



## Thomas R Jenkyn, PhD, PEng

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### **TLS FORENSIC BIOMECHANICS AND ENGINEERING LTD**

#### **Principal and Senior Engineer**

TLS Forensic Biomechanics and Engineering Ltd.

13-1615 North Routledge Park

London, ON, N6H 5L6

[www.tlsforensic.com](http://www.tlsforensic.com)

(519) 282-0275

[tjenkyn@tlsbiomechanics.com](mailto:tjenkyn@tlsbiomechanics.com)

**Professional Engineer**, licensed in the Province of Ontario (PEO #90491257) since 2004  
Expertise in Mechanical Engineering, Biomechanical Engineering, Aerospace Engineering  
Evaluator for PEO accreditation as Biomechanical Engineer since 2012

### **80+ Forensic Biomechanics reports since 2008**

45 involving accident reconstructions, 41 using HVE software, 5 using MADYMO software

Clients include Morse Shannon LLP, Williams Walsh O'Connor LLP, Macksey Smye LLP, Lerner LLP, Siskinds LLP, McCall Dawson LLP, as well as municipalities and insurers in Central Canada and New England

Serving both plaintiffs and defendants

### **ACADEMIC POSITION**

#### **Professor of Engineering and Human Biomechanics**

Joint appointment with tenure in

Department of Mechanical and Materials Engineering,

Faculty of Engineering

and

School of Kinesiology,

Faculty of Health Sciences

The University of Western Ontario

London, ON, Canada N6A 5B9

Tel: (519) 661-2111 ext. 88339 Email: [tjenkyn@uwo.ca](mailto:tjenkyn@uwo.ca)

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**Co-Director, Wolf Orthopaedic Biomechanics Laboratory**  
**Director, Impact Biomechanics and Concussion Laboratory**

Fowler Kennedy Sport Medicine Clinic

The University of Western Ontario

3M Centre, Room 1215

London, ON, Canada N6A 3K7

(519) 661-2111 ext. 81122

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## EDUCATION

- 2000-2002 Post-doctoral Research Fellowship**  
Mayo Clinic, Department of Orthopaedic Surgery  
Biomechanics and Motion Analysis Laboratories,  
and  
Magnetic Resonance Imaging Laboratory, Department of Diagnostic Radiology  
Rochester, MN, USA 55905
- 2001 PhD (Biomedical Engineering)**  
The University of Strathclyde, Bioengineering Unit,  
Faculty of Engineering  
Glasgow, UK
- 1996 MSc (Aerospace Engineering)**  
University of Toronto Institute for Aerospace Studies,  
Faculty of Applied Science and Engineering  
Toronto, ON, Canada
- 1994 BSc (Engineering Science)**  
University of Toronto  
Faculty of Applied Science and Engineering  
Toronto, ON, Canada

## RESEARCH SUPPORT AND CONSULTING

Canada Foundation for Innovation (CFI), Leading Edge Fund grant, 2013-2018, "Facility for load-bearing imaging, biomechanics and clinical orthopaedics research."

Canadian Institutes of Health Research (CIHR), Operating grant, 2014-2019, "Single-plane dynamic radiography for quantification of bone and joint motion."

Natural Science and Engineering Research Council, Discovery Grant, 2015-2020, "Biomechanical load sharing in the foot during dynamic, load-bearing activity."

Canadian Olympic Committee (COC) and Canadian Curling Association (CCA), Own the Podium 2010, Top Secret Program, 2006-2010, consulting with national level athletes to

improve biomechanical technique and human-equipment interactions to give our Canadian teams the advantage in Vancouver 2010  
Canada Foundation for Innovation, Infrastructure Operating Grant, 2005-2012, “Abnormal arthrokinematics and osteoarthritis.”  
Canadian Institutes of Health Research (CIHR), University-Industry Partnership Program, Operating Grant, 2003-2013, “Medial opening wedge high-tibial osteotomy for the treatment of knee osteoarthritis.” in partnership with Arthrex, Inc, FL, USA

## **NATIONAL AND INTERNATIONAL MEMBERSHIPS AND AFFILIATIONS**

### Memberships

Society of Automotive Engineers, member since 2009  
Canadian Society for Biomechanics, member since 2003  
International Society of Biomechanics, member since 1997  
American Society of Biomechanics, member since 1999  
Gait and Clinical Movement Analysis Society, member since 1999  
Mayo Clinic Alumni Association, member since 2002  
Health Science Research Ethics Board, The University of Western Ontario, full board member from 2005-2006, alternate member 2003-2005, 2006-present

### Granting agency reviewer

Canadian Institutes of Health Research (CIHR), project grant reviewer since 2016  
Canada Foundation for Innovation (CFI), grant reviewer since 2006  
Manitoba Medical Service Foundation, grant reviewer since 2004  
Natural Science and Engineering Research Council (NSERC), grant reviewer since 2005  
Nova Scotia Health Science Research Foundation, grant reviewer since 2009  
Ontario Graduate Scholarship Program, Biomedical and Mechanical Engineering divisions, review panel chair 2006-present, review panel member 2005-2006

### Journal reviewer

Journal of Orthopaedic Research, reviewer since 2009  
Journal of Biomechanics, reviewer since 2004  
Gait and Posture, reviewer since 2001

## **COURSES TAUGHT**

Clinical Biomechanics (KIN4520, undergraduate course), introduces the role of the clinical kinesiologist in an out-patient rehabilitation setting including the function of articular joints, walking gait and other activities of daily living involving the upper and lower limbs. Specific attention is given to the function of specific joints (ankle, knee, hip, shoulder, lower back and neck) and common pathologies, diagnoses, treatments and outcomes. This course does not qualify the student for clinical practice.

Biomechanics (KIN2241, undergraduate course), study the physical principles that influence the biomechanics of human movement in sport, exercise, dance, the workplace and

activities of daily life. How to analyze the kinematics of the segments of the body and the kinetics that result from that motion. Students will be able to analyze the forces, impact biomechanics, moments of force, work, power and energy of various common activities.

Kinematics and Dynamics of Machines (MME3381, undergraduate course), study of the fundamentals of mechanisms and machines, graphical and analytical synthesis of planar linkages, and the position, velocity and acceleration analysis of planar linkages. Students will design and analyze cams, gear trains and apply dynamics fundamentals and dynamic force analysis. Focus on balancing of rotating and reciprocating machines and vibration analysis using computer modeling, simulation and analysis of machines.

Biomechanics of Human Joint Motion (MME 9516, graduate course), apply engineering concepts to human joint motion; especially the gait cycle. Examine various motion measurement methods, including practical applications and associated errors. Calculate external joint loads, understand inertial effects and simulate impact biomechanics. Study the architecture and function of skeletal muscle; concepts of energy, work and power applied to joint motion.

Engineering Dynamics (MME 2213, compulsory undergraduate course), topics include: rectilinear, angular and curvilinear motion, kinematics of a particle; a translating rigid body and a rigid body in pure rotation; definitions of different energies and energy balance; power and efficiency; linear impulse and momentum; impacts and the inertia of deflections.

Clinical Kinesiology (KIN 4472, elective undergraduate course), topics include: clinical roles of rehabilitation health professionals, basic articular joint function, walking gait, reaching and grasping, biomechanics of trauma and musculoskeletal disorders, specific joint pathologies, diagnoses, treatments and outcomes.

Orthopaedic Biomechanics (KIN 9447, graduate course), applying biomechanical concepts to the musculoskeletal system in health and disease. Topics include: Basic science: concepts of stress-strain, elastic and plastic deformation, forces and moments, impact biomechanics, tension, compression, shear, bending and torsional loads. Applied science: the biomechanics of musculoskeletal injuries and of orthopaedic surgery, plates, nails and screws, total joint replacements and physical therapy. Clinical science: role of biomechanics in osteoarthritis, traumatic and repetitive strain injury of joints of the lower limbs, upper limbs and spine (especially ankle, knees and shoulders), ligament and meniscal tears and ruptures.

## PEER-REVIEWED PUBLICATIONS

1. Balsdon M, Dombroski C, Bushey K, Jenkyn TR. 2019. "Hard, soft and off-the-shelf orthoses and their effect on the angle of the medical longitudinal arch: A biplane fluoroscopy study." *Prosthetics and Orthotics International*. Epub ahead of print

2. Jenkyn TR. 2018. "A person and his bicycle are struck by a pickup truck, but was he riding or walking the bicycle?" Human-vehicle Environment Forum Proceedings. Charleston, SC, USA
3. Jenkyn TR. 2018. "Three vehicle chain reaction collision injures an NHL hockey prospect." Human-vehicle Environment Forum Proceedings. Charleston, SC, USA.
4. Balsdon ME, Bushey KM, Dombroski CE, LeBel ME, Jenkyn TR. 2016. "Medial longitudinal arch angle presents significant differences between foot types: a biplane fluoroscopy study." *Journal of Biomedical Engineering*. 138(10)
5. Belcastro A, Willing R, Jenkyn T, Johnson M, Galil K, Yazdani A 2016. "A three-dimensional analysis of zygomatic symmetry in normal, uninjured faces." *Journal of Craniofacial Surgery*. 27(2): 504-508.
6. Roumeliotis G, Willing R, Neuert M, Ahluwalia R, Jenkyn T, Yazdani A (2015). "Application of a novel semi-automatic technique for determining the bilateral symmetry plane of the facial skeleton of normal adult males." *Journal of Craniofacial Surgery*. 26(6): 1997-2001.
7. Marriott K, Birmingham TB, Kean CO, Hui C, Jenkyn TR, Giffin JR. (2015). "Five-year changes in gait biomechanics after concomitant high tibial osteotomy and ACL reconstruction in patients with medial knee osteoarthritis." *American Journal of Sports Medicine*. 43(9): 2277-2285.
8. Roumeliotis G, Ahluwalia R, Jenkyn T, Yazdani A (2015). "The Le Fort system revisited: Trauma velocity predicts the path of Le Fort I fractures through the lateral buttress." *Plastic Surgery*. 23(1): 40-42.
9. Khadilkar L, MacDermid JC, Sinden KE, Jenkyn TR, Birmingham TB, Athwal GS. (2014). "An analysis of functional shoulder movements during task performance using Dartfish movement analysis software." *International Journal of Shoulder Surgery*. 8(1): 1-9.
10. Syed SH, Willing R, Jenkyn TR, Yazdani A (2013). "Video analysis of the biomechanics of a bicycle accident resulting in significant facial fractures." *Journal of Craniofacial Surgery*. 24(6): 2023-9.
11. Willing RT, Roumeliotis G, Jenkyn TR, Yazdani A (2013). "Development and evaluation of a semi-automatic technique for determining the bilateral symmetry plane of the facial skeleton." *Medical Engineering and Physics*, epublished ahead of print
12. Moyer RF, Birmingham TB, Dombroski CE, Walsh RF, Leitch KM, Jenkyn TR, Giffin JR. (2012). "Combined effects of a valgus knee brace and lateral wedge foot orthotic on the external knee adduction moment in patients with varus gonarthrosis." *Archives of Physical Medicine and Rehabilitation* 94(1): 103-21.
13. Bechard DJ, Birmingham TB, Zecevic AA, Jones IC, Leitch KM, Giffin JR, Jenkyn TR. (2012). "The effect of walking poles on the knee adduction moment in patients with varus gonarthrosis." *Osteoarthritis and Cartilage* 20(12):1500-1506.
14. Kedgley AE, Fox AM, Jenkyn TR. 2012. "Image intensifier distortion correction for fluoroscopic RSA: the need for independent accuracy assessment." *Journal of Applied Clinical Medicine and Physics* 13(1): 3441
15. Birmingham TB, Zecevic AA, Jones IC, Giffin JR, Jenkyn TR. 2012. "Toe-out, lateral trunk lean, and pelvic obliquity during prolonged walking in patients with medial compartment knee osteoarthritis and healthy controls." *Arthritis Care and Research* 64(4): 525-32.
16. Fox AM, Kedgley AE, Lalone EA, Johnson JA, Athwal GS, Jenkyn TR. 2011. "The effect of decreasing computed tomography dosage on radiostereometric analysis (RSA) accuracy at the glenohumeral joint." *Journal of Biomechanics* 44(16): 2847-50.

17. Lalone EA, Fox AM, Kedgley AE, Jenkyn TR, King GJ, Athwal GS, Johnson JA, Peters TM. 2011. "The effect of CT dosage on glenohumeral joint congruency measurements using 3D reconstructed patient-specific bone models." *Physics in Medicine and Biology* 56(20): 6615-24
18. Shultz R, Jenkyn T. 2012. "Determining the maximum diameter for holes in the shoe without compromising shoe integrity when using a multi-segment foot model." *Medical Engineering and Physics* 34(1): 118-22.
19. Leitch KM, Birmingham TB, Jones IC, Giffin JR, Jenkyn TR. 2011. "In-shoe plantar pressure measurements for patients with knee osteoarthritis: Reliability and effects of lateral heel wedges." *Gait and Posture*, 34(3): 391-6.
20. Shultz R, Birmingham TB, Jenkyn TR. 2011. "Differences in neutral foot positions when measured barefoot compared to in shoes with varying stiffnesses." *Medical Engineering and Physics*, 33(10): 1309-13.
21. Shultz R, Kedgley AE, Jenkyn TR. 2011. "Quantifying skin motion artifact error of the hindfoot and forefoot marker clusters with the optical tracking of a multi-segment foot model using single-plane fluoroscopy." *Gait and Posture* 34(1): 44-8.
22. DJ Bechard, TB Birmingham, AA Zecevic, TR Jenkyn. 2011. "Time-varying behavior, test-retest reliability and concurrent validity of lateral trunk lean and toe-out angles during prolonged treadmill walking." *Gait and Posture* 34(1): 81-5.
23. TR Jenkyn, JC Erhart, TP Andriacchi. 2011. "An analysis of the mechanisms for reducing the knee adduction moment during walking using a variable stiffness shoe in subjects with knee osteoarthritis." *Journal of Biomechanics*, 44(&): 1271-6.
24. CL Pollock, IC Jones, TR Jenkyn, TD Ivanova, SJ Garland. 2010. "Changes in kinematics and trunk electromyography during a 2000m race simulation in elite female rowers." *Scandinavian Journal of Medical Science in Sports*, 22(4):478-487.
25. T Bhatnagar, TR Jenkyn. 2010. "Internal kinetic changes in the knee due to high tibial osteotomy are well-correlated with change in external adduction moment: an osteoarthritic knee model." *Journal of Biomechanics* 43(12): 2261-6.
26. TR Jenkyn, R Shultz, JR Giffin, TB Birmingham. 2010. "A comparison of subtalar joint motion during anticipated medial cutting turns and level walking using a multi-segment foot model." *Gait and Posture* 31(2): 153-158.
27. D Bechard. AE Kedgley, V Nolte, TR Jenkyn. 2009. "Total kinetic energy production of body segments is different between racing and training paces in elite Olympic rowers." *Sport Biomechanics* 8(3): 199-211.
28. AE Kedgley, TR Jenkyn. 2009. "RSA calibration accuracy of a fluoroscopy-based system using non-orthogonal images for measuring functional kinematics." *Medical Physics* 36(7):3176-3180.
29. TB Birmingham, JR Giffin, BM Chesworth, DM Bryant, RB Litchfield, K Willits, TR Jenkyn, PJ Fowler. 2009. "Medial opening wedge high tibial osteotomy: a prospective cohort study of gait, radiographic, and patient-reported outcomes." *Arthritis and Rheumatism*. 61(5): 648-657.
30. AE Kedgley, TB Birmingham, TR Jenkyn. "Comparative accuracy of radiostereometric and optical tracking systems." *Journal of Biomechanics*. 42(9): 1350-1354.
31. CO Kean, TB Birmingham, J Garland, TR Jenkyn, T Ivanova, I Jones, JR Giffin. "Knee joint moments and muscle activity following simultaneous high tibial osteotomy and ACL reconstruction." *Medicine and Science in Sport and Exercise*. 41(3): 612-619.

32. C Pollock, T Ivanova, I Jones, TR Jenkyn, J Garland. "Electromyography and kinematics of the trunk during rowing in elite female rowers." *Medicine and Science in Sport and Exercise*. 41(3): 628-636.
33. TR Jenkyn, K Anas, AC Nicol. 2009. "Foot segment kinematics during normal walking using a multi-segment model of the foot and ankle complex." *Journal of Biomechanical Engineering*. 131(3): 034504.
34. NM Dunk, AE Kedgley, TR Jenkyn, JP Callaghan. 2009. "Evidence of a pelvis-driven flexion pattern: are the joints of the lower lumbar spine fully flexed in seated postures?". *Clinical Biomechanics* 24(2): 164-168.
35. MA Hunt, TB Birmingham, D Bryant, I Jones, JR Giffin, TR Jenkyn, AA Vandervoort. 2008. "Lateral trunk lean explains variation in dynamic knee joint load in patients with medial compartment knee osteoarthritis." *Osteoarthritis and Cartilage*. 16(5): 591-9.
36. TR Jenkyn, MA Hunt, I Jones, JR Giffin, TB Birmingham. 2008. "Toe-out gait in patients with knee osteoarthritis partially transforms external knee adduction moment into flexion moment during walking gait: A tri-planar kinetic mechanism." *Journal of Biomechanics*. 41(2): 276-83.
37. MA Hunt, TB Birmingham, TR Jenkyn, JR Giffin, I Jones. 2008. "Measures of frontal plane lower limb alignment obtained from static radiographs and dynamic gait analysis." *Gait and Posture*. 27(4): 635-40.
38. TB Birmingham, MA Hunt, IC Jones, TR Jenkyn, JR Giffin. 2007. "Test-retest reliability of the peak knee adduction moment during walking in patients with medial compartment knee osteoarthritis." *Arthritis and Rheumatism*. 57(6): 1012-7.
39. TR Jenkyn, AC Nicol. 2007. "A multi-segment kinematic model of the foot with a novel definition of forefoot motion for use in clinical gait analysis during walking." *Journal of Biomechanics*. 40(14): 3271-8.
40. MA Hunt, PJ Fowler, TB Birmingham, TR Jenkyn, JR Giffin. 2006. "Foot rotational effects on radiographic measures of lower limb alignment." *Canadian Journal of Surgery*. 49(6): 401-6.
41. A Specogna, T Birmingham, MA Hunt, IC Jones, TR Jenkyn, PJ Fowler, JR Giffin. 2007. "Radiographic measures of knee alignment in patients with varus gonarthrosis: effect of weightbearing status and associations with dynamic joint load." *American Journal of Sport Medicine*. 35(1): 65-70.
42. EA Hassan, TR Jenkyn, CE Dunning. 2007. "Direct comparison of kinematic data collected using an electromagnetic tracking system versus a digital optical system." *Journal of Biomechanics*. 40(4): 930-5.
43. MA Hunt, TB Birmingham, JR Giffin, TR Jenkyn. 2006. "Associations among knee adduction moment, frontal plane ground reaction forces and lever arm during walking in patients with knee osteoarthritis." *Journal of Biomechanics*. 39(12): 2213-2220.
44. A Specogna, T Birmingham, J DaSilva, JS Milner, J Kerr, MA Hunt, IC Jones, TR Jenkyn, PJ Fowler, JR Giffin. 2004. "Reliability of lower limb frontal plane alignment measurements using plane radiographs and digitized images." *Journal of Knee Surgery*. 17(4): 203-210.
45. TR Jenkyn, RL Ehman, K-N An. 2003. "Noninvasive muscle tension measurement using the novel technique of magnetic resonance elastography (MRE)." *Journal of Biomechanics*. 36(12): 1917-1921.

46. G Heers, T Jenkyn, MA Dresner, MO Klein, JR Basford, KR Kaufman, RL Ehman, KN An. 2003. "Measurement of muscle activity with magnetic resonance elastography." *Clinical Biomechanics*. 18(6): 537-42.
47. N Mura, SW O'Driscoll, ME Zobitz, G Heers, TR Jenkyn, S-M Chou, AM Halder, K-N An. 2003. "The effect of infraspinatus disruption on glenohumeral torque and superior migration of the humeral head: A biomechanical study" *Journal of Shoulder and Elbow Surgery*, 12(2): 179-184.
48. TR Jenkyn, B Koopman, P Huijing, RL Lieber, KR Kaufman. 2002. "Finite element model of intramuscular pressure during isometric contraction of skeletal muscle." *Physics in Medicine and Biology*. 47(22): 4043061.
49. JR Basford, TR Jenkyn, KN An, RL Ehman, G Heers, KR Kaufman. 2002. "Evaluation of healthy and diseased muscle with magnetic resonance elastography." *Archives of Physical Medicine and Rehabilitation*. 3(11): 1530-1536.
50. G Babis, RT Trousdale, TR Jenkyn, KR Kaufman. 2002. "The comparison of two methods of screw fixation in periacetabular osteotomy." *Clinical Orthopaedics and Related Research*. 403: 221-227.