Historically, safety devices have been primarily added to prefilled syringes to meet anti-needle-stick legislation around the globe. Today, we see a growing number of biotechnology drugs in pharmaceutical company pipelines that require devices to meet self-injecting patient needs. For example, patients with chronic diseases often suffer from impaired dexterity, making it difficult to perform an injection. And, many biologics have more complex properties which make them harder to inject subcutaneously. Therefore, the design of an injection device to support biotechnology drugs must be able to address these requirements.

**THE STATE OF NEEDLESTICK SAFETY**

The exposure of healthcare practitioners to blood-borne pathogens as a result of injuries caused by needlesticks is of significant public health concern. The US Centers for Disease Control and Prevention (CDC) has estimated the number of sharps injuries in healthcare to be at 385,000 each year,\(^1\) with about half of those injuries, or approximately 1,000 injuries per day, occurring in U.S. hospitals.\(^2\)

Given the high incidence of needlestick injuries, we have seen an increase in legislation on a global scale. In 2000, the US enacted the Needlestick Safety and Prevention Act;\(^3\) in 2008 the Province of Ontario passed 474/07;\(^4\) Brazil passed rule Norma Regulamentadora NR32 in 2005 and Portaria MTE N° 939 in Nov 2008 with a deadline to implement in Oct 2010;\(^5\) Germany implemented TRBA250 in 2007 and the EU passed a mandate 2010/32/EU which requires all EU member countries to address the danger of accidental sharps injuries (including needlesticks) by enforcing this legislation by May 13, 2013.\(^6\) In Europe, local legislation is already in the process of being amended to meet these requirements. For example, in Germany, the website for the German Ministry of Labor and Social Affairs provides a link to new draft legislation to be implemented to address the EU Directive’s mandate to minimise injury risk from sharps. It is anticipated that this increasing legislation will impact the presentation of injectables, especially those in prefilled syringes.

Although this legislation has not specifically targeted the pharmaceutical manufacturer, many pharmaceutical companies are using this as an opportunity for brand differentiation as they are seeing value in offering safer injection presentations for end-users.

**REQUIREMENT – PASSIVE ACTIVATION**

Several studies have confirmed that the safety aspect of an injection device is highly valued with nurses and self-injecting patients and preferred over a bare prefilled syringe.\(^7\) However, it is very important that the correct device is selected. A passive safety technology has been shown to be the most effective as demonstrated by the 2010 Tosini study, conducted by Groupe d’Etude sur le Risque d’Exposition des Soignants (GERES), which confirmed that...
passive, fully automatic safety devices offer significantly better protection against accidental needlestick injuries. The UltraSafe Passive® Needle Guard (shown in Figure 1) uses an innovative passive safety technology. The superiority of the passive safety technology arises because most needlestick injuries happen in the few moments after needle withdrawal. Because of this, it is critical that the needle is shielded right after the injection without the user having to actively or manually initiate the safety mechanism. Any extra steps required by the user may result in no activation of the safety mechanism resulting in an unshielded and potentially infectious needle until disposal.

**SUPPORTING BIOLOGICS**

The growth in the biologics segment, estimated at US$176.4 billion in sales for 2012, is driving the need for novel delivery systems. The majority of the over 550 biologics in development are monoclonal antibody (MAb) therapies targeting chronic and auto-immune diseases such as rheumatoid arthritis (RA), psoriasis or multiple sclerosis (MS). These biologics are typically administered by a subcutaneous injection by the patient or caregiver at home rather than at a clinic or doctors office. This provides convenience for the patient while also reducing healthcare costs.

Many self-injecting patients suffering from chronic diseases may also suffer from reduced dexterity, making self-administration especially difficult. Self-injecting patients are trained when they receive treatment for the first time. However, intuitiveness and ease-of-use are essential factors in overall injection device design. To address this, many devices are provided in a variety of designs and different activation mechanisms to suit patient requirements.

In addition, biotech drugs, specifically MAbs, can be quite viscous, which then make them even more difficult to inject. This is especially true for patients who suffer from debilitated disease such as RA.

Furthermore, biologics often are administered in varying doses and volumes, requiring that the injection device design be able to support a range of fill volumes.

**FACTORS INFLUENCING SELF-INJECTING DEVICES**

Currently, there are several device options available for biotech drugs, yet there is not one solution that meets all patient requirements. Size, shape, sound, drug dispensing speed and injection angle are just some of the factors that need to be considered when designing a device for self-injecting patients.

**INTRODUCING ULTRASAFE PLUS**

Safety Syringes, Inc (SSI), now part of BD Pharmaceutical Systems, has developed a novel injection device, UltraSafe PLUS™. It is based on the clinically proven UltraSafe Passive® Needle Guard platform. The UltraSafe Passive® Needle Guard, designed primarily for use in a clinical setting, has been marketed for over 12 years and successfully commercialised with more than 30 different drugs.

The design of the UltraSafe PLUS™ Passive Needle Guard (see Figures 2 and 3) is specifically to support biotechnology drugs and provide improved handling. Specific features are described below:

- Extended built-in finger flanges and ergonomic plunger head provide a better feel for the self-injecting patient.
- Robust plunger rod (Figure 4) supports injection of viscous drugs.
- Larger drug inspection window improves drug visibility.

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**Figure 1:** The clinically proven UltraSafe® Passive Needle Guard.

**Figure 2:** The UltraSafe PLUS™ is specifically designed to support self-injecting patients.

**Figure 3:** The UltraSafe PLUS™ provides intuitive one-handed passive activation.

**Figure 4:** The UltraSafe PLUS™ ergonomically designed plunger rod.
HUMAN FACTORS AND DESIGN

The overall design of the UltraSafe PLUS™ was validated by performing handling studies with both nurses and self-injecting patients. In June 2012, SSI conducted a large Human Factors user study of PLUS which involved 500 injections by self-injecting patients and nurses. Patients in this study suffered from RA, MS, cancer, Crohn’s disease and asthma. These diseases can have very different effects on dexterity so it was important to validate the PLUS design with a broad range of patients.

Results from the Human Factor user study confirmed that PLUS was intuitive and easy to use with a 100% activation success rate for all 500 injections. In addition, the added design features such as the wider finger flanges and ergonomic plunger rod were positively received by all users for providing additional injection support.

The results of the Human Factors user study not only validated the added design features but also the ability of PLUS to provide additional support in injecting drugs of higher viscosity. All users preferred to inject viscous solutions using PLUS than with a standard prefilled syringe. 

SUPPORTING MANUFACTURING CAPABILITIES

After the design of the UltraSafe PLUS™ was confirmed, SSI consulted with leading automation machine builders to ensure assembly of the UltraSafe PLUS™ was compatible with ISO standard 1.0 mL long prefilled glass syringes.

SUMMARY

The market for biotechnology drugs is ever growing and there is a need for pharmaceutical companies to offer injection devices that support both the complex properties of the biologic as well as the needs of the end-user who will be performing the injection. Patients, especially those with limited dexterity, have very specific needs and requirements for the injection device. Providing a prefilled syringe with a safety device specifically designed for patients with reduced dexterity and for drugs with high viscosity ensures that both requirements are being met.

ABOUT SAFETY SYRINGES, INC

Safety Syringes, Inc (SSI) produces high-quality, clinically proven safety devices to help reduce the incidence of needlestick injury. On December 24, 2012, BD completed the acquisition of SSI and both companies look forward to continuing to bring innovative safety technologies to the market. Our experienced teams are committed to providing comprehensive support from product conception through to launch. We ensure rapid and efficient integration of our products to give unmatched time-to-market capability.

* Pending Regulatory Clearance

REFERENCES


“ALTHOUGH THIS LEGISLATION HAS NOT SPECIFICALLY TARGETED THE PHARMACEUTICAL MANUFACTURER, MANY PHARMACEUTICAL COMPANIES ARE USING THIS AS AN OPPORTUNITY FOR BRAND DIFFERENTIATION AS THEY ARE SEEING VALUE IN OFFERING SAFER INJECTION PRESENTATIONS FOR END-USERS”