

## Evaluation of over-the-counter and prescription methods for treating acne.

Abhi Singh

### Abstract

Acne vulgaris is a skin condition in which excess sebum, oil, and bacteria in the pores of one's skin cause inflammation and comedones/pimples (Sutaria et al.) Acne is a common skin condition in adolescents as increasing levels of androgen hormones with puberty causes excess oil production. Acne is not limited to adolescents; adults can also suffer from acne due to hormone imbalances or medications. Female patients account for more than half of visits to the dermatologist for acne (Tan et al.). In today's society, acne can be frowned upon as it is not considered conventionally attractive and can be seen as having a "dirty face" or "bad skin." While some people choose to let acne run its course, many choose medical interventions or over-the-counter (OTC) treatments to manage the volume and severity of their acne. OTC acne products or prescribed medications are common ways to treat acne. This review aims to generally describe OTC and medical interventions for acne, as well as discuss some of the benefits and limitations of these management approaches. Medically-advised treatments for acne include topical, oral, and procedural treatments that effectively reduce acne, but may have side effects. Health professionals like dermatologists administer medication safely to patients to avoid these side effects and can treat acne effectively having years of schooling and experience. Research has shown that it can be challenging to see a dermatologist because of cost, insurance, and living far from dermatologists. OTC treatments can be convenient and range from mechanical treatments to chemical formulations with effective acne-fighting ingredients. However, false-advertising can exaggerate the benefits of these treatments and downplay risks such as harsh side effects. This review will focus on the differences between OTC and prescription medication treatments in the management of acne and how non-medical factors can contribute to acne treatment.

### Medical and Prescription Treatments for Acne

Medical treatments for acne can be divided into topical treatments directly applied on the skin, oral medications, or medical procedures. Topical prescriptions that are often prescribed by dermatologists include, but are not limited to, retinoids, antibiotics, azelaic acid, salicylic acid, and dapsone (Zaenglein et al.). Another popular acne treatment method, typically used in combination with topical antibiotics for more severe acne, are oral prescriptions. Popular oral antibiotics prescribed are doxycycline and minocycline. Medical professionals generally advise to not administer oral antibiotics for extended periods of time and to evaluate their efficacy after three to four months of usage to prevent development of drug resistance (Hauk). Other forms of oral medications are hormonal agents, such as oral contraceptives for female patients with inflamed acne and oral isotretinoin for extreme nodular acne (Hauk). The potential side effects of oral isotretinoin can be extreme, so it is important to measure liver function, serum cholesterol, and triglycerides to ensure that the patient is responding to the tretinoin in a healthy way (Hauk). Topical and oral prescription treatments are prevalent medical acne treatments due to their ability to reduce acne well, but they have side effects which can be extreme if not accounted for carefully.

Aside from these treatments, unique medical procedures are also an option for acne vulgaris management. Laser therapy uses the application of intense pulse light to reduce sebaceous gland size, kill *Propionibacterium acnes* (*P. acnes*) bacteria, reduce cytokines (proteins) that can contribute to acne when overproduced, and increase cytokines that can help fight against acne (Li et al.). CO<sub>2</sub> lasers have also been shown to help with lessening acne scars. Photodynamic therapy is a procedure which uses a photosensitizer, a molecule which absorbs light energy and causes a chemical reaction with another substance, to react with the skin and create an oxygen species that disrupts sebaceous glands and targets *P. acnes* bacteria. Research has shown that this can have side effects such as erythema, swelling, and other unprecedented results. Blue light therapy activates endogenous porphyrins, which help with oxygen transport and that in turn helps to reduce the lifespan of *P. acnes* bacteria, reducing acne. Red light therapy can aid in tissue regeneration and it can penetrate deeply into tissues unlike blue light which has limited penetration ability. Combining both red and blue light therapy together allows both sets of benefits to impact the skin and can greatly help with treatment of moderate acne. Chemical peeling is the use of chemical agents to cause epidermal and dermal damage, which promotes skin regeneration. Some common agents used in these peels include alpha hydroxy acids, salicylic acid, phenol, and other compounds. These peels can help control sebum production, get rid of comedones, and have other anti-inflammatory effects as well. They can also be used in conjunction with topical acne treatments or simply by itself as a method for acne maintenance regardless of acne severity (Li et al.). There are three main different intensities of peels: superficial, medium, and deep peels. When a patient is choosing their peel, the physician or dermatologist performing the procedure should consider whether the peel is effective and safe for the patient (Castillo and Keri). More specifically, they should do a physical exam and look into the past medical history of the patient because factors such as the patient's immune system, current medications, past surgeries, and current psychological state can affect the outcome of the peel (Castillo and Keri). Medical procedures such as the ones mentioned in this section are popular choices for treating acne and generally reduce acne effectively.

## Over-the-counter Acne Products

There are many over the counter products for treating acne. Some popular options include cleansers, mechanical acne treatments, certain essential oils, and oral vitamins/supplements. As for cleansers, their main purpose is to remove dirt, bacteria, and dead skin cells from the skin. Effective ingredients in cleansers include benzoyl peroxide, hydroxy acids such as alpha-hydroxy acid (AHA), beta-hydroxy acid (BHA), and triclosan. Benzoyl peroxide is an effective ingredient in cleansers and over the counter products due to its anti-inflammatory properties. Its ability to exfoliate the skin's outer layer, reduce comedones, and non-inflammatory acne bumps caused by excess sebum and dead skin greatly contribute to the reduction of acne vulgaris. (Decker and Graber). AHAs are exfoliative acids which interfere with the dead skin cells and keratin in the outer layer of the skin by disrupting their ionic bonding. These acids are essentially exfoliating this outer layer of the skin and removing the dead skin cells and built-up keratin, which can reduce and prevent acne vulgaris. BHAs exfoliate skin by their desmolytic properties, allowing bonds of dead skin to be dissolved and loosened, which can allow for exfoliation and reduction of comedones. Triclosan is an agent found in OTC

cleansers which prevents bacteria from spreading on the skin, thus preventing acne vulgaris. Cleansers are an over-the-counter treatment that is a popular choice for treating acne due to the agents and ingredients which fight acne effectively.

A popular type of mechanical treatment is a scrub and it provides physical abrasion when rubbed against the skin, which is commonly believed to disrupt comedones and prevent them from spreading and causing more acne vulgaris. While scrubs may be able to physically get rid of dead skin and keratin, which can cause acne vulgaris, they can also cause physical irritation, which may potentially contribute to acne vulgaris as well. As a gentler alternative, cleansing cloths can provide a similar physical exfoliation because of their fibers. Another mechanical treatment are cosmetic adhesive pads such as Biore® pore strips. They are composed of a cationic adhesive polymer, which binds to the anionic amino acids in comedones, aiding in pulling them and other impurities out of the skin, leading to lessened acne inflammation (Decker and Graber). Heating devices are also popular among mechanical OTC acne treatments as they supposedly activate the acne-causing bacteria's heat shock, killing them.

Essential oils are a commonly used treatment for acne vulgaris. Specifically, tea tree oil has anti-microbial properties and anti-inflammatory properties that suppress production of substances in the skin that cause inflammation, reducing acne (Decker and Graber).

OTC acne treatment products feature key acne-fighting ingredients. Retinol is one ingredient often used in OTC products for treating acne. Retinol is derived from vitamin A and can quicken the process of cell turnover and generate new skin cells, which would have a decreased chance of developing acne. It can also lessen inflammation and reduce sebum production, processes which contribute to reduction of acne vulgaris. Zinc is another strong ingredient in OTC products due to its inflammatory properties, which can result in reduction of acne vulgaris via stopping the process of immune cells interacting with comedones and preventing keratinocytes releasing acne-contributing cytokines. Similarly, nicotinamide is used in both oral and topical OTC products as it can also stop release of cytokines from keratinocytes and lessen the expression of specific genes which can cause inflammation. Sulfur as an OTC product has also been shown to have antimicrobial properties and it has a cysteine component, which can lessen acne-causing keratinocytes upon interaction (Decker and Graber). It is ingredients such as these which allow the OTC products to be effective against acne due to their powerful anti-inflammatory and acne-fighting nature.

### **Benefits of Medical Acne Management**

A popular factor of medical acne management is to see medical professionals like dermatologists as they specialize in diagnosing and treating skin conditions such as acne (Hoey). Medical professionals can also determine possible side effects to treatments, which patients might not know. For example, pregnant women have limited options when it comes to acne treatment due to health risks (Zaenglein et al.). A medical professional would be able to inform their pregnant patients about their treatment options and manage prescription changes as needed after the pregnancy.

Another important part of medical acne management is the use of prescription acne treatment that can be highly effective. Tretinoin can reduce excess sebum and

*Propionibacterium acne* (*P. acnes*), two factors that contribute to acne onset, and it can create a more aerobic environment in the skin, which prevents growth of *P. acnes* (Schmidt and Gans). Similarly, healthcare professionals can provide effective oral treatments such as doxycycline. In a double-blind where patients were given subantimicrobial-dose doxycycline, which are small doses of doxycycline, twice daily for six months, it was found that their comedones and inflammatory lesions improved (Skidmore et al.). Oral medications like these can be preferred over over-the-counter acne treatments as healthcare professionals can prescribe treatments to effectively kill moderate to severe acne over a short time period.

### **Limitations of Medical Acne Management**

Oral medications are not ideal as a long-term treatment because there are potential health risks, such as increased chance of having hypersensitivity reactions, nausea, vomiting, photosensitivity, diarrhea, and the development of antibiotic resistance (Dao et al.). In a 2012 study of 1906 patients designed to evaluate adverse side effects of minocycline, results showed that minocycline caused adverse side effects in single organ systems (vestibular, gastrointestinal, dermatologic) for 332 of the patients, 17.4 percent of the sample size (Dao et al.) The study also showed that 56 cases of hypersensitivity disorders were associated with oral tetracyclines (tetracycline, oxytetracycline, lymecycline, doxycycline, minocycline) and that with one year use of minocycline, there was increased risk of 2.6-8.5 times of getting SLE autoimmune disorder and 2.1 times of developing liver dysfunction (Dao et al.) These findings provide insight as to how using oral medications such as tetracyclines long-term can have negative health effects. Especially with isotretinoin (accutane) use, side effects may include allergic reactions, altered vision, hearing loss or ringing in the ears, increased pressure around the brain, liver injury, mood and behavior changes, pancreatitis, redness, blistering, peeling, and stomach and rectal pain. Non-medically urgent side effects can include dryness or irritation around the lips, mouth, and nose, joint and muscle pain, and nausea (“Accutane (Isotretinoin)”). It is crucial that healthcare providers are aware of acne treatment side effects so that they can prescribe it to their patients safely and appropriately (Tripathi et al.). Oral medications for acne vulgaris can have harmful side effects if used for a long period of time so it is important that healthcare providers prescribe these medications in a safe manner.

### **Benefits of OTC Acne Management**

While standard medical intervention for acne has existed for decades, there has been an increase of OTC product use for acne treatment over the past few years due to cost, having poor insurance status, and the difficulty with finding a dermatology provider in rural areas (Duniphin). While, in the past, a standard norm was to use prescription acne treatments, due to the financial and time-commitment stressors of seeing a dermatologist and using their treatments, OTC treatments have increased in popularity (Decker and Graber). Despite not having to be medically-advised, OTC products feature effective ingredients that can greatly help with reduction of acne. In a 6-week study involving both genders aged from 12 to 35 years old with mild-to-moderate acne, participants used a supposed acne-fighting OTC 3-step skincare routine both morning and night to test OTC products’ effectiveness with acne reduction (Rodan et al.) Key over-the-counter ingredients featured in these products as a whole were sulfur 3%, witch hazel water, ethoxydiglycol, aloe leaf juice, glycolic acid, sodium hydroxide, sodium

hyaluronate, and benzoyl peroxide 5%. Research found that about 33 percent of participants noticed acne improvement after 2 weeks of use, 70 percent experienced improvement after 4 weeks of use, and 90 percent of participants recognized improvement after 6 weeks of use. All of this data suggests that the ingredients featured in over-the-counter products are extremely effective and in turn can help reduce acne both quickly and effectively.

### **Limitations and Advertising of OTC Treatments**

In a study evaluating the claims made by 84 over-the-counter product ads, it was found that 23% of those claims were objectively true, 7% were completely false, and 61% were misleading (Faerber and Kreling). This raises a problem of false advertising in over-the-counter product ads. A variety of over-the-counter skincare products say on the packaging that they are recommended by dermatologists, using this advertising strategy as a way to build credibility and get customers to buy their products (Decker and Graber). Dermatologists have to undergo many forms of education as requirements in order to become a dermatologist, allowing them to be well-versed in their field and treatments (Lee et al.). However, as discussed above, seeing a dermatologist can be difficult so by using acne treatments that are “dermatologist recommended,” the user feels as if they are getting the same experience of having their acne treated by a dermatologist. This strategy is employed by Proactiv, a very popular over-the-counter acne skincare brand. However, terms such as “dermatologist recommended,” “dermatologist tested,” and “dermatologist approved” are not FDA regulated terms. It can be a common occurrence for paid endorsements to go unnoticed by the Federal Trade Commission which means that the dermatologist may have been paid to endorse the products in a marketing advertisement (“FTC’s Endorsement Guides”). Endorsements from celebrities have also caused Proactiv to gain popularity (Decker and Graber). People see that celebrities have “perfect” and “clear” skin so when brands like Proactiv use these people to promote their brand, it gives the audience the feeling that they can achieve the state of the celebrities’ skin by using that brand, inclining them to buy it. However, this is not the case as rules regarding retouching and image editing in the US are very ambiguous and up to the company’s discretion. The consumer might believe that the product the celebrity or advertiser achieved their appearance through use of the advertised product, when in reality the advertiser is heavily edited to have an unattainable appearance (Friedman). Marketing through endorsements by public figures and dermatologists can be misleading and inaccurate in relation to the quality of the product as there is little FDA regulation regarding photo manipulation of product results and dermatologist recommendations.

Similarly, marketing of concentrations in relation to how effective the product is for the reduction of acne vulgaris can also be manipulated by companies in advertising. In a study, a gel with a 2.5% benzoyl peroxide concentration was compared to its vehicle and gels with 5% and 10% benzoyl peroxide concentrations. The vehicle is a method of transportation for the chemicals to enter your skin; they act as a control that contains everything but the active ingredient to see what reaction it produces to the skin (Johnson and Besselsen). The study showed that the 2.5% benzoyl peroxide gel caused reduction in acne vulgaris that was the same as 5% and 10% benzoyl peroxide gel equivalents’ effects (Mills et al.). This is an example of how a company can market a higher benzoyl peroxide concentration as more effective and maximum strength, which the average consumer may believe, when in reality both low and high concentrations were just as effective in acne reduction. However, higher concentration products

can actually cause harm to sensitive skin; in this study, desquamation, which is skin shedding, erythema, which is redness, and burning of the skin occurred after use of the 5 and 10 percent benzoyl peroxide concentrations. On the other hand, this study shows how over the counter treatment can be effective as brands like Neutrogena with their “On-the-spot” acne treatment incorporate low active concentrations like 2.5% benzoyl peroxide. In the study, the 2.5% benzoyl peroxide lessened acne, showing that over-the-counter treatments can be effective for the treatment of acne vulgaris. Over-the-counter skin product marketing can be problematic as higher concentration products may be advertised as stronger, more effective treatments with higher price tags, but these higher concentrations of active ingredients may be just as effective as the lower concentrations and may cause more skin irritation than their lower concentration counterparts.

## Discussion

Over-the-counter acne treatments use mechanical therapeutics and chemical formulations with ingredients that fight to reduce acne. These OTCs often aid in the convenience of not having to see a dermatologist, but these products’ effects can be deceiving due to false advertising. To address the downsides of OTC acne treatments, products that use high concentrations of strong active ingredients should display that it can be very irritating for certain skin and may even slow down the acne reduction process. By doing this, consumers can choose different over-the-counter products with a lower concentration of active ingredients to avoid potential skin irritation. Celebrities should be encouraged to be more transparent in their advertisements about whether or not it was the advertised product which helped them achieve their skin condition or management. This can result in the consumer making an informed decision when buying a product and setting their acne treatment expectations to a realistic, healthy standard. Likewise, “dermatologist recommended” should include consideration by multiple dermatologists where the product was clinically tested to ensure safety. The effect of this would be that consumers are actually getting dermatologist-recommended products and treatment results which one would attain by visiting a dermatologist in person.

Medically-advised acne treatments include topical/prescription treatments, oral treatments, and professional treatments done by a health professional. These ingredients and treatments are very effective in the reduction of acne. Seeing a health professional like a dermatologist has benefits such as how they are able to administer medication to a patient curated for that patient’s needs and health risks, and how they have high credibility due to the years of education they must endure in order to practice. However, it can be inconvenient to see a health professional about acne due to factors like cost, poor insurance, and lack of dermatologists where a patient lives. Additionally, medically-advised treatments can have a high risk of both medically urgent and medically non-urgent side effects. To address the potential adverse effects for medically-advised prescription treatments, healthcare professionals should recommend alternate treatment to combat these side effects or design acne treatment plans for patients in a way so they can still get effective results but with a short amount of treatment time.

## Conclusion

In the treatment of acne vulgaris, two popular methods such as over-the-counter acne treatment and medically-advised or prescribed treatment are used by people and are effective. To strengthen the efficacies of these treatments, research into the clinical, financial, and personal downsides of these treatments has to be done to work towards low risk of skin irritation, general decrease of side effects, affordability, trustworthy advertising, and acne treatment effectiveness for patients and the future of skincare.

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