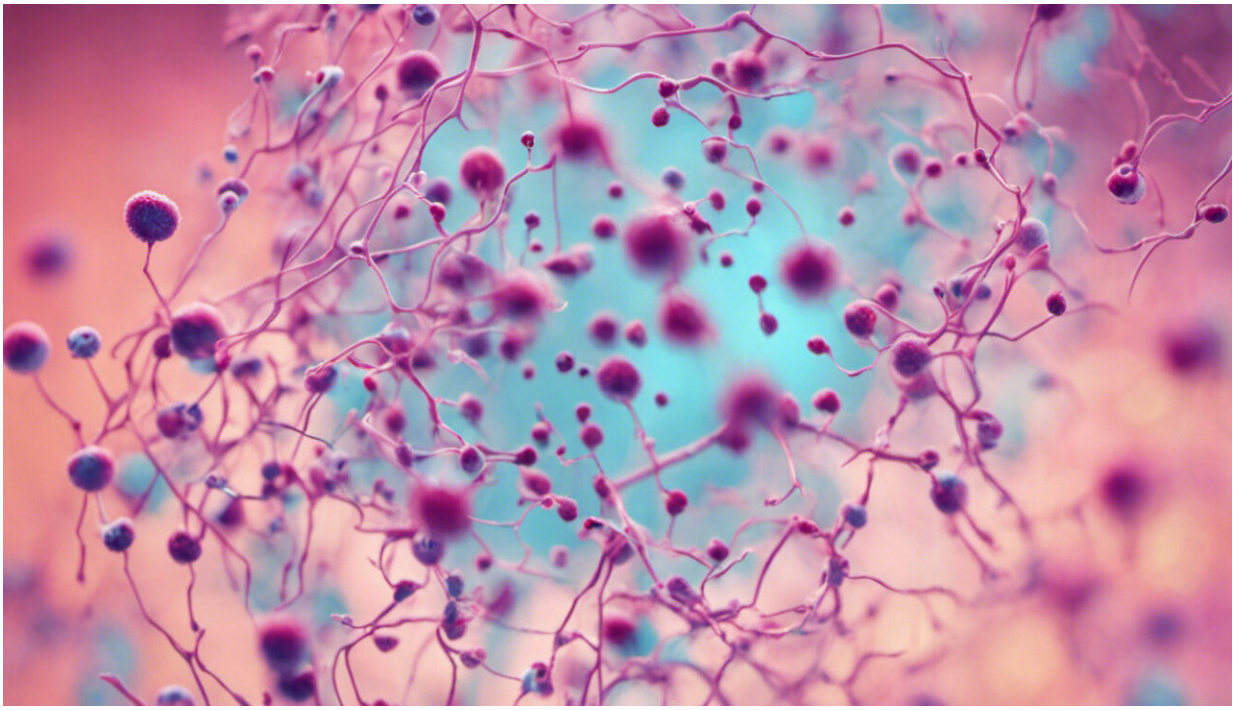
Acne treatment—antibiotics don't need to kill bacteria to clear up your skin

March 18 2016, by Adam Friedman, George Washington University



Credit: AI-generated image (disclaimer)

Acne is one of the most common dermatologic diseases, affecting 40-50 million people each year in the United States. While best known as a bothersome part of puberty, affecting approximately 85 percent of young people, acne can persist (or even start) in adulthood, causing emotional and physical distress and sometimes permanent disfigurement.

Many people with acne will be prescribed antibiotics for treatment at some point. In fact, about five million prescriptions for oral antibiotics are written each year for the treatment of acne in the United States. While dermatologists comprise 1 percent of physicians overall, they are responsible for 5 percent of all antibiotic prescriptions written.

Even though national recommendations say that a course of antibiotics to treat acne shouldn't last more than three months, a study published in the *Journal of the American Academy of Dermatology* found that the average amount of time a patient is prescribed an oral antibiotic is actually over 300 days.

Antibiotics may be prescribed at higher doses than what is really needed to treat acne. While antibiotics can kill the bacteria associated with acne, it's their anti-inflammatory effects, not their antimicrobial effects, that yield the biggest skin-clearing benefits.

The result is that the bacteria associated with acne are becoming resistant to common antibiotics – and this overuse also contributes to more harmful bacteria, like *Staphlycoccus aureus* and *Streptococcus* becoming resistant.

Credit: AI-generated image (disclaimer)

What is acne anyway?

Acne is a chronic inflammatory skin condition, characterized by blackheads and whiteheads (called comedones), pimples, and deeper lumps (cysts or nodules). They are caused when hair follicles are clogged with oil, bacteria and dead skins cells, and can occur on the face, neck, chest, back, shoulders and upper arms.

While once thought to be a direct result of overactive sebaceous oil glands, now we know that inflammation is the driving force behind acne. In fact, this inflammation can be seen in the skin even *before* a pimple pops up. And clogged follicles can also stimulate more inflammation.

The bacterium that lends its name to the condition *Propionibacterium*

acnes, is just one of the factors that stimulates this acne-causing inflammation.

Hereditary and genetic factors, hormones, emotional stress and even diet can also bring on the zits. For instance, foods with a high glycemic load such as white grains (bread, rice, pasta) and sweets have been linked to acne, as they can increase oil production and skin cell turnover. This ultimately causes a backup in the pores and follicles on our skin – creating a nice environment for the inflammation-inducing *P. acnes* to flourish.

Treating the inflammation can help prevent acne from developing, and the potent anti-inflammatory effects of antibiotics can help to treat acne, much more than their ability to kill bacteria. For instance, the tetracycline class of antibiotics, such as doxycycline and minocycline, can inhibit the production of pro-inflammatory signaling molecules.

They also inhibit overactive demolition enzymes called matrix metalloproteinases. Normally, these enzymes help keep our skin healthy, breaking down old and dying structures to allow new ones to be built up. But when they're overactive, these enzymes can damage the hair and oil gland unit as well as surrounding supporting structures in the skin.

When that happens, these enzymes contribute to the formation of the big, angry, red, cystic acne lesion, and they can also contribute to the creation of pitted scars.

This is why antibiotics are used to treat acne, but also rosacea, razor bumps and scarring hair loss, to name a few other dermatological conditions.

We need to change how we use antibiotics

Thanks to using higher-than-needed doses of antibiotics and keeping patients on them for longer than recommended, the *P. acne* and other skin bacteria, like *Staphlyococcus aureus* (MRSA, the multi-drug resistant strain of staph bacteria) have developed resistance to multiple topical and oral antibiotics used to treat this disease chronically. For instance, 20 or 30 years ago, the antibiotic erythromycin was used frequently to treat acne, but now both bacteria are uniformly resistant.

So far we have not seen too much resistance to the tetracycline class of antibiotics used today, but they too will be on their way out if we do not change our prescribing patterns.

This is frustrating because antibiotics don't need to kill bacteria to treat acne. Clearing *P. acnes* from the area can be helpful, but the bacteria is just one stimulus of inflammation, so removing it is an assist, not a win. And research has shown that the desired anti-inflammatory effects can be achieved at sub-antibacterial dosing. This means that the needed dose is so low that it can't kill good bacteria or challenge pathogenic bacteria to become resistant.

And antibiotics should never be prescribed on their own to treat acne. In fact, treatment guidelines always recommend that antibiotics be combined with a nonantibiotic topical treatment.

An oldie but goodie is benzoyl peroxide in a relatively low strength (2.5 percent, compared to the 8-10 percent that you get at the drugstore). It can kill *P. acnes*, but because it's not an antibiotic, bacteria can't become resistant to it. It can also break down the skin overgrowth covering the pore, which leads to blemishes.

Retinoids, derived from vitamin A, are by far the most effective topical anti-acne drugs. They limit pore clogging, inhibit inflammation and matrix metalloproteinases. Retinoids also affect the various genes

involved in producing the structural components of the skin, such as collagen and elastin, improving the appearance of scars.

The future of acne treatment

A future direction in acne treatment development is utilizing agents that can kill *P. acnes* but that don't lead to microbial resistance.

For instance, there are studies using synthetic antimicrobial peptides, tiny strings of amino acids that can physically destroy *P. acnes*. This remedy would likely be used in conjunction with other therapies that can treat other causes of acne.

Even more promising is the use of nitric oxide, one of the most important and potent biological molecules, which can both kill *P.acnes* without the risk of it or any other bacteria developing resistance *and* inhibit multiple elements of inflammation involved in the formation of the vicious pimple. The limitation to date has been delivery, as nitric oxide is highly unstable.

But nanotechnology might provide a way of delivering nitric oxide to treat acne. I, along with collaborators at the Albert Einstein College of Medicine and the University of California, Los Angeles, recently showed that a nanoparticle capable of generating low levels of nitric oxide over time could hit all the key pathologic elements that lead to acne.

In the meantime, if you are prescribed antibiotics for acne, ask your doctor how long you need to take them and if the dose is appropriate. And try to avoid popping those zits.

This article was originally published on The Conversation. *Read the* original article.

Source: The Conversation