Microneedle Array
Margaret Franklin, Biomedical Engineering, University of Rhode Island
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Abstract—Forms to deliver drugs are always being created and improved. Rather than receiving an injection, scientists have discovered an alternative, painless, simple approach of delivering the same drugs. This new process is used through microneedle arrays.

I. INTRODUCTION

Microneedle arrays are small patches made up of dozens of miniature needles. The patches are usually less than a square inch in size and are used to deliver drugs to the skin. The needles that make up the patches, which are smaller than a strain of hair, are filled with medicine. This medicine often is a vaccine or an antibiotic. These microneedles are extremely small and invasive. When used to deliver a drug, the microneedle only penetrates the skin about half of a millimeter deep. This is enough to pass through the epidermis layer of the skin, but not enough to enter the dermis or hypodermis layers of the skin, which is where the nerves are held. Since the needles don’t come into contact with the nerves, no pain is felt by the patient. [1] Delivering these drugs directly to the skin rather than the muscle, where typical injections are delivered, has proved to be a more successful root for vaccines. Because the body encounters pathogens first on its surface, delivering the drug into the skin will result in better immune responses.

II. METHODS

A microneedle is used by simply pressing the patch to the skin. These microneedles are made out of hydrogels which are polymers with a three-dimensional structure that exhibit the ability to swell in water and keep water within the structure. When the patch is dry, the needles are sharp and hard and able to penetrate through the skin. Once it is pushed against the skin, the patient’s body fluid surrounds the microneedle and, because of the hydrogels, the needles swell. When the needles swell, the hard polymer that was on the inside of the needles turn into a soft jelly like material that keeps the needle open while the medicine leaves the patch and goes into the skin. The microneedle is then soft and can be removed painlessly. [2]

III. MICRONEEDLE CAPSULES

Scientists are looking to keep improving these microneedles and expanding their use. Something that they are doing studies on now are microneedle capsules to allow for oral delivery of large molecules, like insulin, that are limited to injection. The hopes of this is that patients will be able to swallow a capsule made up of a microneedle with a drug reservoir and a pH-sensitive coating. Once in the GI track, the coating would dissolve and the drugs would be pushed out of the needles. This process has already been tested on a pig and results were that this GI injection was actually superior to a normal injection. Hopefully this will be a simpler, painless process to deliver insulin in the future. [3]

IV. DISCUSSION

This device is a great device alternative to medicine delivery. In addition to the process being painless and bloodless, it is safer for everyone around the patient. Since the needles get soft once used, when taken out of the patient, there is no risk of the needles poking into another individual, which eliminates the risk of spreading certain diseases. [4] Because of this, there is no routine to dispose of the patch, it can simply be thrown away, which allows for convenience and disposability. Since the microneedles are solid, there is no need for a temperature control when storing them, which makes it easier for storage and transportation. These devices are very cost effective. Arrays are able to be manufactured at only pennies per square centimeter. The simple manufacturing processes used allows unlimited size and shape of both the needles and patch areas. Being cost effective, easier, disposable, and not requiring temperature control, gives high hopes that these microneedles can eventually be transported to places that don’t have many medical clinics available to them and patients will be able self-deliver vaccines successfully.

V. REFERENCES