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Journal of Controlled Release 114 (2006) 15–40
journal of controlled release
www.elsevier.com/locate/jconrel

Review

Buccal bioadhesive drug delivery — A promising option for orally less efficient drugs

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Received 4 December 2005; accepted 26 April 2006
Available online 7 July 2006

Abstract

Rapid developments in the field of molecular biology and gene technology resulted in generation of many macromolecular drugs including peptides, proteins, polysaccharides and nucleic acids in great number possessing superior pharmacological efficacy with site specificity and devoid of untoward and toxic effects. However, the main impediment for the oral delivery of these drugs as potential therapeutic agents is their extensive presystemic metabolism, instability in acidic environment resulting into inadequate and erratic oral absorption. Parentral route of administration is the only established route that overcomes all these drawbacks associated with these orally less/inefficient drugs. But, these formulations are costly, have least patient compliance, require repeated administration, in addition to the other hazardous effects associated with this route. Over the last few decades' pharmaceutical scientists throughout the world are trying to explore transdermal and transmucosal routes as an alternative to injections. Among the various transmucosal sites available, mucosa of the buccal cavity was found to be the most convenient and easily accessible site for the delivery of therapeutic agents for both local and systemic delivery as retentive dosage forms, because it has expanse of smooth muscle which is relatively immobile, abundant vascularization, rapid recovery time after exposure to stress and the near absence of langerhans cells. Direct access to the systemic circulation through the internal jugular vein bypasses drugs from the hepatic first pass metabolism leading to high bioavailability. Further, these dosage forms are self-administrable, cheap and have superior patient compliance. Developing a dosage form with the optimum pharmacokinetics is a promising area for continued research as it is enormously important and intellectually challenging. With the right dosage form design, local environment of the mucosa can be controlled and manipulated in order to optimize the rate of drug dissolution and permeation. A rational approach to dosage form design requires a complete understanding of the physicochemical and biopharmaceutical properties of the drug and excipients. Advances in experimental and computational methodologies will be helpful in shortening the processing time from formulation design to clinical use. This paper aims to review the developments in the buccal adhesive drug delivery systems to provide basic principles to the young scientists, which will be useful to circumvent the difficulties associated with the formulation design.

Keywords: Buccal delivery; Bioadhesive; Polymers; Formulation; Permeation enhancers; Evaluation

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doi:10.1016/j.jconrel.2006.04.012

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1. Introduction

The main impediment to the use of many hydrophilic macromolecular drugs as potential therapeutic agents is their inadequate and erratic oral absorption. The relatively recent evolution of recombinant DNA research and modern synthetic and biotechnological methodologies allow the biochemist and chemist to produce vast quantities of variety of peptides and proteins possessing better pharmacological efficacy. However, therapeutic potential of these compounds lies in our ability to design and achieve effective and stable delivery systems. The future challenge of pharmaceutical scientists will not only be polypeptide cloning and synthesis, but also to develop effective nonparenteral delivery of intact proteins and peptides to the systemic circulation. Based on our current understanding of biochemical and physiological aspects of absorption and metabolism of many biotechnologically-produced drugs, they cannot be delivered effectively through the conventional oral route. Because after oral administration many drugs are subjected to presystemic clearance extensive in liver, which often leads to a lack of significant correlation between membrane permeability, absorption, and bioavailability [1]. Difficulties associated with parenteral delivery and poor oral availability provided the impetus for exploring alternative routes for the delivery of such drugs. These include routes such as pulmonary, ocular, nasal, rectal, buccal, sublingual, vaginal, and transdermal. In absence of external stimuli to facilitate absorption, use of these alternative routes has had limited success. Various strategies have been implemented to promote the bioavailability of these drugs, including supplemental administration of enzyme inhibitors, use of absorption enhancers, novel formulation strategies, and reversible chemical modifications [2].

Among the various transmucosal routes, buccal mucosa has excellent accessibility, an expanse of smooth muscle and relatively immobile mucosa, hence suitable for administration of retentive dosage forms. Direct access to the systemic circulation through the internal jugular vein bypasses drugs from the hepatic first pass metabolism leading to high bioavailability. Other advantages such