

An Overview on Acne

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ABSTRACT: *Acne is a common inflammatory disease that affects teenage girls and boys. Despite the fact that it is not a life-threatening illness, it has a negative impact on the patient's self-esteem. They've also been diagnosed with depression and suicide thoughts. It may be divided into various kinds depending on the intensity. Acne may be caused by a number of different causes. This article discusses the most important aspects. When we examine the epidemiology, approximately 85 percent of the population is impacted, according to the Global Burden of Disease research. The Americans are the most vulnerable to it. For the treatment of acne, retinoid derivatives, benzoyl peroxide, antibiotics, and other medicines are available on the market. The topical therapy is the most popular among them. Other treatments are only used if the current one isn't producing the intended outcomes. In order to target the illness, nanotechnology has also been integrated into the current medication. Acne in the animal may be induced. There is information in the literature on how to cause acne in an animal utilizing bacteria as well as chemicals. Various in-vitro and in-vivo investigations have been conducted to determine various features of the medicine. We've covered all of the aforementioned subjects briefly in this post.*

KEYWORDS: *Acne, Acne Vulgaris, Benzoyl peroxide, Disease, Treatment.*

INTRODUCTION

Acne vulgaris is another name for acne. It's a long-term inflammatory condition. It affects the face, neck, upper chest, upper back, and other areas. Acne is the most common illness in the world, according to research. It has a psychological and emotional impact on the sufferer. The topical therapies that are now available have minimal negative effects. To prevent these adverse effects, researchers have created a medication that incorporates nanotechnology, as well as a combination treatment to reduce the drug's concentration. We addressed acne, its pathogenesis, epidemiology, therapeutic options, and ultimately the production of acne in an animal model in this article[1]–[4].

Acne:

"Acme" is a Greek word for "prime of life" and refers to pimples. Acne is a persistent inflammatory condition that affects the skin (Acne vulgaris). The oil produced by the sebaceous gland, also known as the oil glands of the skin, causes inflammation of the skin.

The following are the main factors that contribute to the development of acne:

Follicular Epithelial Hyperproliferation:

Ductal hypercornification is another name for follicular hyperkeratinization. When there is cohesiveness between the follicle cells and they do not shed correctly on the skin surface, hyperkeratinization develops, resulting in the development of micro comedones, which leads to the appearance of acne. Fatty acids are the cause of follicular hyperkeratinization. Linoleic acid is a

fatty acid that induces hyperkeratinization when the amount of this acid is low. Furthermore, MUFAs (monounsaturated fatty acids) as well as lipoperoxides are to blame.

Hormone-Induced Excess Sebum Production:

Inflammation is exacerbated by the creation of sebum. Androgen and testosterone, two hormones that control sebum production, are in charge. To begin, androgen hormone is thought to be a primary cause. Men with severe acne had higher levels of dehydro epiandrosterone sulfate (DHEAS) and lower levels of sex hormone binding globulin (SHBG), both of which contribute to elevated androgen levels. Women with acne had a significantly higher level of androgen than men with acne. Adult women with significant acne have abnormal DHEAS, androstenedione, and SHBG levels, according to research[5]–[10].

Propionibacterium acnes (P. acne):

Cutibacterium is another name for Propionibacterium, which is a gram-positive, anaerobic bacteria that causes skin inflammation. P. acne metabolizes triglycerides (broken down from sebum) and releases free fatty acids, which stimulate the inflammatory response, resulting in acne formation. TLR2 is activated by P. acne. TLR2 stands for toll-like receptors, which are a kind of innate immune receptor. TLR2 activation by P. acne on monocytes and neutrophils results in the release of cytokines, interleukins 12, 8, and tumor necrosis factor, among other proinflammatory mediators. Furthermore, P. acne possesses a CAMP factor. CAMP factor is a Christie, Atkins, Munch-Peterson factor that Staphylococcus aureus uses to cause acne lesion hemolysis.

Topical Agents Used in Acne Treatment:

a. Topical Retinoids:

Vitamin A is the source of retinoids, which are also known as comedolytics. It's used as a stand-alone treatment or in conjunction with other topical or oral antimicrobials. They have anti-inflammatory properties as well as comedogenic properties. Topical retinoids are the first line of treatment for mild-moderate acne patients. Instead of inhibiting P. acne, topical retinoids make life difficult for the bacteria.

The following are the several types of topical retinoids used to treat acne:

- Tretinoin (Cream, gel or microsphere gel vehicle).
- Isotretinoin is a type of isotretinoin that is used to treat acne.
- Adapalene (Cream, gel, lotions).
- Tazarotene (Cream, gel or foam).

a. Tretinoin:

For the last three decades, it has been used to treat acne. Tretinoin is a vitamin A derivative. It is a comedolytic agent that aids in the treatment of acne. It has anti-inflammatory properties and

protects the pilosebaceous unit from becoming clogged. Tretinoin is available in cream, gel, and liquid forms.

b. Isotretinoin:

Isotretinoin is converted to tretinoin via isomerization. Isotretinoin's effectiveness is comparable to that of tretinoin. When adapalene and isotretinoin are compared, it is claimed that isotretinoin has a greater impact than adapalene. Isotretinoin helps to reduce both inflammatory and non-inflammatory lesions. Isotretinoin in combination with erythromycin has more action than isotretinoin alone.

c. Adapalene:

In the case of acne vulgaris, adapalene is utilized as a first-line therapy. A synthetic retinoid compound is what it's called. It contains anti-inflammatory properties that help to clear up acne blemishes. The follicular epithelial cells' differentiation is normalized. When compared to other retinoids, they are less efficacious. However, as compared to other topical retinoids, adapalene causes less irritation and has no photosensitivity.

d. Tazarotene:

Tazarotene, also known as TAZORAC, is a synthetic retinoid that has a comedolytic effect (causes lysis of comedones in acne). It's used to treat acne that's mild to moderate. It is sold commercially as a gel (0.05 percent, 0.1 percent) that is applied once daily in the evening. When compared to tretinoin, they are more active (0.025 percent and 0.05 percent). Combining tazarotene and clindamycin results in increased efficacy. A triple preparation (tazarotene 0.1 percent gel, clindamycin 1 percent/Benzoyl peroxide 5 percent gel, and erythromycin/Benzoyl peroxide) shows better efficacy.

b. Benzoyl Peroxide (BP):

BP comes in the form of a cream, gel, or lotion and has antimicrobial, anti-inflammatory, and comedolytic properties. In the treatment of acne, it is used as a peeling agent. It is used to treat papules, pustules, and cysts that are caused by inflammatory acne. The size of the sebaceous gland and the presence of oil on the skin are both reduced. Because BP has a lipophilic nature, it can easily penetrate the stratum corneum and into the pilosebaceous unit. BP is combined with clindamycin⁹ in order to improve efficacy. Benzoyl peroxide degrades bacterial protein by releasing free radical oxygen against *P. acnes* and is rapidly degraded into benzoic acid and hydrogen peroxide.

c. Azelaic Acid:

It is a natural dicarboxylic acid that inhibits the production of *P. acne* protein. It contains anti-inflammatory, antioxidant, anti-keratinizing, and bacteriostatic effects, among others. The concentration is high. On the skin's surface, *Propionibacterium acne* is decreased. Azelaic acid reduces inflammation by inhibiting pro-inflammatory cytokines. It also activates the gamma

subunit of the peroxisome proliferator-activated receptor (PPARG). PPARG, commonly known as the glitazone receptor, is a protein that reduces inflammatory reactions.

d. Antibiotics for the Skin:

Topical antibiotics primarily target the *Propionibacterium acnes* bacteria. Topical antibiotics like clindamycin and erythromycin are often used to treat acne. Bacteriostatic action is seen in clindamycin and tetracyclines. Quinolone scaffold interacts with DNA supercoiling to show bactericidal action. Dapsone is both an anti-inflammatory and an antibacterial substance. It prevents bacteria from making DNA. Dapsone is said to be safe and effective in the treatment of long-term acne. Mild skin irritation and dryness are two of dapsone's side effects. When dapsone and Benzoyl peroxide are used combined, the skin becomes an orange-brown hue owing to dapsone oxidation.

Oral Isotretinoin and Oral Antibiotics:

1. Antibiotics used orally:

Oral antibiotics are used to treat moderate to severe acne, as well as acne that has become resistant to topical treatments. Antibiotics used orally are meant to be taken for a long time. These chemicals work by suppressing the growth of *Propionibacterium acnes* and the production of inflammatory mediators. Systemic antibiotics such as tetracycline, doxycycline, minocycline, erythromycin, and azithromycin are used to treat acne. Photo sensitivity, vulvovaginal candidiasis, and stomach discomfort are some of the adverse effects of erythromycin and tetracycline. Furthermore, tetracycline has a side effect that causes permanent bone and teeth coloring.

2. Isotretinoin (Oral):

It has been used to treat acne by demonstrating its effect against a variety of causes, including decreased sebum production, the development of comedones, and *Propionibacterium acnes* colonization of the skin. They also have anti-inflammatory properties. The therapy begins with a modest dosage and is gradually raised depending on tolerability. The bioavailability of the medication is enhanced when it is given with meals. Teratogenicity, dryness of the skin, lips, nasal passages, and eyes are only a few of the adverse effects of systemic isotretinoin treatment. The majority of adverse effects, however, may be endured and managed.

Acne Treatment with a Twist:

i. Liposomes:

They are spherical vesicles made up of a lipid bilayer that serve as a carrier or vehicle for delivering drugs to a specific location, enhancing the therapeutic effect of liposomal drugs. Drugs that are both hydrophilic and hydrophobic can be incorporated into liposomes. Lauric acid was shown to be a common free fatty acid in human sebum with potent antibacterial properties.

ii. Niosomes:

Synthetic non-ionic surfactants are used to make niosomes. They're either unilamellar or multilamellar vesicles that act as a carrier for drugs to get to their destination. In the pharmaceutical industry, non-ionic surfactants are employed to solubilize and stabilize insoluble drugs. Niosomes are utilized to compensate for the drawbacks of liposomes. They offer a number of benefits, including better therapeutic impact, drug stability, higher chemical stability, cheaper cost, increased penetration capacity, and extended biological system circulation time. Drugs may be integrated and delivered to a target location in both hydrophilic and lipophilic forms.

iii. Nanoparticles:

The application of nanotechnology to the transdermal drug delivery system aims to improve it. We should have known about the interaction and long-term as well as short-term toxicity studies between the skin and the nanocarriers before designing a transdermal/dermal drug delivery system. To begin, the following factors influence the interaction of skin with nanocarriers:

- Size and surface charge are physicochemical properties.
- Capacity to load drugs
- The property of nanomaterials.
- The structure's adaptability.
- Application methods.

iv. Microsponge:

Topical medication distribution is carried out using microsponges. They are porous spherical microparticles that vary in size from 5 to 300 micrometers. They have the ability to entrap a wide variety of active medicinal substances. When a microsphere is placed to the skin, it acts like a tiny sponge, storing the active substance until it is released.

v. Fullerene:

The cage structure of fullerene is a one-of-a-kind structure. It is a carbon molecule that is spherical. Fullerene has a hundred times the antioxidant activity of typical antioxidant substances. Fullerene is claimed to be useful in the treatment of neurological diseases and arthritis. They are also believed to be helpful against a variety of oxidative diseases.

DISCUSSION

Acne is a skin condition that occurs when your hair follicles get clogged with oil and dead skin cells. Pimples, whiteheads, and blackheads are all caused by it. Acne affects people of all ages, although it is most prevalent among teenagers. Acne may be obstinate, despite the fact that there are effective acne treatments available. Acne is mainly a hormonal condition brought on by androgen hormones, which are at their highest levels throughout adolescence and early adulthood. Acne is caused by a sensitivity to these hormones, which may be aggravated by skin bacteria and fatty acids in the oil glands. Acne generally fades away on its own by the end of

adolescence, although some people suffer with acne far into adulthood. Almost all acne, on the other hand, may be successfully treated. It's just a matter of determining which treatment is best for you.

CONCLUSION

Although acne is a common inflammatory disease among adolescents, it has psychological and psychosocial consequences. It may also lead to despair and attempts at suicide. We've listed the potential repercussions as well as solutions for dealing with them. In order to enhance effectiveness and reduce treatment duration, combination treatments are available on the market. Rather than opting for a monotherapy with a traditional delivery method, we may choose for a combination treatment or a product derived from nanotechnology for enhanced effectiveness.

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