Research & Reviews: Drug Delivery

# Microneedles: A Novel Approach to Improve Patient Compliance and their Types

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Perspective

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## ABOUT THE STUDY

In order to administer vaccines, medications, and other therapeutic substances, medical professionals utilize micron-scaled devices called microneedles, microneedle patches, or microarray patches. Microneedles were first investigated for transdermal drug delivery applications, but their use has now been expanded to include intraocular, vaginal, transungual, cardiac, vascular, gastrointestinal, and intracochlear drug administration. There are several ways to make microneedles, but often they include micro-molding or photolithographic techniques. These techniques entail etching tiny structures into silicon or resin in order to cast microneedles. Silicon, titanium, stainless steel, and polymers are just a few of the materials used to make microneedles. Some microneedles are constructed of drugs to be injected into the body, yet they are shaped like needles to pierce the skin.

Usually, a single needle or tiny array of micro needles is used for application. The arrays employed are a collection of microneedles that can have anywhere from a few to hundreds attached to an applicator, which is occasionally a patch or another solid stamping device. Patients' skin is covered with the arrays, which are then left on for a while to enable for effective medication administration. Microneedles make drug administration to patients safer and less painful while also avoiding some of the disadvantages of using other forms of drug delivery, such as the risk of infection, the production of hazardous waste, or the cost. They also require less training to use than other needles and do not pose the same safety risks.

Microneedles can be classified into five primary categories: solid, hollow, coated, dissolvable/dissolving, and hydrogel-forming.

### Solid

The microneedle array is put to the skin to make microscopic wells just deep enough to pierce the epidermis, and the medicine is then delivered *via* a transdermal patch. This sort of array is developed as a two-part system. Dermatologists currently employ solid microneedles in collagen induction treatment, a technique that involves repeatedly puncturing the skin with tiny needles to encourage the expression and deposition of the skin's collagen and elastin.

### Hollow

In terms of construction, hollow microneedles are comparable to solid ones. They have reservoirs that allow the medicine to be delivered on-site. This kind of array could potentially become clogged by excessive swelling or poor design because the flow rate of the microneedle determines how quickly the medicine is delivered. This design also makes it more likely that it will give way under stress and stop dispensing medication.

### Coated

Like solid microneedles, coated microneedles are often made of metals or polymers. Instead of applying the medication through various patches or applicators, this approach injects it directly into the microneedle array. Coated microneedles are frequently coated in additional surfactants or thickening agents to ensure effective medication delivery. Known irritants are among the compounds used to coat microneedles.

### Dissolvable

Dissolvable microneedles are a relatively recent development in the microneedle design that encapsulates the medicine in a harmless polymer that dissolves once within the skin. This polymer would enable medication delivery *via* the skin and allow for drug breakdown once the drug reached the body. Researchers and pharmaceutical companies are starting to examine and use polymers like Fibroin, a protein derived from silk that can be formed into structures like microneedles and then dissolved once inside the body.

### Hydrogel-forming

Medicines are encapsulated in polymers in hydrogel-forming microneedles. The stratum corneum can be penetrated by the microneedles, which can also be used to pull fluid from the interstices, causing the polymer to inflate. The enlarged matrix allows drugs to enter the skin.