The Randomized Withdrawal Study Design: A Flexible Study Design for use in Regulated Medical Device Studies

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Clinical studies for new medical devices are expensive to conduct and, if not designed efficiently or with sufficient scientific rigor, can add years to the product development life cycle. In the United States, since the implementation of the 1976 Medical Device Regulations, medical device companies have been working with FDA to find innovative and effective methods to bring new devices to the market. The randomized, controlled clinical trial is the gold standard; however this gold standard study design has not always been required to prove safety and effectiveness of medical devices. This paper explores the Randomized Withdrawal Study Design as a novel trial design for regulated medical device studies. A mock-up trial is described and the advantages and disadvantages of the design are analyzed. The randomized withdrawal trial has been successfully implemented in the pharmaceutical industry. In this design, all patients receive the study therapy and are randomized to have the therapy withdrawn at a time point near the end of the treatment phase. In some settings, a randomized withdrawal study may solve some of the problems inherent in either a traditional randomized design or a nonrandomized design. The potential benefits to utilizing such a design include a higher level of scientific evidence from a single arm study, minimization of the amount of time subjects are exposed to a placebo control, and in the case of enrichment designs, the potential for increased power and decreased time to market due to a smaller sample size requirement.

Intelligent Motor Powered Prosthetic Knee Joint

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POWER KNEE is the world's first intelligent motor powered prosthetic knee. The knee replaces lost muscle functions and is designed to increase gait symmetry and to reduce unwanted load in level ground walking, stair and ramp descent/ascent, sitting down and standing up. During the first part of swing phase, in general, the knee joint flexes, lifting the foot off the ground. This is an important part of the swing phase as insufficient ground clearance at initial swing has a rippling effect throughout the whole phase and can cause toe stubbing, insecurity of the user, and as a result some types of gait deviations. User of a passive prosthesis knee joint uses his hip to force the foot off the ground whereas a powered knee joint can actively flex the knee at the right moment, ensuring enough ground clearance throughout the swing phase. Every prosthetic knee joint has some internal resistance, which needs to be overcome in order to transfer from knee flexion to extension in swing. In order to overcome this internal resistance, users of passive knee joints use excessive hip power to force the joint into extension. This can cause gait deviations and insecurity for the user as the center of mass is shifted back. An intelligent motor powered knee joint has the ability to remove this unwanted action by actively extending the knee at the right moment. Another benefit of a motor powered prosthesis is that the motor can be actively locked in any flexed position without the risk of the joint buckling. This means that the joint does not have to be fully extended at heel strike and the extension at terminal swing can be fine tuned to leave the joint in approximately 5 deg flexion, imitating the position of a healthy knee. While the motor is blocked at heel strike, avoiding buckling, a mechanical spring controls a stance flexion angle. The stance flexion works as a shock absorption and ensures more symmetry during walking. In addition to controlling the speed and amount of flexion and extension of the knee joint in every gait cycle, a powered knee prosthesis provides the user with enough lifting power to ascend stairs step over step and stand up from a chair with equal weight on the sound side and the prosthesis side. This important feature reduces the unsymmetrical load put on the sound side, arms, and shoulders in those activities.

