An Overview of Sustained Release Drug Delivery Systems: Mechanisms, Formulation Strategies, and Clinical Applications

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Abstract: *Sustained release (SR) tablets are an innovative class of drug delivery systems designed to release the active pharmaceutical ingredient (API) gradually over an extended period, thus maintaining a steady concentration in the bloodstream. This review article explores the significance of SR tablets in enhancing therapeutic efficacy, improving patient compliance, and minimizing side effects compared to conventional dosage forms. It discusses the various mechanisms of drug release, including diffusion-controlled, dissolution-controlled, osmotic systems, and bio-responsive formulations. Additionally, the article highlights the materials used in SR tablet formulations, such as natural, semi-synthetic, and synthetic polymers, and the role of excipients and matrix-forming agents. The review also examines the formulation techniques employed, such as direct compression, wet granulation, and coating techniques, and evaluates the challenges and limitations associated with SR tablets, such as dose dumping, food and pH variability, and manufacturing complexities. Furthermore, it explores recent advances in SR tablet technology, including the integration of nanotechnology, biodegradable polymers, and 3D printing. The article concludes by emphasizing the role of SR tablets in the clinical management of chronic diseases like diabetes, hypertension, and pain, improving patient adherence and therapeutic outcomes.*

Keywords: Sustained release tablets, drug delivery systems, controlled release, polymers, formulation techniques, chronic diseases, patient compliance, therapeutic outcomes, drug release mechanisms, nanotechnology