Welcome to the first issue of +AdAktivresearch’s scientific e-letter!

This e-letter is created to help you take part of the latest research in the area of orthopaedic technology and biomechanics. The articles are presented in a summarized version. This issue is covering the areas of diabetics, sport medicine/orthotics and prosthetics.

Biomechanics/diabetics

Zimi Sawacha, Guarneri Gabriella, Giuseppe Cristoferi, Annamaria Guiotto, Angelo Avogaro, Claudio Cobelli,  
**Diabetic gait and posture abnormalities: A biomechanical investigation through three dimensional gait analysis**  
Clinical Biomechanics 24 (2009) 722–728

It is well known that sensimotor polyneuropathy is a long-term diabetic complication, involved in the pathogenesis of the diabetic foot, which causes morbidity and also mortality.

Sawacha and colleagues investigated how diabetic polyneuropathy affected gait and posture with the aim to develop a methodology to identify subjects at risk for ulceration. They wanted to find alternations in both diabetic gait and postural alternations.

The study team included 67 subjects: 26 diabetics with polyneuropathy, 21 diabetics without polyneuropathy and 20 control subjects. The mean age was 63.2 (SD 5.6), 63.8 (SD 5.4) and 59.0 (SD 5.2) years respectively, mean body mass index were 25.6 (SD 3), 26.3 (SD 2.5), 24.0 (SD 2.9) respectively.

The test subjects underwent morphological evaluation by physical examination, gait analysis and postural assessment by a motion capture system that was connected with force plates and baropodometric systems.

The investigators evaluated mobility of lower limb, deformities of foot, posture of trunk and pelvis, position of knee and heel, plantar foot arch, three-dimensional kinematics and kinetics during gait. Further the effect of peripheral vascular disease and microangiopathy on trunk and lower limb motion was evaluated.

The result showed that mobility of trunk and lower limb joint (in static and dynamic states) were reduced in both diabetic groups on each plane, but in diabetics with polyneuropathy the test significantly recorded lower
ranges of motion. Additionally, significant reductions in each joint moment and velocity during gait were found in both diabetic groups. The authors also noticed a further significant reduction in presence of both vasculopathy and microangiopathy.

The study of Sawancha et al showed an altered gait and posture in diabetic patients regardless of polyneuropathy. The authors suggest that this approach may be relevant to predict the risk of ulceration before clinically detectable neuropathy.

Sports medicine/orthotics

Yeung SS, Yeung EW, Gillespie LD. 
Interventions for preventing lower limb soft-tissue running injuries.

Runners frequently acquire overuse soft tissue injuries. This Cochrane review conducted by Yeung et al have assessed the effects of interventions used to prevent lower limb soft tissue injuries in runners. This review is an update of a review published in 2001.

Interventions often advocated for preventing injuries are stretching exercises, modification of training schedules as well as protective devices such as braces and insoles. The included trials tested four categories of interventions: exercises, modification of training schedules, use of orthoses, and footwear and socks.

The investigators included 25 trials with 30,252 participants. 19 trials were on military recruits, three trials were on runners from the general population, one trial was on soccer referees and two trials were on prisoners.

After going through the result of the included studies the reviewers did not find evidence that stretching exercises reduces lower limb soft tissue injuries. It was neither found evidence supporting a training regimen of conditioning exercises to improve strength, flexibility and coordination nor that longer more gradual increase in training reduces injuries in novice runners.

Some evidence was found, from a poor quality trial, that additional
training resulted in a significant increase in the number of naval recruits with shin splints. Limited evidence was found that injuries were less frequent in prisoners when running duration or frequency were reduced.

For preventing anterior knee pain it appears to be effective to use patellofemoral braces.

In order to decreasing shin splints (medial tibial stress syndrome) in military recruits it seems that custom-made biomechanical insoles may be more effective than no insoles.

The study group did not find significant reduction in the rate of running injuries in military recruits when wearing running shoes based on foot shape, rather than standard running shoes.

The authors concluded the evidence for the effectiveness of interventions to reduce soft-tissue injury after intensive running is very weak. They ask for more well designed and reported RCTs, preferable designed, conducted and reported to contemporary standards and focusing on recreational or competitive runners, rather than military recruits.

Sae Yong Lee, Patrick McKeon, Jay Hertel

Does the use of orthoses improve self-reported pain and function measures in patients with plantar fasciitis? A meta-analysis

Physical Therapy in Sport 10 (2009) 12–18

Plantar fasciitis is a common problem, frequently seen in athletic populations and military recruits, but also observed in the sedentary population. It is a chronic injury, which causes inflammation and pain at the origin of the plantar fascia on the plantar surface of the heel. It has been found that about 10% of recreational runners reported plantar fasciitis. Another study showed that 159 out of 267 injury patients who where runners had plantar fasciitis. It has also been found that more general and sedentary populations also suffers from plantar fasciitis. That means that plantar fasciitis is relatively common, regardless of activity level of individuals.

Lee, McKeon and Hertel wanted to perform a meta-analysis to investigate how self reported pain and function in patients with plantar fasciitis were affected by the use of foot orthoses.

The authors used data bases to find original research studies that fulfilled their criterias;

1. randomised controlled trials or prospective cohort designs
2. the patients had to be suffering from plantar fasciitis at the time of recruitment
3. evaluated the efficacy of foot orthoses with self-reported pain and/or function
4. means, standard deviations, and sample size of each group had to be reported.

The authors included six articles and compared their pooled orthoses results to the result of another article.

The result of the meta-analysis showed significant reductions in pain and increases in function after orthotic intervention. Further one study showed significant reduction in pain after night splint treatment.

The authors concluded that usage of foot orthoses in patients with plantar fasciitis appears to be connected to less pain and better function.

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**Prosthetics**

C. Dietrich, et al.,

For patients amputated at forearm level the constrained functionality and phantom limb pain are of major concern.

Neuroscientific investigations have found that relevant stimulation of the stump can decrease phantom limb pain and also that the prosthesis user could use feedback information of the prosthesis hand for optimizing the control of the prosthesis. Therefore somatosensory feedback information from a prosthetic hand might help to improve prosthesis functionality and reduce phantom limb pain.

Dietrich et al wanted to investigate if a two weeks training on a hand prosthesis that provides somatosensory feedback may help to improve the function of the prosthesis and reduce phantom limb pain.

The study group let eight forearm amputees with phantom limb pain be trained for two weeks to use a hand prosthesis that gave somatosensory feedback on grip strength.

This study displayed a functionality of the prosthesis in everyday tasks that was significantly increased. Additionally, the study showed that phantom limb pain was reduced after amputees had used hand prostheses that provided somatosensory feedback on the grip strength.
The authors concluded that a prosthesis with feedback function appears to be a promising therapeutic tool to reduce phantom limb pain and to increase functionality in everyday tasks. They suggest that future studies should further investigate the possibility of use of that principle.

William D Miller; A Berry Deathe

The influence of balance confidence on social activity after discharge from prosthetic rehabilitation for first lower limb amputation

Prosthet Orthot Int August 16, 20110309364611418874

It is known that community living individuals with lower limb amputation have low balance confidence. However the level of balance confidence in the first six months after discharge from prosthetic rehabilitation is not known.

With this study Miller and Deathe wanted to determine if balance confidence levels differ after discharge from prosthetic rehabilitation and furthermore determine if balance confidence at discharge predicts social activity at three months post-discharge while controlling for important covariates such as walking ability.

The researchers performed a prospective study on 65 subjects experiencing their first unilateral transfemoral or transtibial amputation. The subjects were followed-up at one and three months after discharge. The assessments of balance confidence and walking ability collected at discharge were used to predict social activity at follow-up.

It was found that the mean balance confidence scores did not change significantly between discharge and at three-month follow-up despite a mean improvement in walking ability. Further the researchers reported that confidence scores and basic walking ability at discharge were the two strongest predictors of three-month social activity.

The authors concludes that balance confidence after discharge from prosthetic rehabilitation for lower limb amputation is low and it does not improve over the first three months after discharge despite a better walking ability. Furthermore the balance confidence scores independently predicted the social activity scores after three-month discharge.

Miller and Deathe stated, based on their experience, that balance confidence is not directly addressed during prosthetic rehabilitation despite evidence suggesting that mean balance confidence of this
population is low. They suggest that change in confidence may be indirectly acquired through traditional rehabilitation; however, programmes augmented with strategies focusing on balance training may increase confidence that would promote improved social activity.

Diana Zidarov, Bonnie Swaine, Christiane Gauthier-Gagnon

**Quality of Life of Persons With Lower Limb Amputation During Rehabilitation and at 3-Month Follow-Up**

Archives of Physical Medicine and Rehabilitation Volume 90, Issue 4, April 2009, Pages 634-645

Zidarov and colleagues wanted to describe and compare the quality of life in persons with lower limb amputation at admission, discharge and three months after rehabilitation discharge. Furthermore they wanted to explore the relationships between quality of life and demographic and clinical variables, including body image.

The study was performed as a longitudinal case series study on 19 unilateral lower limb amputees in an inpatient rehabilitation facility.

The main outcome measures were generic and specific quality of life measures and perception of body image at three different test occasions.

The result of the study indicated that the patients’ subjective quality of life was relatively high at the three test occasions, except for items related to physical functioning. There was no significant change over time for all but one quality of life satisfaction measure that assessed the ability to go outside. Prosthesis related quality of life was high at discharge and follow-up. Body-image disturbances were absent over the study period. Quality of life satisfaction and prosthetic satisfaction were strongly related to lower limb pain and psychosocial factors (eg, body image).

The authors concluded that quality of life of persons with lower limb amputation were high and remained relatively stable during inpatient rehabilitation and three months after discharge.