The Bipedal Exchange
The Newsletter of the Gait Society of the American Academy of Orthotists and Prosthetists
April 2013

Gait Society mission: To promote gait analysis as a method for advanced clinical care and research; and to further educate orthotists, prosthetists and other medical professionals about the analysis and treatment of gait disorders in order to improve the functional abilities of physically challenged individuals in our community.

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The views expressed in The Bipedal Exchange are those of the authors and not necessarily those of the American Academy of Orthotists and Prosthetists.
Letter from the Editor

Dear members,

We have seen incredible growth within the Gait Society. Thanks to Shane Wurdemann, CP, MS, and Elisa de Jong, CPO, LO, we have reviewed 14 clinically relevant journal articles. These reviews are not just summaries but critical evaluations of the experiment design and conclusions by the authors.

Our first book club review was also a success. Sarah Sawers, CO, moderated the 14 chapter reviews of Clinical Gait Analysis: Theory and Practice. Author Chris Kirtley, MD, PhD, was heavily involved in the discussions.

We will sponsor the spring 2013 issue of the Academy TODAY. Articles will discuss video-based gait assessment, osseointegration for prosthetic attachment, and a gait analysis textbook review. In addition, Cara Negri, CP, is working with Silicon Coach to facilitate posting clinical case videos for group discussion on our networking site.

If you would like to become more involved, we will welcome you to the team. Please contact Gait Society Chair John Brinkmann, MA, CPO, FAAOP (johnbrinkmannncpo@gmail.com) or Vice-Chair Teri Chou, PhD (tchou@orthocareinnovations.com), for more information.

Thank you for your membership and participation.

Best Regards,
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Gait Society Leadership updates

We are extremely grateful for the work that Shane Wurdemann, CP, MS, Justina Shipley, MEd, CO, FAAOP, and Elisa de Jong, CPO put into the society over the past two years. They’ll remain involved, but in lesser roles moving forward.

Additions to the leadership include Cara Negri, BSME, CP, who accepted the role of Scientific Liaison. Negri will coordinate the Journal Club by selecting articles and facilitating online discussion. She will also be instrumental in maintaining and facilitating use of the Gait Society’s online video sharing website. Brian Kaluf, CP, has accepted the role of Academic Committee Chair. He will help recruit speakers and generate ideas for the Academy Annual Meeting and Gait Society Forum, while also developing materials for the Academy Today and other publications.

2013 Academy Annual Meeting & Scientific Symposium

We are excited to have hosted a session during the 39th Academy Annual Meeting in Orlando, Florida.

Michael Orenduff, PhD, and Toshiki Kobayashi, PhD, from Orthocare Innovations LLC, and Peter Adamczyk, PhD, from Intelligent Prosthetic Systems LLC, presented at the session, entitled Novel Technology for Measuring Prosthetic Users Gait In and Outside of the Clinic. Read the symposium abstract below.

INTRODUCTION

The integration of force and motion sensors into prosthetic components has recently been used to address several long-standing challenges in prosthetics. Sensors integrated into prosthetic components may provide new methods of analyzing the gait of prosthetic
users in both the clinical and in the community setting. Gait analysis usually involves expensive equipment in the confines of laboratory settings, but some novel sensors may make clinic and community measures more common. Three new technologies are of growing importance to real-world applications: 1) moment and force logging lower-limb prosthetic components; 2) time-synchronized step counters with advanced activity discrimination algorithms; and 3) foot-mounted inertial measurement units with advanced processing for gait variability measurement.

**METHOD**

Study 1: Eleven transtibial amputees were fit with a force-sensing component below their socket. Socket alignment was randomly perturbed in both translation and angle. Both perceptions of alignment changes and the socket reaction moments from the alignment changes while walking were recorded.

Study 2: Fifteen anonymous experienced prosthetists rated the functional level of 68 anonymous transtibial amputees. The average functional rating was compared to the calculated value from an algorithm to estimate potential to ambulate (i.e., most steps in one minute), cadence variability (i.e., ratio of low:med:high step rates), and ambulatory requirement (i.e., energy expenditure based on daily step total) using a sensor worn over seven days.

Study 3: Inertial measurement units (IMUs) were used to estimate balance-related gait characteristics in healthy and balance-impaired individuals in single-task and added-task scenarios during long walks in a hallway. Specially constrained data processing allowed the path of each foot to be estimated, and gait measures such as variability in stride length, width, and timing were measured.

**RESULTS**

Study 1: Transtibial amputees were suggested to be sensitive only to coronal angle malalignment even though malalignment can produce high and potentially detrimental socket reaction moments on the residual limb. Alterations in the socket reaction moments were systematic for both angular and linear displacements of the socket on the prosthetic limb. Sagittal socket malalignment also caused changes in coronal reaction moments.

Study 2: For the functional level study, the algorithm estimate was able to account for 82 percent of the experienced prosthetist’s K level score. Despite the high agreement, the prosthetists also responded that they did not feel confident in their ability to rate the amputees’ functional level based on activity data alone.

Study 3: IMU-based footstep locations were validated using a mobile motion capture system. Compared to standard gait mat measurements, the IMU system yielded a larger and richer data set from simpler tests at significantly lower cost. Current work focuses on evaluating similar metrics with prosthesis users and harvesting additional gait information from the swing-phase motion of each foot.

**DISCUSSION**

These new sensor technologies integrated into the user’s prosthetic components provide a new level of information to the clinician. These objective data may be used to optimize socket alignment, evaluate functional level, and determine gait stability and variability in prosthesis users. Intuitive graphical user interface design to automate and display these data to prosthetists in a useful and simple way.
will bring gait analysis out of the laboratory and into the clinic and community settings.

**CONCLUSION**

As evidence-based practice continues to drive the field forward, novel methods of collecting and processing gait information can help clinicians improve care for prosthesis users. As published work continues to demonstrate the efficacy and clinical utility of new sensor information, use of these systems may become more widespread.

**CLINICAL APPLICATION**

Prosthetists can use novel, trustworthy, and actionable clinical information to improve their understanding of an individual’s gait. This sensor data can inform component choice and delivery and aid in understanding the real-world gait consequences for prosthesis users.

References

**Activity on the Gait Society Networking Site**

Currently, there are more than 300 users on the Gait Society Networking Site (http://gait-society.ning.com/main/). This resource provides participants with a huge network to discuss special cases and techniques that can improve their practices.

**Textbook Club**

The textbook club is coordinated and moderated by Sarah Sawers, CO. More than 20 practitioners from around the globe participated in the club. Sawers recruited author Chris Kirtley, MD, PhD, to participate in discussions of his book *Clinical Gait Analysis: Theory and Practice* on the society’s networking site. The research perspectives of Kirtley and Shane Wurdeman, CP, MS, clarified and offered a good complement to the primarily clinical perspectives of the rest of the group. A sample of the discussion follows: “As a clinician, I really feel like the most applicable aspects of gait analysis to my everyday practice rest in this chapter. I wish this ‘soup to nuts’ discussion of observation gait analysis (OGA) was available to me as a student. Trying to take in all of the different joint positions at each stage of the gait cycle was overwhelming when I first started out. I plan to share Kirtley’s simplified OGA check sheet (Table 14.1) with my future students and residents to help them isolate the key components in pathologic gait as they build their pattern recognition skills.” View all discussions on the textbook club page.

The society’s networking site also hosts a **journal club** led by Shane Wurdeman, CP, MS, and Elisa de Jong, CPO, LO. They post clinically relevant journal articles for discussion amongst our online community. The club does a great job of critically evaluating conclusions and determining what can be used to improve clinical practice. Visit the **journal club** to read a summary of posted articles and to participate in discussions.

**How to Navigate the Gait Society Networking Website**

1. **Customize your profile**
   Your name should appear on the top of the vertical toolbar on the right hand side of the main page. Clicking on “Settings” allows you to customize the website to your needs.
You can upload a photo which will be displayed with any content you add to the site.

2. Set Email Alerts
Alerts will be sent to you via email to notify you when new content is added to the site. These allow you to follow discussions and content postings without having to log in to the site first. This is especially helpful if you belong to multiple society networking sites.

3. Once set up, all you have to do is read, comment, post content, and NETWORK. The following describes each of the networking site features and tabs.

HOME: Brings you to the society’s main page, for an overview of the site, including recent additions to the forum, current members, and other activity.

Invite is found under your name, next to ‘Friends’ and allows you to invite colleagues who are member to participate in the society’s networking site.

Journal Club: This tab exposes the list of Journal Club articles that have been selected to generate discussion among our members. You will find a dated link to each article, a summary, and a list of comments by members who are following the discussion. If you wish, you can click “Follow” below the comment box to have alerts sent to you when someone posts a comment about this discussion.

Textbook Club: This tab is where scheduled discussions of a chosen textbook occur. The first Textbook Club discussion has ended and a new one will begin soon.

Clinical Cases: Post a new case by using the ‘Add’ button, or comment on someone else’s.

Forum is located in the middle of the home page and is where the ‘action’ is. Members and society leaders post information, discussions, and questions here to which you may respond. Choose “View All’ to see more options and to be able to sort by “My Discussions.”

Library: This tab connects you to lists of resources regarding particular aspects of gait, including orthotics, prosthetics, outcome measures, general gait information, and research references. You can also add a comment to post your own resources.

Academy Annual Meeting: Leave comments regarding the upcoming Academy Annual Meeting. We are always interested in your suggestions for new topics and dynamic speakers for society-sponsored lectures highlighting a gait-related topic.

By Sarah Sawers, CO, membership coordinator and John Brinkmann, MA, CPO, FAAOP, chair.
**Gait Society Members**

**New Members (2012-13)**

- Marva Butters-Adams, CPed – Sterling Podiatric, PC – Brooklyn, NY, USA
- Benjamin Call – – Coppell, TX, USA
- Kim M Castelli, CPed, CFO – KMC Pedorthics, Inc. – Woodhaven, NY, USA
- Christopher M. Cole, CPed – Foot Solutions – Estero, FL, USA
- Thomas J. Cutler, CPO, FAAOP – Sequoia Prosthetics & Orthotics – Visalia, CA, USA
- Michael J. Dodd, CO – Applied Orthotic & Prosthetic Services – San Jose, CA, USA
- Charissa A Doerger, CP – Ossur Americas, Inc. – Orlando, FL, USA
- Hilary M. Engelhardt, CPO – Cadence Biomedical – Seattle, WA, USA
- Can Erdem – Can Erdem O&P Lab, Istanbul, TURKEY
- Scott T. Fager, CO, RFO – Becker Orthopedic Appliance Co. – Grosse Pointe, MI, USA
- Amber Fleer, DPT, OCS, ATS, CSCS – Southwest Baptist University – Bolivar, MO, USA
- Gilbert L. Gulbrandson, CO – Gulbranson Orthotics & Prosthetics – Cary, IL, USA
- David E Hensley, CPO, FAAOP – Orthocare Innovations – Bothell, WA, USA
- William Lee Hodges, CP – Bluff Prosthetics and Orthotics – Poplar Bluff, MO, USA
- Brian D Kaluf, CP – Ability Prosthetics & Orthotics, Inc. – Greenville, SC, USA
- Tyler Klenow – – Ypsilanti, MI, USA
- Cale R. Konetchy, CP – OttoBock – Hugo, MN, USA
- Anthony G. Korjagin, CP, LP – Capital Orthotics and Prosthetics, LLC – Concord, NH, USA
- Steven Kramer, BOCP – Carolina Orthotics and Prosthetics Inc. – North Charleston, SC, USA
- Leanne R. LaChance, CO – Wright & Filippis, Inc. – Madison Heights, MI, USA
- Frank J. Ledezma, CPed – Dr. Comfort – Thiensville, WI, USA
- Kelvin C Lee – – Davenport, IA, USA
- Patrick V. Logan, CPO – Mary Free Bed Orthotics – Ada, MI, USA
- Alexander L. Lyons, CPO – Lyons Prosthetics & Orthotics, Inc. – Conway, SC, USA
- Donald McGovern, CPO, FAAOP – Rehabilitation Institute of Chicago – Western Springs, IL, USA
- Cara M. Negri, CP – Ossur Asia Pacific – North Parramatta, NSW, AUSTRALIA
- Amanda Parsons-Twes ten, CPO – Orthotic & Prosthetic Design – Millstadt, IL, USA
- Cristian Pauchard – THEODULOZ Y CÍA. LTDA. – Santiago, CHILE
- Robert L. Rhodes, CO, FAAOP – Eastern Michigan University – Ypsilanti, MI, USA
- James P. Rogers, CPO, FAAOP – Pinnacle Orthotic & Prosthetic Services – Chattanooga, TN, USA
- Richard M. Sainz, CP – Ability Dynamics, LLC – Tempe, AZ, USA
- Marion E. Sanders, COA – Bio Prosthetic-Orthotic Lab, Inc. – Ashburn, VA, USA
- Brandon Smith, BOCO – Tindal Orthotic & Prosthetic – Leonardville, KS, USA
- Jan J. Stokosa, CP, FAAOP – Stokosa Prosthetic Clinic – Okemos, MI, USA
- Anne F. Street, CP – Brevard Prosthetics, Inc. – Rockledge, FL, USA
- Ann Yamane, CO – Univ. of Washington Med Center P&O – Seattle, WA, USA

**Renewed Members**

- Crispin Barry Adams, CPed – Sterling Podiatric, PC – Brooklyn, NY, USA
- Jonathan Alexander, CP, FAAOP – Myobility Inc. P&O Services – Nanuet, NY, USA
- Michael M. Amrich Jr., CPO, FAAOP – FDR Center for Prosthetics & Orthotics – Franklin, MA, USA
- David A. Boone, PhD, CP, LP – Yarra, Inc. – Seattle, WA, USA
- John T. Brinkmann, MA, CPO, FAAOP – Northwestern University Prosthetics-Orthotics Center – Rockford, IL, USA
- Ray G. Burdett, PhD, PT, CO – University of Pittsburgh – Pittsburgh, PA, USA
- Kevin E. Calvo, CPO, FAAOP – Bionics Orthotics & Prosthetics – Del Mar, CA, USA
- April Jeanette Chambers – University of Pittsburgh – Glenshaw, PA, USA
- Cheryl G. Chance, CO – J and C Orthotics & Prosthetics – Beaumont, TX, USA
- James W. Claiborne Jr., CPO, FAAOP – Claiborne Prosthetics & Orthotics – Charlotte, NC, USA
Kenneth R. Collier, CO – Augusta Prosthetics, Inc. – Augusta, GA, USA
Elisa Marie de Jong, CPO – Children’s Memorial Hospital – Chicago, IL, USA
Thomas V. DiBello, CO, LO, FAAOP – Dynamic Orthotics and Prosthetics, LP – Houston, TX, USA
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Michelle J. Hall, CPO, FAAOP – Gillette Lifetime Speciality Healthcare – St Paul, MN, USA
P.R. Hepburn – Orthocare CC – Cape Town, SOUTH AFRICA
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Michael McKinney, CP – McKinney Prosthetics – Gurnee, IL, USA
Sara MorganCPO – University of Washington – Seattle, WA, USA
Edward S. Neumann, PhD, CP, FAAOP – Human Kinetic Engineering, LLC. – Las Vegas, NV, USA
Mary V. Paletta, CPO – Rehabilitation Practitioners, Inc. – Inwood, WV, USA
Jaime Pantoja Lozada, BOCP – Diabetic Solutions – Vega Baja, PR, USA
Mark A. Parrell, CO – High Plains Orthotics & Prosthetics Inc. – Scottsbluff, NE, USA
Amanda Parsons-TwestenCPO – Orthotic & Prosthetic Design – Millstadt, IL, USA
Timothy B Rayer, CP – Prosthetic Innovations, LLC – Eddystone, PA, USA
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Roy R. Rice III, CP – Augusta Prosthetics, Inc. – Augusta, GA, USA
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