

# Innovations in the field of sports medicine

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Sports is the pride of any nation, India is no exception, we celebrate our sports stars and even worship them. In India, apart from the most watched cricket and football other sports like tennis, kabaddi, shooting, athletics, gymnastics, and weight-lifting are gaining popularity and have wide viewership. Unfortunately, in our country, the field of sports is taken for granted and practiced and played with the conventional training strategies. Application of science to sports and sports health needs utmost attention in the current era in order to match the international standards.

Though researches pertaining to sporting activities and training implications are being conducted on a small scale, there exists a huge gap between the scientific research and practical application. There are mindblowing advances in the area of sports medicine which can cater and enable a qualified player to achieve optimal performance, to rectify his flaws in playing techniques, to adopt tailored training strategies so as to prevent injury on the field, to return to sports as soon as possible in case of any injury and many more. A comprehensive multimodal approach is needed to tune our talented bunch. Innovation in sports science is the core of research in many developed nations. India lacks such a scientific approach though we have a pool of competent and skilled players. This essay will discuss the technological innovations and advancements in the field of sports science.

Maximising performance and injury prevention are the two key aspects which determine the success of a player and the team as a whole.

Performance enhancement of a contestant can be attained only on detection of areas where he or she is deficient in. Utilizing recent advancements like Three dimensional biomechanical analysis of the sporting movements to give

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an extra edge to a player's performance , Focussed high performance training using high end rehabilitative equipment like isokinetic dynamometers , Training at the high altitude chambers for improving endurance, Periodical assessments of the physiological parameters like vital capacities, lactate threshold etc., Sports Training in Virtual Reality Labs , App based athletic monitoring systems and leveraging machine learning help players and coaches to make better decisions during games. The above said modern techniques have been implemented in the popular clubs and national teams of developed nations. Detailed performance analysis of a player can be done by measuring the three-dimensional biomechanical parameters during a simulation play in a well-equipped sports lab.

Retroreflective markers are placed over the key anatomical landmarks of the player and several segments of body motion can be easily studied.

Derivatives like peak linear velocities, angular velocities, and degrees of range of movements of each joint can be obtained. The above said parameters which can be referred to as the kinematic data of motion will be essential to visually track the areas of interest so as to scientifically correct the playing techniques followed by a player. Several performance-related entities like maximum knee flexion-extension during a soccer kick, cocking of the shoulder at ball release in cricket, hip movements during rowing and ball release speeds or maximum distance traveled by the ball are easily obtained which can be used to fine-tune movements. The kinetic data, the forces which drive the particular motion can be studied with the help of force plate platforms to calculate the ground reaction forces exerted by the players. A detailed analysis of such forces will help out in modulating the training load.

The evolution of surface electromyography techniques provides the path to compute the pattern of activation, coordination and loading intensity of several muscle groups involved in a particular action hence provides an idea on deciding the best musculoskeletal specific strengthening for the respective sporting activity. The combined data of the 3D capture and the surface electromyography provides an insight to identify the shortcomings of each player and thus produces a comprehensive data on the domain of improvement. Such an analysis can help the high-performance trainers and coaches to tailor a personalized training protocol for each player thereby targeting maximal performance. Alan Fern, a sports analytic and computer science professor at Oregon State University mentions “ knowing how players move during a game could help coaches plan an athlete’s training so he reaches peak performance. It could also shed light on the best matchups between receivers and cornerbacks and measure the contribution of each player to every play.” High altitude training can be used by endurance athletes like those involved in cycling, rowing, sprinting, soccer and swimming to improve sea-level performance. Various segments of high altitude training include live low- train high, live high- train low and live low- train low with intermittent hypoxic training.

These specialized training modalities are given using High Altitude chambers which use the nitrogen washout mechanisms and customized software based high altitude range settings with cycle ergometers and other resistance training workout machines in the chambers. Hypoxic training in high altitude chambers brings about physiological adaptations like an increase in cardiac output, elevated hemoglobin and erythropoietin levels, a dramatic increase

in aerobic capacity and lactate thresholds further triggering the expression of genes like Hypoxic inducing factor 2 alpha (HIF 2 alpha) in individuals expressing polymorphisms for that particular gene. All put together will greatly improve endurance thus empowering athletes to obtain maximal performance. Hardly few sports centers in India are equipped high altitude training facilities and players have to visit foreign countries for this advanced training. Training and monitoring of the team members are more convenient and systematic than ever. Thanks to the introduction of the latest sports software and applications. App-based athletic monitoring systems have gained tremendous response worldwide. There are a few great apps available to track training programs and individual's progress. Basic ones include Training Peak, AppStrong, Fitbit Flex, Jawbone Up, Jaybird Reign, HRV4 Training, Omegawave and so on.

Our coaches should acquire knowledge in these training monitoring systems to keep on track the team's workout schedules. Match analysis is yet another crucial part. On-field data collection, data processing, data visualization, electronic performance and recording systems should be a part of all games from state level matches. Evaluation of information such as performance, position, and vital data is of utmost importance in assessing the players and the team. This data can aid in screening the players for their selection to national level matches. The injury is the most common limiting factor for any sportsperson. Injury prevention is the biggest challenge faced by the sports physicians and coaches. Sports training in Virtual Reality Laboratories allows players to run through virtual on-field scenarios and thus tune the decision-making, pattern recognition and reaction time. In situations of athletic high,

injuries can be avoided in people trained in a virtual environment to make better decisions. Correlation of the variables obtained in the 3D capture analysis and comparing them with the western population aids in developing training implications to prevent injury in Indian players in their respective sports. The best example is the implementation of the FIFA 11+ injury prevention exercises before every football match so as to decrease the risk of trauma. Such tactics need to be researched using scientific tools in the most commonly played games and need to be modified for the Indian scenario.

Proper rehabilitation using machines like isokinetic dynamometers, virtual balancing systems and formulating structured individualized rehab protocols may assist the player to return to sports in a short span of time. In my view, the execution of the advanced technologies in the sports sector would provide numerous benefits to our nation. Khelo India- the National Programme for Development of Sports, launched recently by the Department of Ministry of youth affairs and sports is a great start and would spearhead the rise of Indian sports. The fitness challenge put forth by our prime minister has become viral and received tremendous response from the people. Such initiatives will go a long way in creating public awareness about sports and health in general. ' Catch them young' is a popular slogan for Khelo India programme. Certainly identifying talents at a young age is essential however nurturing them with advanced facilities in a scientific way is equally important. Discovering the Achilles heel of a player with 3D motion capture and training at virtual labs and specialized chambers, monitoring their exercise physiological parameters, equipping them with personalized

training programs and thus preventing injuries with unparalleled rehab protocols are the dire needs at present for India. To conclude, implementing the research-based technology in the discipline of sports will definitely succor in molding our country and bridge the gap between innovation and real-life application. Incorporating science in sports will unleash the hidden potential of our fellow Indians thus transforming our Future India into “SPORTS INDIA”.