A spiky eye patch, which looks like a small nail bed, releases the drug directly into the cornea

And though it looks like a small nail bed, scientists insist that the patch is painless and as easy to use as contact lenses.

Pictured is a drawing of the patch with microneedles on the surface, penetrating the front of the eye and releasing medication.

An eyelid covered with small needles may sound like a particularly cruel form of torture, but scientists believe that their invention could change the treatment of eye disease.

The patch, which is covered with dissolvable microneedles, penetrates gently into the front of the eye to release gradually drugs that could relieve everything from glaucoma to macular degeneration.

Researchers believe that the controlled delivery of the patch makes it more effective than existing eye drops, tablets and painful injections.

Scientists at Nanyang Technological University, Singapore, told Nature Communication, "The flexible patch can be easily applied to the ocular surface by gently and briefly pressing the thumb.

"It's as easy as wearing a disposable contact lens without causing discomfort or requiring high levels of skill."
As soon as the patch is attached, liquid from the eye begins to enter the space between the microneedles. This will erode the material that holds it, which will embed the needles in the cornea.

The outer layer that surrounds these microneedles begins to dissolve, providing an initially heavy dose of medication.

As the microneedles continue to dissolve, more medication will be released in the next few days.

To prove their effectiveness, the scientists under the direction of Aung Than's eyesight on mice suffering from corneal neovascularization (CNV).

CNV occurs when new blood vessels grow into the cornea as a result of oxygen deprivation and lead to vision loss in up to 20 percent of those affected. Each year, about 280,000 people in the UK and 1.4 million people in the US are affected.

When the rodents received only 1 microgram of a drug against blood vessels via the patch, 90 percent of the affected area healed.

The researchers predict that a single 20-mcg dose will be sufficient to treat CNV in humans.

In a test for animal safety, the scientists found no evidence that the mice were in pain, which they believe is due to the patch not dotting the entire cornea.

Any punctures erased after one day indicate that they have been healed naturally by the animal's body. They also did not observe any bleeding or inflammation in the eyes of the rodents.

In humans, no side effects are expected, as the patch gradually releases drugs, so that a large single dose of drugs is no longer required.

Although the patch has only been tested in CNV, the researchers believe that other eye diseases could also be treated.

Once the patch is attached, liquid from the eye seeps into the space between the microneedles. This will erode the material that holds it, which will embed the needles in the cornea. As a result, a strong dose of medication is initially released.

Eye diseases such as glaucoma, diabetic retinopathy and macular degeneration are on the increase worldwide due to the aging population, the growing diabetes rate and the high use of contact lenses.

Medication to the eye has traditionally been difficult due to its persistent blood-retinal barrier.

The researchers claim that the patch addresses patients because it is easy to use, "minimally invasive" and suitable for home use.

"We believe that this approach can provide a paradigm shift for long-term home care and the treatment of various eye diseases," they wrote.

Taking oral tablets for eye diseases usually requires a high dose, which increases the risk of side effects.

Administration of drugs via eye drops is often ineffective, as less than five percent of the treatment is typically absorbed.
And injections directly into the eye are usually painful and run the risk of infection, bleeding and even permanent damage.

The three administration methods mentioned above also indicate only one outbreak of a drug instead of slowly releasing it. This is typically what is required for chronic conditions such as glaucoma, the researchers claim.