THE CHANGING LANDSCAPE OF WEARABLE DRUG CONTAINMENT AND DELIVERY

Biologics and biosimilars are set to make waves in the pharmaceutical arena, but these drugs can be very difficult to deliver in a patient-centric way. Wearable injectors offer a solution to the large, infrequent dosing regimens these drugs often demand. Here, Graham Reynolds, Vice-President, Strategic Partnerships and Business Development, West Pharmaceutical Services, explains more.

As innovations in medicine enable the introduction of new therapies for the treatment of chronic conditions that impact patients around the globe, safely containing and delivering these therapies is a top priority for both pharmaceutical companies and their manufacturing partners. For many new injectable medicines, the patient's first experience is often with the delivery system rather than the drug itself.

A patient- and therapy-centric drug delivery system can open the door to at-home self-injection for medicines that might previously have only been available through multiple injections or intravenous (IV) administration. While a good injection system cannot improve the drug product itself, there is a recognition that an inadequate system, meaning one that a patient struggles to use effectively and in compliance with the appropriate regimen, may have an impact on both the experience and therapeutic outcome for that patient.

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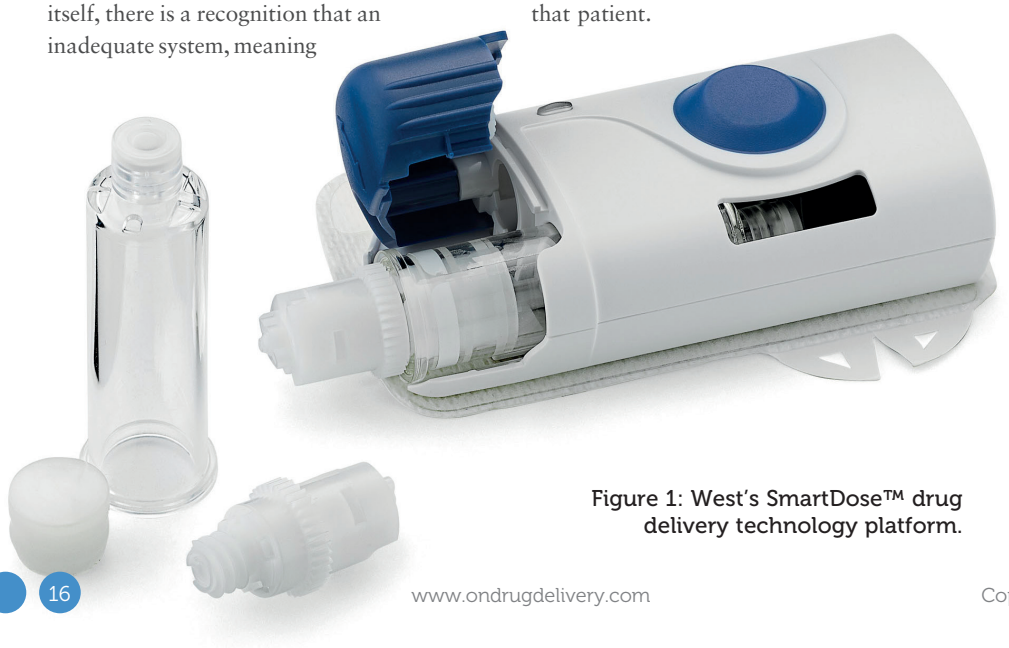

Figure 1: West's SmartDose™ drug delivery technology platform.

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With the commercialisation of Amgen's Repatha® (evolocumab), available as a once-monthly dose via the Pushtronex® system, the landscape of injectable medication has changed. The wearable self-injection system, which is the first-generation device from West's SmartDose™ drug delivery technology platform (Figure 1), was many years in the making. Through an ongoing innovation process, improvements have been made to the platform, including a greater variety of dose delivery options. While potentially impacting time-to-market, taking the time to qualify how a new delivery system works, not only with the drug but also with the end user, can help to improve patient adherence and compliance to therapeutic regimens.

By partnering with a device or delivery system manufacturer early in the drug development journey, and working closely with them to make the most of their expertise, pharmaceutical companies can not only move to market with an approved, commercially viable drug delivery system, but also gain valuable insight into the drug product along the way.

PUTTING PATIENTS FIRST

In many cases, being diagnosed with a chronic condition is a life-changing event. With diseases such as diabetes, haemophilia, rheumatoid arthritis, multiple sclerosis and other chronic conditions, a patient is often beginning a constantly evolving journey of care. After the initial shock of diagnosis has worn off, patients may experience a sense of relief that the cause of their health issues has been found. On the other hand, many will respond with more negative emotions, such as anger or depression. The need to adhere to a regimen of treatment may be met with denial, fear or anxiety.

While adjusting to a new normal, patients with chronic diseases are also seeking freedom from frequent visits to the clinic or hospital, sometimes opting instead to self-administer their prescribed medications at home, when the opportunity exists. This trend is emerging alongside an increase in new biologic and biosimilar medicines for the treatment of many autoimmune diseases.

With a steady pipeline of biologics and biosimilars poised to come onto the market as self-injectable treatments for several chronic conditions – often in autoinjectors or wearable injector systems – the pharmaceutical industry is experiencing the very beginning of a potential new wave of drug delivery. Patients who must regularly self-administer medication have eagerly awaited this shift to more user-friendly drug delivery systems, which better align with how they live their everyday lives.

However, as the use of biologic therapies is on the rise, it can be challenging for patients tasked with injecting these therapies to do so consistently and effectively, as many are delivered as large doses of highly viscous medicines. This is compounded by the fact that biologics are often dosed less frequently, meaning that just as a patient is adjusting to a new diagnosis and how to use a self-administered therapy and new drug delivery system, the time between doses gets longer and potential loss of device familiarity looms larger.

MAKING A GOOD FIRST IMPRESSION

When creating a drug delivery system, the primary goal is to ensure ease of use for the patient, best achieved via minimal use steps and a convenient device format. As more biologic drugs enter the market, delivery systems need to be able to accommodate a range of dose volumes and injection times or rates, while still accommodating the patient's desire for a small, simple system. Additionally, biopharmaceutical manufacturers are seeking to bring drugs to market quickly and optimise patient outcomes whilst also ensuring a robust and reliable supply chain for their product. Once on the market, the drug must demonstrate the ability to positively impact patient outcomes in order to support the higher cost of some newer therapies. Therefore, patient adherence and the ability to demonstrate outcomes through data are also important factors.

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When injecting a drug, the first thing a patient or caregiver sees is the delivery system – not the drug itself. A complex delivery system can create initial patient frustration and confusion, which may lead to an ongoing unwillingness to comply with therapeutic regimens if the process of injection is seen as too complicated. On the other hand, simple systems with excellent training and onboarding systems, easy access to help and educational information, and a professional look can complement the drug product and encourage compliance. If a pharmaceutical manufacturer begins to think of the system as an extension of the drug itself, it is clear that making a good first impression will be of paramount importance.

Because bringing a drug delivery system from concept to market can take several years, it's imperative that drug product manufacturers think about delivery options as early as possible in the development process. This process may start with an early evaluation of the container system, supported by analytical testing, which is used to help ensure that the primary drug packaging is a viable option for the drug product. Additionally, the selection of container and delivery system have often been disconnected in this process, however, the most successful approach requires consideration of both the container and device as an integrated system early in the process. Testing that supports such an evaluation can provide valuable insight into the drug product and how it reacts with its primary packaging, and how the product and its delivery system are perceived and used by the patient.

INSIGHT ALONG THE DEVELOPMENT JOURNEY

Innovation doesn't take place overnight in the pharmaceutical and biopharmaceutical packaging and delivery industries. An idea may spring to life today but take several years before it is fully realised and ready to be introduced to the market.

With an early-stage molecule, it can be difficult to determine the product's strength or final dose frequency. Different analytical studies can help determine the proper primary containment selection, including the need for barrier film-coated elastomers or a cyclic olefin polymer (COP) container instead of glass. The final selection of materials may help to map out delivery options. COPs, such as the Daikyo Crystal Zenith® cartridge used in the SmartDose drug delivery technology platform, can offer design flexibility, as they can be moulded into a variety of shapes and sizes, and are highly break resistant when compared with glass.

As the molecule moves through the clinical phases and delivery becomes more structured, there is a need for speed, flexibility and expertise in the development of a delivery system. For example, Phase I may require multiple injections from a vial containment system, but, by Phase II, dose volume and frequency, as well as patient considerations, may drive the need for a delivery system such as prefilled syringe, autoinjector or wearable injector. The ability to fill the container at different stages must also be considered. Working with a partner with in-house small-quantity filling capabilities can provide samples during early phase development. Considering whether to use a contract manufacturing partner or leverage internal capabilities can also help to support fill-finish operations during scale up. Biopharmaceutical manufacturers should seek out a partner with a range of different filling options, from clinical to commercial, and those that can easily adapt to handle unique containment systems.

As the drug manufacturer prepares to commercialise the product, patient adherence, onboarding and compliance must be considered with respect to drug delivery. Furthermore, it will be critical to consider what information is required to support product registration, such as stability studies, human factors testing, device studies, etc. In preparation for commercialisation, it is also critical to consider the overall supply chain and provide a robust solution including containers, drug, filling, device manufacture and assembly, secondary assembly of the device and drug container, patient services (training and adherence solutions) and a variety of other factors. West has increased its capabilities in these areas to be able to partner with customers through the journey from the early molecule all the way to the patient. Traveling the development pathway together can help reach these patient-preferred options much sooner, as well as prevent a move to market with a drug product that may cause adherence and compliance concerns due to the delivery system technology.

Figure 2: Wearable injectors are a route to maximising patient convenience and comfort by delivering large volumes over a period of minutes or hours.

BUILDING ON WEARABLE INNOVATION

Modern biologics are large molecules that may need high dose volumes to ensure the proper concentration, but too-frequent or too-rapid dosing may cause pain to patients and therefore hinder adherence. Typical dose volumes have been in the 1 mL range, however, with more complex molecules and the desire for less-frequent dosing, volumes of up to 10 mL can be required. Based on patient preference, and the effectiveness of the drug, this type of volume requires either multiple injections of 1–2 mL, or a single injection of a higher volume that should be administered over a longer period of time. Typically, it is desirable that a hand-held device, such as an autoinjector, should deliver its dose within 10 seconds, whereas a device attached to the body, commonly referred to as a "wearable injector", can deliver slowly over a period of minutes or even hours, to help optimise drug absorption and patient comfort (Figure 2).

As the next generation of wearables moves through development, options for higher dose volumes, preloaded systems and the inclusion of findings around human factors and connectivity have helped to ensure that upcoming delivery systems offer a sophisticated, yet simple, solution to drug delivery.

OPTIMISING WITH PATIENTS IN MIND

The typical drug development cycle can take several years. Optimising drug containment

and delivery systems – from primary containment to commercialisation – during that time can help ensure that, when pharmaceutical manufacturers are ready to move to market, the delivery system will make a great first impression on the patient. By understanding the requirements of the drug product as well as the patient, continued innovation in wearable injectors will help move products to market with minimal risk and maximum benefit.

By partnering with experienced drug containment and delivery system manufacturers, companies may be able to shorten the drug development cycle by potentially avoiding unnecessary delays. As the next generation of wearables continue to build on the success of West's SmartDose drug delivery technology platform, pharmaceutical and biopharmaceutical companies and their drug delivery system partners can ensure that the patient remains at the forefront of development innovations. A strong partnership from the onset will help influence a needed positive first impression and a lasting impact on adherence and compliance so the drug product can do what it was designed to do – help patients.

ABOUT THE COMPANY

West Pharmaceutical Services Inc. is a leading manufacturer of packaging components and delivery systems for injectable drugs and healthcare products. Working by the side of its customers from concept to patient, West creates products that promote the efficiency, reliability and safety of the world's pharmaceutical drug supply. West is headquartered in Exton, PA, US, and supports its customers from locations in North and South America, Europe, Asia and Australia. West's 2017 net sales of US$1.6 billion reflect the daily use of approximately 112 million of its components and devices, which are designed to improve the delivery of healthcare to patients around the world.

ON drugDELIVERY

2018/19 EDITORIAL CALENDAR

Publication Month	Issue Topic	Materials Deadline
Oct 2018	Prefilled Syringes & Injection Devices	Sep 6th 2018
Nov 2018	Pulmonary & Nasal Drug Delivery	Oct 4th 2018
Dec 2018	Connecting Drug Delivery	Nov 1st 2018
Jan 2019	Ophthalmic Drug Delivery	Dec 6th 2018
Feb 2019	Prefilled Syringes & Injection Devices	Jan 3rd 2019
Mar 2019	Skin Drug Delivery: Dermal, Transdermal & Microneedles	Feb 7th 2019
Apr 2019	Pulmonary & Nasal Delivery	Mar 7th 2019
May 2019	Injectable Drug Delivery	Apr 4th 2019
Jun 2019	Connecting Drug Delivery	May 2nd 2019
Jul 2019	Novel Oral Delivery Systems	Jun 6th 2019
Aug 2019	Industrialising Drug Delivery Systems	Jul 4th 2019
Sep 2019	Wearable Injectors	Aug 1st 2019
Oct 2019	Prefilled Syringes & Injection Devices	Sep 5th 2019
Nov 2019	Pulmonary & Nasal Drug Delivery	Oct 3rd 2019
Dec 2019	Connecting Drug Delivery	Nov 7th 2019

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- Maximize patient comfort through pre-programmable delivery times

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West seeks partners for its SmartDose platform. This platform is intended to be used as an integrated system with drug filling and final assembly completed by the pharmaceutical/biotechnology company.

For more information visit www.westpharma.com

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