Design a Treadmill HIIT Program with Six Sigma DMAIC Methodology for Diabetic Patients

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Abstract

Design a HIIT (High-Intensity Interval Training) Profile to help a Diabetes-Type II Patient avoid taking Insulin glargine injection. In addition to meal control, Metformin medicine, Insulin shot, diabetes patient should exercise at a higher heart rate to burn sugar faster. A Full Factorial DoE of Treadmill Setting (Incline, Speed) was conducted to build a Heart Rate RSM model to design the optimal HIIT Profile. Based on RSM model, Interaction effects are all very little which may indicate Treadmill Heart Rate model is not Coupling (complicate). Heart Rate is linearly proportional to Incline level (Potential Energy when incline angle is small), and in quadratic form with Speed (Kinetic Energy). To avoid the injury risk around the knee/foot, ACL (anterior cruciate ligament) injury and jumping patterns were studied by 3D-Motion Bio-Mechanics modeling. The fatigued muscles could not hold knee stable and provide sufficient knee cushion during the shorter soft landing which could increase the ACL injury risk during the 2nd hard landing period. Use the Model Driven SPC to study the injury mechanism to determine the highest speed limit of the Treadmill profile for this Diabetes patient. Through these ACL risk stuiesy, the HIIT profile has been further optimized considering these ACL design constraints. Following the JMP_based HIIT profile, this Diabetic patient has significantly reduced the Blood Glucose, Serum reading from over 200 mg/dL to near 75 mg/dL in 4 months (Acceptable in 65-99 mg/dL).

Keywords
Six Sigma, DMAIC, Diabetes, HIIT, IMP

Biography

Mason Chen is a junior high school student in the Online High School of Stanford University (SOHS). Chen has certified IASSC Black Belt, IBM SPSS Statistics, Modeler Data Mining, and JMP STIPS certificates. Chen has also published more than 50 papers in the STEAMS (Science, Technology, Engineering, AI, Mathematics, Statistics) and has won many awards in IEOM STEM and Six Sigma Competitions. Chen has found his STEAMS Organization (website: stem2steams.weebly.com and also found the SOHS STEAMS Club since his middle school years. SOHS club has sent many students to IEOM and complete well in most STEM competition events. Mason Chen is currently concentrating on the Computational Biology research fields.