factor when selecting the range of dosage forms to be prepared. Factors such as the need for systemic or local therapy, duration of action required, and whether the drug will be used in emergency situations, need to be considered. In the vast majority of cases a single drug substance is prepared into a number of dosage forms to satisfy both the particular preferences of the patient or physician and the specific needs of a certain clinical situation. For example, many asthmatic patients use inhalation aerosols, from which the drug is rapidly absorbed into the systematic circulation following deep inhalation for rapid emergency relief, and oral products for chronic therapy.

Patients requiring urgent relief from angina pectoris, a coronary circulatory problem, place tablets of nitroglycerin sublingually. This gives rapid drug absorption directly into the blood capillaries under the tongue. Thus, whilst systemic effects are generally obtained following oral and parenteral drug administration, other routes can be employed as the drug and situation demand. Local effects are generally restricted to dosage forms applied directly, such as those applied to the skin, ear, eye, throat and lungs. Some drugs may be well absorbed by one route and not another and must therefore be considered individually.

The age of the patient also plays a role in defining the types of dosage forms made available. Infants generally prefer liquid dosage forms, usually solutions and mixtures, given orally. Also, by having liquid preparations, the amount of drug administered can be readily adjusted by dilution to give the required dose for the particular patient, taking weight, age and patient's condition into account. Children can have difficulty in swallowing solid dosage forms and for this reason many oral preparations are prepared as pleasantly flavoured syrups or mixtures. Adults generally prefer solid dosage forms, primarily because of their convenience. However, alternative liquid preparations are usually available for those unable to take tablets and capsules.

Interest has grown in the design of drug-containing formulations which deliver drugs to specific 'targets' in the body, for example the use of liposomes and nanoparticles, as well as providing drugs over longer periods of time at controlled rates. Alternative technologies for preparing particles with required properties – crystal engineering – provide new opportunities. Supercritical fluid processing using carbon dioxide as a solvent or anti-solvent is one such method, allowing fine tuning of crystal properties and particle design and fabrication. Undoubtedly, these new technologies and others, as well as sophisticated formulations, will be required to deal with the advent of gene therapy and the need to deliver such labile macromolecules to specific targets and cells in the body. Interest is also likely to be directed to individual patient requirements such as age, weight and physiological and metabolic factors, features which can influence drug absorption and bioavailability, and the increasing application of diagnostic agents will play a key role in this area.

Other areas of innovation in formulation science responding to drug regulatory agency requirements in applications for marketing authorization of medicines are emerging, such as the concepts of 'computational pharmaceutics'. This topic incorporates i) the use of in-silico procedures to predict drug substance properties, and ii) decision making and optimization tools, such as experimental design, artificial intelligence and neural computing. All of these can facilitate faster and rational design of formulations and manufacturing processes.

Summary

This chapter has demonstrated that the formulation of drugs into dosage forms requires the interpretation and application of a wide range of information and knowledge from several study areas. Whilst the physical and chemical properties of drugs and additives need to be understood, the factors influencing drug absorption and the requirements of the disease to be treated also have to be taken into account when identifying potential delivery routes. The formulation and associated preparation of dosage forms demand the highest standards with careful examination, analysis and evaluation of wide-ranging information by pharmaceutical scientists to achieve the objective of creating high-quality, safe and efficacious dosage forms.

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