MANGALORE UNIVERSITY

Global Initiative for Academic Network (GIAN) Program

Implementation of a Biomechanical Framework in the Development of Sports Studies and Performance

(February 02-08, 2019)

Overview

Biomechanics is the science concerned with the internal and external forces acting on the human body and the effects produced by these forces. Sports biomechanics allows detailed analysis of sports movements. With these results the mechanics of movements can be improved to allow better sports performance and /or less injury risk. Sports biomechanics is often confronted with very special requirements:

- Analysis often has to be done at the place of sports performance (in the field)
- High performance athletes need to get analyzed in competition to enhance performance.
- Results have to be communicated and be understood by athletes and trainers to make use of them in training

The optimization of the efficiency of movement and the effects of training require a deep knowledge of the human body and its motions. Performance improvements and injury prevention are made possible by the extensive biomechanical research conducted all over the world. As athletes and their conditions are very individual, sports biomechanical assessments need to be individual to the athlete and investigating and reporting to the specific questions. Methods used in sport biomechanics can differ and mostly include 2D or 3D kinematics, kinetics, EMG or pressure. A special requirement in high performance sports is the analysis in competition, where no markers or sensors can be used and practically the analysis depends on digitizing. The World of sports biomechanics are typically interested in actual performance in competitions rather than lab testing's.

Electromyography is the recording of the electrical activity of muscles, and therefore constitutes an extension of the physical exploration and testing of the integrity of the motor system. It can be said that sEMG, sometimes called kinesiological electromyography, is the electromyographical analysis that makes it possible to obtain an electrical signal from a muscle in a moving body. It has to be added, by way of clarification, that according to this definition its use is limited to those actions that involve a dynamic movement. Nevertheless, it is also applicable to the study of static actions that require a muscular effort of a postural type. It is based on the fact that muscular activation involves:

- A prior ionic diffusion within the muscle, which generates an electric field around it proportional to the ionic concentration. This electrical field is detected by the EMG electrodes.
- A consequent mechanical response occurs due to the articular moment generated by the force that the muscle makes upon contracting.

The principal purpose of this type of measurement is to establish the activity of one or more muscles involved in a particular action. This includes:

- Determining, at each moment, whether the muscle is active or inactive.
  Determining the degree of activity exhibited during periods in which there is activity.
- Determining what type of relationship or interaction the muscle maintains with the rest of the muscles involved in the action under study (the concept of *intermuscular coordination*).

In order to be able to identify the moments and periods in which the activation of the different muscles involved in a specific dynamic action occurs, it is essential to synchronise the electromyographic recording with the recording of other measurement systems that provide kinematic data such as cameras etc. sEMG forms part of this approach and has been introduced as an important part of biomechanical analysis. The knowledge of such muscular action, evaluation and feedback should allow for the optimization of muscular movement, enhancing optimum training and sports performance.

Objectives

- ❖ Exposing participants to the fundamentals of Biomechanics in sports and exercise science.
- ❖ Knowledge of mechanics of sport can help coaches to realise the dynamics of their sport and make them more confident in their coaching and practice.
- ❖ The crude knowledge of sport can be made more scientific enabling the coaches as well as teachers to bring about efficient techniques in teaching and coaching and thereby result in faster learning processes.
- ❖ The study of sports can be made more specific, more awareness can be created regarding the forces of nature and internal forces which affect performance and the methods to tame them to achieve our ends.
- ❖ A modern sports science laboratory can be developed in more places paving the way for professionalization of approach towards sports training and coaching.

This course is divided into the following aspects

1) To introduce the basic concepts of biomechanics and its applications in sports.
2) To introduce the participants to sEMG systems and their applications in sports evaluation and performance management.

3) To give exposure to various sports and movement analysis software.
4) To give hands on experience in managing the systems and analysis of sports skills.

Who Can Attend?

- Physical Education administrators and coaches, Faculty from physical education training institutions, Physical Education teachers and students, Physical Education research scholars, Sports enthusiasts and athletes.

Course Duration: February 2-8, 2019

Course Schedule

Date	Lectures / Tutorials
February 2, 2019	
10:00 – 10: 30 hrs	Inaugural Program
11:00 – 12:00 hrs	Introduction to sports biomechanics and modern technology used in sports analysis.
12:00 – 13:00 hrs	Principles of sports Biomechanics – Laws, Levers and projectiles
14:30 – 15:30 hrs (Tutorial)	Biomechanics of Resistance exercise.
15:30 – 16:30 hrs (Tutorial)	Penalty corner Injection – technique analysis : Techno-tactical aspects in penalty corner push in
February 3, 2019	**Sunday**
February 4, 2019	
10:30 – 11:30 hrs	Video analysis – Introduction to software –Kinovea
11:30 – 12:30 hrs	Running – Kinematic analysis
14:30 – 15:30 hrs (Tutorial)	Kinovea – video analysis - Practical – hands on session
15:30 – 16:30 hrs (Tutorial)	Hockey Drag Flick – 2D Technical Analysis
February 5, 2019	
11:00 – 12:00 hrs	Weight Lifting –first pull analysis-Motion analysis
12:00 – 13:00 hrs (Tutorial)	Swimming – start analysis/sprint start analysis
14:30 – 16:30 hrs (Tutorial)	Clinical analysis and prevention of injury – Bike fitting/Injury cases
February 6, 2019	
11:00 – 12:00 hrs	Introduction to EMG hardware and software and its applications
12:00 – 13:00 hrs	Use of sEMG in Sports Analysis
14:30 – 15:30 hrs (Tutorial)	Theory and concepts of sEMG
15:30 – 16:30 hrs (Tutorial)	Practical Application of sEMG in static and Dynamic sports movements and analysis
February 7, 2019	
11:00 – 12:00 hrs	Biomechanics and Disabled athletes
12:00 – 13:00 hrs	Gait analysis – a Case study presentation
14:30 – 16:30 hrs (Tutorial)	Introduction to Performance analysis – sportscode software

February 8, 2019	
10:00 – 11:00 hrs	TEST
11:30 hrs	Valedictory Programme

Foreign Faculty

Dr. SAJU JOSEPH (e-mail address: sajujoseph@msn.com)
Senior Biomechanist, Department of Biomechanics,
National Sports Institute of Malaysia, KompleksSukan Negara,
PetiSurat 7102, Bukit Jalil, Post Code: 57700,
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Basically hailing from Kerala, India, Dr. Saju Joseph obtained his PhD degree from Alagappa University in the Year 2001 for his "*Study of Isokinetic Concentric and Eccentric Muscle Performance at Different Velocities for Knee Extensor and Flexor, Plantar and Dorsi Flexors among National Level Sportsmen and Non -Sportsmen."*He has published about 23 scientific papers in sports and physiotherapy scientific journals. He has authored seven books on sports planning and evaluation of general and specific fitness.

He has worked as the Assistant Hockey coach and Biomechanist/Performance Analyst/ Fitness Trainer in Indiafrom 1996 to 2005.

In the last ten years, his research work includes

- Analysis of various technical movements of women hockey players, such as goalkeeping, penalty corner drag flick, hitting and foot work in various skills.
- Analysis of technical movements of swimmers, synchronized swimmers, athletes, sprinters, start techniques, cyclist with back pain, bike fitting, knee pain, gait analysis and specificity in exercising and core strengthening.

He has vast experience of working with **Sports Science Lab Machines, Software& Equipment** such as Isokinetic systems, Gait system (Motion Analysis Control) 3D- infra red system to analyze gait patterns of movement with sport persons in Malaysia (Institute of Sports, Malaysian Sports Council), **Silicon Coach Pro** software, **Time warp** software's, **Utilius VS**, **Sports Code** software with sports such as Golf, Hockey, Cycling, Athletics, Cricket, Swimming and synchronized swimming in Malaysia (National Institute of Sports, Malaysia). He also has hands on experience in working with motion analysis system Qualisys, sEMG wired as well as wireless sEMG, Dikablis and SMI Eye trackers, Isokinetic system, tech trainers, Radar Guns to measure velocity, GPS systems, Sam put lab for golf, Foot scan, instrumented tread mill, force platforms, bike fit in Malaysia. Currently he works as a senior biomechanist whose scientific works also include providing regular training support to National athletes in Malaysia in various sports in terms of sports biomechanics, functional biomechanics, clinical biomechanics, Injury prevention and skill acquisition in various sports.

Course Co-Ordinator

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Dr. Gerald D'Souza obtained his doctoral degree from Mangalore University in 2005. In addition to having topped the NIS coaching diploma Course in Hockey and sports sciences from Sports Authority of India he has also led the men and women university hockey teams to creditable performances at the Inter University level. He has been teaching Sports Biomechanics to post graduate physical education students of Mangalore University for the last 22 years, in which he has introduced usage of video cameras and still cameras in analysing sports skills. He has been instrumental in procuring Physiological Data Acquisition system for Wireless EMG, Exercise Physiology System & Psychophysiology System from AD Instruments, Australia for the Department of Physical Education, Mangalore University. He has published / presented papers in more than thirty international/ national journals and conferences / seminars.

Course Fee

Scientists and Faculty Members	Rs.3000
Guest faculties / Research Scholars	Rs.1000
Students	Rs.500
International participants	US$100

Note: The participants will be provided with accommodation (on request in advance) on payment basis.

Please contact the Course Coordinator for all the queries pertaining to the GIAN course.

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