, G. Neale, S. Reinecke, M. Pope, Fracture Gap Motion in External Fixation

M.H. Krag, B.D. Beynnon, M.H. Pope, J.W. Frymoyer, L.D. Haugh, Fatigue Evaluation of a New Spinal Fixation Device