



## A Review on Needle Free Injection System (NFIS)

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### ABSTRACTS:-

Needle-free injection technology (NFIT) encompasses a variety of drug delivery systems that eliminate the need for hypodermic needles and use forces such as Lorentzian, shock waves, high pressure, or electrophoresis to push drugs into the skin. Many uses. It relieves pain and is very popular among patients. Other advantages include very fast injection time compared to traditional doses and no needle problem. Keeping the drug free of chemicals, shelf life and viscosity are important for effective NFIT management.

### Introduction :-

The idea of needle-free injection was put forward by Marshall Lockhart with his jet injection patent in 1936. Needle-free vaccination provides the pork industry with a fast and effective way to inject vaccines and drugs without the use of needles. However, ensuring the safety of workers who do not use needles is important and requires extensive training. Today, needle-free syringes continue to advance with the ability to increase efficiency and reduce discomfort from drug delivery.

### History :-

Derived from the Greek word "syrinx", syringes have a history of thousands of years. Over time, innovations such as Blaise Pascal's invention in 1650 and Francis Rynd's hollow needle

in 1844 continued to refine his work. In 1946, Chance Brothers developed the first fully automatic syringe, followed by Charles Rothauer in 1949, who developed the disposable plastic syringe

### Objective:-

The **main** goal of **needlefree** injection is to **reduce** the risks and complications associated with traditional **injection**, **especially** in conditions such as diabetes, **dermatology**, **allergies** and asthma.

### Advantages:-

- 1.Improve compliance: - They can improve patient compliance, especially in patients who avoid injections due to fear or pain.
- 2.Reduces the risk of infection: By eliminating the need for a needle, this device reduces the risk of infection if the needle is misused or discarded.



Fig 1 – Needle Free Injection

**Disadvantages:-**

1. Pain at the injection site
2. Higher education and care should be provided
3. Not all machines are one size fits all

**Applications:-**

- **Dermatology:** Needle-free injections are used for delivering fillers, Botox, and other cosmetic treatments, offering a less painful and more precise alternative to traditional injections.
- **Medical Injections:** Needle-free injections are used for administering vaccines, insulin, and other medications, reducing needle phobia and the risk of needle-stick injuries.

**Needle free injection consist of 3 main components:-**

- Injection device:-

The device has a chemical reservoir for self administration and its plastic material ensures sterilization throughout the process. Contains needle-free syringes made of sterile plastic.

- Nozzle:--

The mouthpiece functions as both a conduit for the medication and a surface in contact with the skin. It has a hole, usually 100 microns in diameter, that allows the medicine to be injected into the skin.

- Pressure Source:-

The device plays an important role in delivering the drug from the skin into the bloodstream. This pressure can be created mechanically by storing energy in a spring and releasing it through a piston, or by using compressed gas (usually carbon dioxide or nitrogen) stored in the reservoir.

**Types of needle free injection :-****1. Powder Injections:-**

This medicine includes a chamber containing the medicine and a mouthpiece that uses compressed gas as a force to release the medicine into the skin.

Mechanism:-

The product hits the skin and creates a hole when injected. At the end of the pore, the drug forms a spherical shape and enters the stratum corneum. The drug penetrates the skin and is completely distributed throughout the stratum corneum and active epidermis.

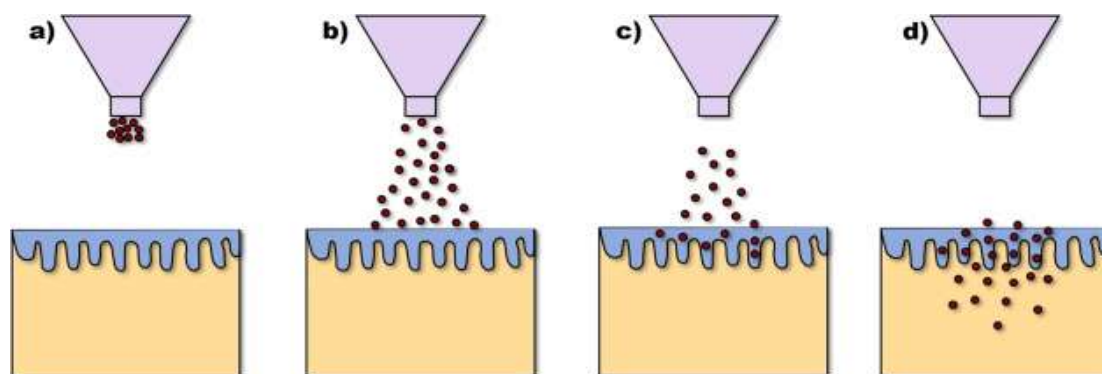


Fig 2 – Mechanism Powder Injection

**2. Liquid Injection:-**

"If the fluid close to the skin can create enough pressure, the fluid will create a hole in the skin and send it into the nose, intradermal and subcutaneous tissue." Although the same concept applies to injectable products, there are differences in terms of design and functionality

Mechanism:--

The piston's influence on the liquid reservoir in the nozzle grows, causing the jet to be thrown out at high speed (speed > 100m/s).

- Large The effect of iron is on the skin. owing to erosion, cracking, or other skin processes that did not operate when the surface was first formed.

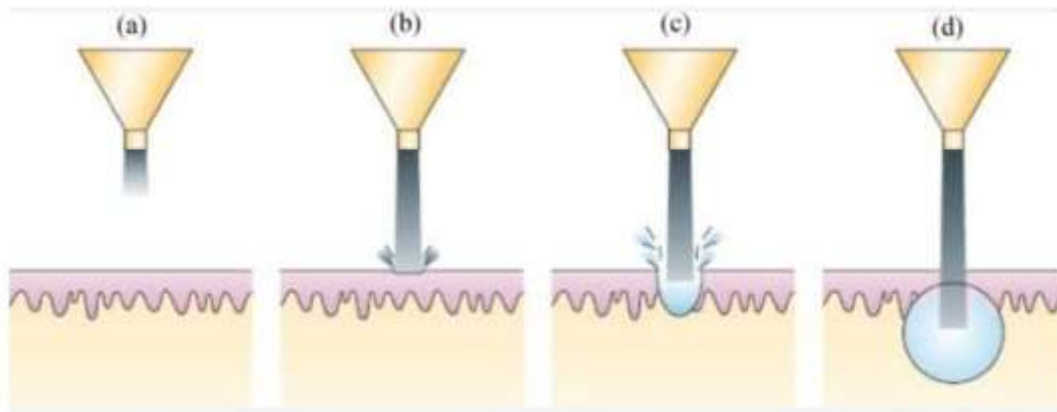


Fig 3 – Mechanism of Liquid Injection

**3.Depot injections:-**

The medications used in long acting injections are the same as those in other types of medications, such as pills or liquids.

- **Needle-free injection system market Dynamics:-**
- **Drivers:-**

**I) High Prevalence of Infectious Diseases Worldwide -**

Despite significant advances in hygiene and medicine, the prevalence of infectious diseases worldwide remains high. Although noncommunicable diseases are the leading cause of morbidity and mortality, infectious diseases are still a major public health problem worldwide. WHO 2021 data, there were approximately 37.7 million people living with HIV at the end of 2020, and more than two-thirds of them (25.4 million) were in the WHO African Region. The rise in chronic illnesses has boosted demand for biologics (big molecule medications).Most big molecular medications are administered via injection

**II) Rise in demand for self injection devices:-**

The autoinjection approach is speedier and more popular than traditional medication administration methods. Self injection minimizes the need for medicine, resulting in improved patient compliance, particularly in the elderly. To address this issue, pharmaceutical firms have created a mix of needle-free and selfadministration solutions that are safer for patients.



Fig 4 – Needle Free Injection Market

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## Companies in needle free injection:-

### 1. Pharmajet:-

PharmaJet, a leading producer of needlefree injection technology, has extensive experience providing vaccines and prescription medications. Their gadgets employ a springpowered mechanism to precisely distribute medicine via the skin, eliminating the need for needles.

### 2. Medical Instrument Technology (MIT):-

MIT is a top maker of sterile, needlefree injectable syringes for both veterinary and human use. The items are userfriendly, safe, and effective, making them suited for usage in many settings, such as homes, clinics, and hospitals.

### 3. Bioject Medical Technologies:-

Bioject Medical Technologies, an American firm, designs and manufactures drug-free syringes for giving medications and vaccinations. It injects the devices straight into the muscle or beneath the skin using a high-pressure flow. High volume injection is ideal for the Bioject machine.

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## CONCLUSION:-

Needlefree technology provides the advantage of alleviating patients' dread of using needles. Other benefits include a much faster injection time than traditional dosage and a smaller number of needles required. It not only helps the pharmaceutical company raise revenue, but it also has the potential to enhance drug adherence and results. In underdeveloped nations, the problem of infection caused by needle reuse can be solved by implementing needlefree technologies.

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