



1975 W El Camino Real, Suite 102
Mountain View, CA 94040
Phone 650-963-9743
Fax 650-963-9413
cdyrby@InSciTech.com

Chris Dyrby, M.S.

Professional Profile

Mr. Dyrby specializes in accident reconstruction and biomechanics of human injury. His past research included human dynamics, the initiation and progression of osteoarthritis, total joint replacements, and sports injuries. His expertise includes the following:

- **Dynamic testing of human test subjects:** His research included designing and conducting research experiments utilizing motion capture techniques to explore orthopedic issues. He also focused on medical imaging and segmentation of knee cartilage to create three-dimension thickness maps to relate to human movement. He uses his knowledge of human dynamics to evaluate injury mechanisms.
- **Thermal imaging:** Mr. Dyrby uses his knowledge of thermal imaging cameras to evaluate different scenarios where water, heat or fire can be an important clue to a problem.

Mr. Dyrby completed his degree in Mechanical Engineering at Stanford University. After completion, he stayed on to become a research engineer and manager of a biomechanics laboratory.

Credentials and Professional Affiliations

Degree of Engineer (Mechanical Engineering), Stanford University, 2001

M.S. (Bioengineering), University of Illinois at Chicago, 1998

B.S. (General Engineering), University of Illinois, Urbana-Champaign, 1993

Member, Society of Automotive Engineers

Member, American Society of Biomechanics

Member, California Association of Accident Reconstruction Specialists

PUBLICATIONS - ARTICLES

Differences in tibial rotation during walking in ACL reconstructed and healthy contralateral knees. *J Biomech.* 2010. Jun 18; 43(9):1817-22. S. F. Scanlan, A.M. Chaudhari, C.O.Dyrby, T.P. Andriacchi.

Changes in vivo knee loading with a variable-stiffness intervention shoe correlate with changes in the knee adduction moment. *J Orthop Res.* Dec; 2010 28(12):1548-53. J.C. Erhart, C.O. Dyrby, D.D. D'Lima, C.W. Colwell, T.P. Andriacchi.

Accuracy of 3D cartilage models generated from MR images is dependent on cartilage thickness: laser scanner based validation of in vivo cartilage. *J Biomech Eng* 2009. Dec; 131(12) S. Koo, N.J. Giori , G.E.Gold, C.O.Dyrby, T. P. Andriacchi.

Influence of patellar ligament insertion angle on quadriceps usage during walking in anterior cruciate ligament reconstructed subjects. *J Orthop Res.* 2009. Jun; 27(6):730-5. C.S. Shin, A.M. Chaudhari, C.O. Dyrby, T.P. Andriacchi.

A comparison of measuring mechanical axis alignment using three-dimensional position capture with skin markers and radiographic measurements in patients with bilateral medial compartment knee osteoarthritis. *Knee.* 2008.Dec;15(6):480-5. A. Mündermann, C.O. Dyrby, T.P. Andriacchi.

In vivo knee loading characteristics during activities of daily living as measured by an instrumented total knee replacement. *J Orthop Res.*2008. 26(9), 1167-72. A. Mündermann, C.O. Dyrby, D.D. D'Lima, C.W. Colwell, Jr., T.P. Andriacchi.

The patella ligament insertion angle influences quadriceps usage during walking of anterior cruciate ligament deficient patients. *J. Orthop Res.* 2007 25(12), 1643-1650. C.S. Shin, A.M. Chaudhari, C.O. Dyrby, T.P. Andriacchi.

In healthy subjects without knee osteoarthritis, the peak knee adduction moment influences the acute effect of shoe interventions designed to reduce medial compartment knee load. *J Orthop Res* 2007 25, 540-546. D.S. Fisher, C.O. Dyrby, A. Mündermann, E. Morag, T. P. Andriacchi.

Accuracy of cartilage thickness in MRI changes with cartilage thickness: laser scanner based validation of in vivo osteoarthritis cartilage. *Arthritis and Rheumatism*, submitted for publication. *Arthritis and Rheumatism.* 2007. S. Koo, N.J. Giori, G.E. Gold, C.O. Dyrby, T.P. Andriacchi.

PUBLICATIONS – ARTICLES (*continued*)

The patella ligament insertion angle influences quadriceps usage during walking of anterior cruciate ligament deficient patients. J Orthop Res. 2007. C.S. Shin, A.M. Chaudhari, C.O. Dyrby, T.P. Andriacchi.

Interactions between kinematics and loading during walking for the normal and ACL deficient knee. Journal of Biomechanics 2005 38, 293-298. T.P. Andriacchi, C.O. Dyrby.

Secondary gait changes in patients with medial compartment knee osteoarthritis: increased load at the ankle, knee, and hip during walking. Arthritis Rheum 2005. 52, 2835-2844. A. Mundermann, C.O. Dyrby, T.P. Andriacchi.

Serum concentration of cartilage oligomeric matrix protein (COMP) is sensitive to physiological cyclic loading in healthy adults. Osteoarthritis Cartilage 2005. 13, 34-38. A. Mundermann, C. O. Dyrby, T.P. Andriacchi, K.B. King.

A framework for the in vivo pathomechanics of osteoarthritis at the knee. Ann Biomed Eng 32, 447-457.2004. T.P. Andriacchi, R.L. Mundermann, E.J. Smith, Alexander, C.O. Dyrby, S. Koo.

Functional evaluation of the Scandinavian Total Ankle Replacement. Foot Ankle Int 2004. 25, 377-381. C.O. Dyrby, L.B. Chou, T. P. Andriacchi, R. A. Mann.

Secondary motions of the knee during weight bearing and non-weight bearing activities. J. Orthop Res 2004. 22, 794-800. C.O. Dyrby, T.P. Andriacchi.

Potential strategies to reduce medial compartment loading in patients with knee osteoarthritis of varying severity: reduced walking speed. Arthritis Rheum 2004 50, 1172-1178. A. Mundermann, C.O. Dyrby, D.E. Hurwitz, L. Sharma, T.P. Andriacchi.

The use of functional analysis in evaluating knee kinematics. Clinical Orthopaedics & Related Research, 2003 44-53. T.P. Andriacchi, C.O. Dyrby, T.S. Johnson.

Mechanical loads at the knee joint during deep flexion. Journal of Orthopaedic Research 2002. 20, 881-886. T. Nagura, C.O. Dyrby, E.J. Alexander, T.P. Andriacchi.

A point cluster method for in vivo motion analysis: applied to a study of knee kinematics. J Biomech Eng 1998 120, 743-749. T.P. Andriacchi, E.J. Alexander, M.K. Toney, C.O. Dyrby, J. Sum.

PUBLICATIONS - BOOK CHAPTERS

Gait Analysis and Total Knee Replacement (Chapter 6). Springer-Verlag GmbH & Co. KG. 2005 T.P. Andriacchi, C.O. Dyrby.

Femoral Rollback is Obtainable and Beneficial in the Total Knee Patient. In: Laskin, R.S. (Ed.), Controversies in Total Knee Replacement. Oxford University Press, Oxford, 2001 pp. 95-106. T.P. Andriacchi, C.O. Dyrby, E.J. Alexander.

PUBLICATIONS – ABSTRACTS

The adduction moment during walking is correlated with cartilage thickness ratio in younger male subjects, the North American Congress on Biomechanics (NACOB), Ann Arbor, MI, August 5-9, 2008. C.O. Dyrby, J. Asay, S. Koo, T.P. Andriacchi.

In vivo knee loading measured by an instrumented total knee replacement during activities of daily living, the 30th Meeting of the American Society of Biomechanics, Stanford, CA, August 22-25, 2007. C.O. Dyrby, J. Erhart, L. Worthen-Chaudhari, D.D. D’Lima, C. Colwell, A. Muendermann, T.P. Andriacchi.

Condylar Lift-Off does not Occur during the Deep Squat. Presented at The American Society of Biomechanics, Blacksburg, VA, 2006. C.O. Dyrby, et al.

Coronal ACL Graft Orientation Influences Tibial Rotation During Walking. In 54th Annual Meeting of the Orthopaedic Research Society. San Francisco, CA. 2008. S.F. Scanlan, A.M. Chaudhari, K. Blazek, C.O. Dyrby, M.R. Safran, T.P. Andriacchi.

In vivo knee loading measured by an instrumented total knee replacement during activities of daily living. In 31st Meeting of the American Society of Biomechanics. Stanford, CA 2007. C.O. Dyrby, D.D. D’Lima, C. Colwell, A. Muendermann, T.P. Andriacchi.

Alterations of Secondary Knee Motion during Walking after ACL Reconstruction. In 53rd Annual Meeting of the Orthopaedic Research Society. San Diego, CA . 2007. A.M. Chaudhari, S. Scanlan, C.O. Dyrby, T.P. Andriacchi.

ACL Sagittal Plane Angle and its Relationship to Gender. In 53rd Annual Meeting of the Orthopaedic Research Society. San Diego, CA. 2007. A.M. Chaudhari, S. Scanlan, C.O. Dyrby, T.P. Andriacchi,

PUBLICATIONS – ABSTRACTS (*continued*)

Short and long-term reductions in knee adduction moment in patients with medial compartment knee osteoarthritis with a variable-stiffness walking shoe. In 53rd Annual Meeting of the Orthopaedic Research Society. San Diego. 2007. J.C. Erhart, C.O. Dyrby, B. Elspas, A. Muendermann, N.J. Giori, T.P. Andriacchi.

Abnormal Ambulation After ACL Rupture affects Knee Articular Cartilage Spatial Thinning Pattern. In 53rd Annual Meeting of the Orthopaedic Research Society. San Diego, CA.2007. S. Koo, C.O. Dyrby, T.P. Andriacchi.

Sensitivity of functional hip joint center location to body mass index, movement pattern and marker cluster. In 31st Meeting of the American Society of Biomechanics. Stanford, CA. 2007. A. Muendermann, P. Gupta, S. Corazza, V. Camomilla, C.O. Dyrby, T.P. Andriacchi.

A Direct Test of the Relationship between Medial Compartment Load and the Knee Adduction Moment using an Instrumented Knee. In 52nd Annual Meeting of the Orthopaedic Research Society. Chicago, IL. 2006. A.M.Chaudhari, C.O. Dyrby, D.D. D'Lima, C.W. Colwell, T.P. Andriacchi.

Condylar Lift-Off Does not Occur During the Deep Squat. In 30th Annual Meeting of the American Society of Biomechanics. Blacksburg, VA. 2006. C.O. Dyrby, D.D. D'Lima, C.W. Colwell, T.P. Andriacchi.

Load-Modifying Footwear Intervention Does Lower Knee Adduction Moment in Subjects with Symptoms of Medial Compartment Knee Osteoarthritis. In 30th Annual Meeting of the American Society of Biomechanics. Blacksburg, VA. 2006. J. Erhart, C.O. Dyrby, B. Elspas, N.J. Giori, T.P. Andriacchi.

Effect of Cartilage Contact Stress on Cartilage Thickness Determination. In 52nd Annual Meeting of the Orthopaedic Research Society. Chicago, IL. 2006. S. Koo, C.O. Dyrby, J. Kang, T.P. Andriacchi.

2006. Compensatory Muscle Moments in ACL-Deficient Subjects Reduce Anterior Tibial Translation during Stair Ascent. In 52nd Annual Meeting of the Orthopaedic Research Society. Chicago, IL.2006. S.F. Scanlan, A.M. Chaudhari, C.O. Dyrby, T.P. Andriacchi.

Large patellar Ligament Insertion Angle Following ACL Injury Causes Large Quadriceps Reduction during Walking. In 30th Annual Meeting of the American Society of Biomechanics. Blacksburg, VA.2006. C. Shin, A.M. Chaudhari, C.O. Dyrby, T.P. Andriacchi.

PUBLICATIONS – ABSTRACTS (*continued*)

Patellar ligament insertion angle influences quadriceps use during stair climbing: effect of an ACL deficit. In 20th Congress of the International Society of Biomechanics, 29th Annual Meeting American Society of Biomechanics Cleveland, OH. 2005. A. Chaudhari, C. Shin, C.O. Dyrby, T.P. Andriacchi.

Combined valgus and internal rotation moments strain the ACL strain more than either alone: Implications for non-contact ACL injuries In 20th Congress of The International Society of Biomechanics and 29th Annual Meeting of the American Society of Biomechanics Cleveland, OH.2005.A. Chaudhari, C. Shin, C.O. Dyrby, T.P. Andriacchi.

Patterns of Cartilage Degeneration for ACL Deficient Patients are Influenced by Gait Mechanics. In 2005 Summer Bioengineering Convergence. Vail, CO. 2005. S. Koo, C.O. Dyrby, A. Muendermann, T.P. Andriacchi.

The influence of stature and knee anatomy on cartilage thickness in healthy knees. In 51st Annual Meeting of the Orthopaedic Research Society. Washington, DC. 2005. S. Koo, C.O. Dyrby, A. Mündermann, T.P. Andriacchi.

3D laser scan based accuracy test of in-vivo cartilage thickness measurement from MRI. In 20th Congress of The International Society of Biomechanics 29th Annual Meeting of the American Society of Biomechanics Cleveland, OH. 2005. S. Koo, N.J. Giori, C.O. Dyrby, G.E. Gold, B. Elspas, T.P. Andriacchi.

Gait compensation in patients with medial compartmental knee osteoarthritis: Increased load at the ankle, knee and hip during walking. In 51th Annual Meeting of the Orthopaedic Research Society. Washington, DC. 2005. A. Mündermann, C.O. Dyrby, T.P. Andriacchi.

Hip abductor strength may be critical for successful gait compensation in patients with medial compartment knee OA. In 20th Congress of the International Society of Biomechanics. Cleveland, OH. 2005. A. Mündermann, C.O. Dyrby, T.P. Andriacchi.

Serum concentration of cartilage oligomeric matrix protein (COMP) is sensitive to a moderate walking exercise in healthy adults. In 51th Annual Meeting of the Orthopaedic Research Society. Washington, DC. 2005. A. Mündermann, K.B. King, C.O. Dyrby, T.P. Andriacchi.

Controlling Force at the Knee during Walking can compensate for the Loss of the Anterior Cruciate Ligament. In 50th Annual Meeting of the Orthopaedic Research Society. San Francisco, CA.2004. T.P. Andriacchi, C.O. Dyrby.

PUBLICATIONS – ABSTRACTS (*continued*)

Anterior tibial translation is not a likely mechanism of anterior cruciate ligament injury during non-contact sports situations. In International Symposium on Ligaments and Tendons. San Francisco. 2004. A. Chaudhari, C.O.Dyrby, T.P. Andriacchi.

Kinematic Factors Associated with Risk of Non-Contact ACL Injuries During Single Limb Landing. In 50th Annual Meeting of the Orthopaedic Research Society. San Francisco, CA. 2004. A.M. Chaudhari, C.O. Dyrby, T.P. Andriacchi.

Bilateral Posterior Stabilized and Cruciate Retaining Total Knee Replacements Compared During Stair Climbing. In Orthopaedic Research Society. San Francisco. 2004. C.O. Dyrby, A.J. Tria, R.V. Johnson, M. Hartzband, T.P. Andriacchi.

Morphological Variations of Femoral Cartilage are Influenced by Gait Characteristics in Healthy and Osteoarthritic Knees. In 50th Annual Meeting of the Orthopaedic Research Society. San Francisco, CA. 2004. S. Koo, A.N. Dixit, E.J. Alexander, G.E. Gold, S.B. Goodman, C.O. Dyrby, N.J. Giori, T.P. Andriacchi.

Reduced Walking Speed: Potential Strategy to Reduce Medial Compartment Loading in Patients with Knee OA of Varying Severity. In 50th Annual Meeting of the Orthopaedic Research Society. San Francisco, CA. 2004. A. Mündermann, C.O. Dyrby, D. Hurwitz, L. Sharma, T.P. Andriacchi.

Serum COMP concentration is related to load distribution at the knee during walking in healthy adults. In 28th Meeting of the American Society of Biomechanics. Portland, OR. 2004. A. Mündermann, K.B. King, C.O. Dyrby, T.P. Andriacchi.

Anterior cruciate ligament injury and patellar ligament insertion angle. In American Physical Therapy Association Combined Sections Meeting. Portland, OR. 2004. C. Shin, C.O. Dyrby, B. Hearn, A. Chaudhari, T.P. Andriacchi .

Kinematic Patterns and Knee Cartilage Thickness. In 49th Annual Meeting of the Orthopaedic Research Society. New Orleans, LA. 2003. E.J. Alexander, C.O. Dyrby, T.P. Andriacchi.

Anatomy of the Extensor Mechanism Influences Tibial Translation Due to Quadriceps Contraction in the ACL Deficient Knee. In 27th Annual Meeting of the American Society of Biomechanics. Toledo, OH. 2003. C.O. Dyrby, J. Deffeyes, M. Vora, T.P. Andriacchi.

PUBLICATIONS – ABSTRACTS (*continued*)

A Method for Testing Tibial Translation with Active Quadriceps Contraction: Tested in Control and Anterior Cruciate Ligament Deficient Population. In 2003 Summer Bioengineering Conference. Key Biscayne, FL. 2003. C.O. Dyrby, T. Guillaume, J. Deffeyes, M. Vora, T.P. Andriacchi.

Walking Speed and External Knee Adduction Moment in Healthy Knees and in Knees with OA: Cause or Effect of OA? . In 27th Annual Meeting of the American Society of Biomechanics. Toledo, OH. 2003. A. Mündermann, C.O. Dyrby, D. Hurwitz, L. Sharma, T.P. Andriacchi.

Adduction Moment, Radiographic Disease Severity, and Pain in Osteoarthritis of the knee. In ASME Summer Bioengineering Conference. Key Biscayne, FL.2003. S. Ueda, C.O. Dyrby, E.J. Alexander, T.P. Andriacchi.

Gait Style Affects External Knee Adduction Moment. In 27th Annual Meeting of the American Society of Biomechanics. Toledo, OH. 2003. S. Ueda, C.O. Dyrby, E.J. Alexander, T.P. Andriacchi.

ACL Injury Causes Rotational Abnormalities at the Knee During Walking. In 48th Annual Meeting of the Orthopaedic Research Society. Dallas, TX. 2002. T.P. Andriacchi, C.O. Dyrby, M.F. Dillingham.

Relationship Between Adduction Moment at the Knee and Changes in Foot Mechanics. In 48th Annual Meeting of the Orthopaedic Research Society. Dallas, TX. 2002. C.O. Dyrby, L.B. Chou, T.P. Andriacchi.

Functional Evaluation of the Scandinavian Total Ankle Replacement. In International Congress on Total Ankle Arthroplasty. San Francisco, CA. 2002. C.O. Dyrby, L.B. Chou, T.P. Andriacchi, R. Mann.

Initial Gait Characteristics Influence the Effect of Footwear Intervention to Modify Knee Loading. In 48th Annual Meeting of the Orthopaedic Research Society. Dallas, TX.2002. D.S. Fisher, T.P. Andriacchi, E.J. Alexander, C.O. Dyrby, E. Morag.

The Importance of the Posterior Cruciate Ligament During Deep Knee Flexion. In 48th Annual Meeting of the Orthopaedic Research Society. Dallas, TX.2002. T. Nagura, T.P. Andriacchi, E.J. Alexander, A.M. Chaudhari, C.O. Dyrby.

Gender Differences in the Biomechanics of Running and Cutting Maneuvers Relative to Non-Contact ACL Injury. In Transactions of the Orthopedic Research Society. 2001. T. Andriacchi, D. Camarillo, E. Alexander, C.O. Dyrby, D. Hurwitz.

PUBLICATIONS – ABSTRACTS (*continued*)

Mechanical Factors can Influence the Gender Differences in the Incidence of Non-Contact Injuries. In ASME Winter International Congress and Exposition. New York, NY. T.P. Andriacchi, D. Camarillo, E.J. Alexander, C.O. Dyrby.

Dynamic Changes in Anterior/Posterior Translation and Internal/External Rotation of the Knee During Cycling. In 25th American Society of Biomechanics. San Diego, CA. 2001. A.M. Chaudhari, C.O. Dyrby, T.P. Andriacchi.

A Relationship Between Lower Limb Kinetics and Foot Mechanics During Gait. In ASME Summer Bioengineering Conference. Snowbird, UT. 2001. C.O. Dyrby, L.B. Chou, T.P. Andriacchi.

Functional Evaluation of the Scandinavian Total Ankle Replacement. In American Orthopaedic Foot and Ankle Society. San Francisco. 2001. C.O. Dyrby, L.B. Chou, T.P. Andriacchi, R. Mann.

Dynamic shift of the Rotation Position of the Knee in Subjects with ACL Deficiency. In Gait and Clinical Movement Analysis Society. Sacramento, CA. 2001. C.O. Dyrby, M.F. Dillingham, T.P. Andriacchi .

Mechanical Loads on the Knee Joint During Deep Flexion. In ASME Summer Bioengineering Conference. Snowbird, UT. 2001. T. Nagura, C.O. Dyrby, E.J. Alexander, T.P. Andriacchi.

Knee Kinetics during the Deep Squat. In American Society of Biomechanics. Chicago, IL. 2000. C.O. Dyrby, T.P. Andriacchi.

Evaluation of dynamic joint loading during rising and descending to a kneeling position. In American Society of Biomechanics. Chicago, IL. 2000. T. Nagura, C.O. Dyrby, A.M. Chaudhari, J. MacMahon, E.J. Alexander, T.P. Andriacchi.

Internal to External Correspondence in the Analysis of Lower Limb Bone Motion. In 1999 Bioengineering Conference. 1999. E.J. Alexander, T.P. Andriacchi, C.O. Dyrby .

The Envelope of Dynamic Knee Motion. In Proceeding of the 1999 Bioengineering Conference: Transaction of the ASME. Big Sky, MT. 1999. C.O. Dyrby, T.P. Andriacchi.

Three-Dimensional Measurement of the Dynamic Envelope Knee Motion. In Transactions of the 45th Annual Orthopaedic Research Society. 1999. C.O. Dyrby, T.P. Andriacchi.

PUBLICATIONS – ABSTRACTS (*continued*)

Deep Knee Flexion and Tibialfemoral Rotation During Activities of Daily Living. In Transaction of the 44th Annual Meeting of the Orthopaedic Research Society. New Orleans, LA. 1998. C.O. Dyrby, T.P. Andriacchi.

A Relationship Between Gait Mechanics and the Incidence of Osteoarthritis in Asian and Caucasian Populations. In Transaction of the 6th North American Conference on Biomechanics. 1998. C.O. Dyrby, T.P. Andriacchi.

Effect of Femoral Reference Placement on the Measurement of Anterior/Posterior Knee Motion in Three Dimensional Kinematics. In Transaction of the 3D Technical Group of the International Society of Biomechanics. Chattanooga, TN. 1998. C.O. Dyrby, M.K. Toney, T.P. Andriacchi.

Internal External Knee Rotation as a Function of Knee Flexion for Activities of Daily Living. In Transaction of the 21st Annual American Society of Biomechanics. Clemson, SC. 1997. C.O. Dyrby, T.P. Andriacchi.

Test of a Simplified Staircase for Evaluating Lower Extremity Mechanics. In 2nd Annual Meeting of the North American Gait and Clinical Movement Society. Gait and Posture, Chicago. 1997. C.O. Dyrby, D.E. Hurwitz, T.P. Andriacchi.

Relation Between Knee Flexion and Tibial-Femoral Rotation During Activities Involving Deep Flexion. In 2nd Annual Meeting of the North American Gait and Clinical Movement Society. Gait and Posture, Chicago. 1997. C.O. Dyrby, M.K. Toney, T.P. Andriacchi.

The influence of muscle contraction on the kinematics of the knee joint. In Gait and Lower Extremity Joint Mechanics. Atlanta, GA. 1996. T.P. Andriacchi, M.K. Toney, C.O. Dyrby, A. Conley.