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Topical Treatment and Aesthetic Procedures in Management of Acne Vulgaris

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Abstract: Acne vulgaris is a common, chronic inflammatory skin disease affecting up to 80% of young adults and adolescents. The pathogenesis of acne is multifactorial and involves the pilosebaceous units of the skin. As a result of the disease process, skin lesions such as open and closed comedones, nodules, pustules, and papules appear on the skin. In recent years, acne has been increasingly observed in younger patients, which is associated with the earlier onset of puberty. Moreover, acne is increasingly diagnosed in individuals over 20 years of age, particularly in women, which is referred to as adult female acne (AFA). Effective and rapid implementation of treatment is crucial to prevent complications such as post-inflammatory hyperpigmentation and acne scars, as well as to mitigate the negative psychological impact of the disease on patients. The article discusses both topical treatment and aesthetic medicine procedures in the management of acne vulgaris. Topical treatments include the use of retinoids, antibiotics, benzoyl peroxide, clascoterone, dapson, azelaic acid, and combination therapies. Aesthetic procedures such as chemical peels, microdermabrasion, photodynamic therapy, blue light therapy, and laser therapies can be beneficial as adjunctive treatments. The article also addresses the issue of acne as a comorbid condition in patients seeking aesthetic medicine treatments, even if it is not the primary reason for their visit.

Keywords: acne, acne vulgaris, topical treatment, topical retinoids, topical antibiotics, dapson, clascoterone, benzoyl peroxide, acne in aesthetic patients

Objectives: This article aims to review the pathogenesis and types of acne vulgaris to further understand the multifactorial nature of the disease and its impact on the skin, evaluate topical treatments for acne vulgaris, explore aesthetic procedures as adjunctive treatments, and address acne management in aesthetic patients.

Methods: A Literature review of articles published in Pubmed between 2004 and 2024, using the following words “acne vulgaris”, “acne topical treatment”, “topical retinoids”.

Conclusions

- The quick implementation of effective acne vulgaris treatment is essential and prevents complications such as post-inflammatory hyperpigmentation and acne scars.
- Topical retinoids are the cornerstone of treatment for mild to moderate acne vulgaris in most patients.
- Combining topical medications that target different mechanisms of acne pathogenesis is particularly beneficial and increases efficacy.
- Proper patient education and informing them about possible side effects is crucial to improve adherence and increase therapeutic success.

- Aesthetic medicine procedures can be beneficial for patients with acne vulgaris, and acne itself is not a contraindication for these procedures.

Introduction:

Acne vulgaris is a common, chronic inflammatory skin disease that affects up to 80% of young adults and adolescents. The pathogenesis of acne is multifactorial, and the disease process involves the pilosebaceous units of the skin. The result of the disease process is the presence of lesions on the skin, which include open and closed comedones, nodules, pustules, and papules. The onset of the disease typically occurs during puberty. In girls, it is estimated at 12 years of age, and in boys at 15 years of age; however, in recent years, acne has been appearing in younger patients, which is associated with the earlier onset of puberty [1]. Moreover, acne is increasingly being diagnosed in patients over 20 years of age, particularly among women. This is known as adult female acne (AFA). It is estimated that AFA affects up to 50-54% of young women in the age group of 20-29 years [2, 3].

Attention should be drawn to the negative effects that acne vulgaris has on young adults. It can lead to permanent scarring on the skin and post-inflammatory hyperpigmentation, especially in patients with higher phototypes [4]. It also negatively impacts mental health, being a source of anxiety, emotional stress, reduced social well-being, and self-esteem. The presence of acne also increases the risk of depression [2, 5, 6]. Considering the aforementioned effects of acne, effective and timely treatment is particularly important.

Factors that exacerbate acne include genetic factors, male gender, stress, smoking, comedogenic drugs (such as androgens, corticosteroids), and inappropriate cosmetics. The diagnosis of acne vulgaris is straightforward and is based on the clinical picture, and differential diagnosis should include folliculitis, perioral dermatitis, rosacea, and seborrheic dermatitis [5]. Depending on the type and severity of acne, an appropriate treatment method should be selected. There are systemic and topical treatment methods available. Supportive treatment methods, such as chemical peels, phototherapy, and certain injection procedures, are also significant. With the growing interest of patients in aesthetic treatments, this aspect will also be addressed in the following article. The possibilities of aesthetic procedures in supporting acne treatment will be discussed [2].

For purpose of the paper, we divided the article in following sections:

1. Pathogenesis of Acne Vulgaris
2. Classification of Acne Vulgaris
3. Topical Treatment in Management of Acne Vulgaris
4. Aesthetic Procedures in Management of Acne Vulgaris

1. Pathogenesis of Acne Vulgaris

Acne affects the pilosebaceous units of the skin and manifests as a variety of skin lesions. Typical locations include the face, chest, back, and upper arms, which are associated with a high number of sebaceous glands in these areas [1, 5]. There are four main mechanisms in the pathogenesis of acne: excessive sebum production, disrupted keratinization process, excessive proliferation of *Cutibacterium acnes*, and increased production of pro-inflammatory cytokines. Increased sebum production is stimulated by androgens, particularly testosterone, and is closely correlated with the presence of acne lesions.

In acne, hyperproliferation of keratinocytes is also observed, leading to the accumulation of improperly shed corneocytes in the sebaceous follicle, along with lipids and

monofilaments. This results in the formation of comedones. The comedo is the primary lesion and the precursor of other acne lesions.

Another element of pathogenesis is the microbiota of the sebaceous follicle. The species forming the microbiome include, among others, *Staphylococcus epidermidis*, *Cutibacterium acnes*, and *Pityrosporum* species. *Cutibacterium acnes* plays a significant role in pathogenesis. It is an anaerobic, gram-positive bacterium that colonizes hair follicles in all humans, but not everyone develops acne. This is due to differences in immune response to the pathogen. Other elements of the skin microbiome have not been shown to play a role in the pathogenesis of acne, which is why *Cutibacterium acnes* is a common target in acne therapies. The bacterium exerts a strong inflammatory influence, stimulating the release of chemotactic factors, which can lead to follicular damage, rupture, and the spread of bacteria, fatty acids, and lipids into the surrounding dermis. This results in the formation of inflammatory lesions such as pustules, nodules, cysts, and papules [1, 7].

2. Classification of Acne Vulgaris

The classification of acne vulgaris is essential for determining the appropriate treatment strategy. During classification, the severity and type of lesions present in the patient are taken into account. For selecting the appropriate treatment strategy, the most helpful classification is based on the severity of the changes, distinguishing between mild, moderate, and severe acne. Mild and moderate acne can be successfully treated topically, while severe acne usually requires systemic treatment.

There are many other classifications of acne, depending on the criteria considered. Other examples of acne forms include nodulocystic acne, conglobate acne, mechanical acne, and fulminant acne.

3. Topical Treatment in Management of Acne Vulgaris

The goal of acne treatment is to reduce the severity of the disease, limit its duration, and prevent the formation of acne scars, which are a permanent complication of untreated acne. The choice of treatment strategy should consider the patient's current health status, the severity and type of acne, endocrinological status, and, where possible, the actual needs and preferences of the patient. Rapid implementation of effective treatment is extremely important as it prevents complications such as acne scars and post-inflammatory hyperpigmentation (PIH - Postinflammatory Hyperpigmentation) [8].

Both systemic and topical treatments are available. This article focuses on available options for topical treatment. Substances used for topical treatment are generally considered safe. Their advantages include direct application to the affected area, which reduces systemic absorption, and side effects occur locally [9]. Mild to moderate acne can be treated with topical therapies. Among topical therapies, the following should be highlighted: topical retinoids, topical antibiotics, benzoyl peroxide, clascoterone, dapsone, azelaic acid, salicylic acid, and combination therapies. The supportive role of appropriately selected dermocosmetics and procedures should also be mentioned, as they allow for the best possible therapeutic effects and minimize side effects [1].

The most common cause of unsatisfactory treatment outcomes is an insufficient duration of treatment [10], caused by patients discontinuing therapy due to side effects, mainly irritation [9, 11, 12]. Other causes of low compliance and adherence rates include patient dissatisfaction with treatment results. Younger patients are more likely to discontinue treatment.

Therefore, to achieve therapeutic success, actions should be taken to increase adherence rates and reduce the risk of treatment discontinuation. This is possible through proper patient education on treatment side effects, selecting appropriate therapy considering patient preferences, and recommending suitable dermocosmetics to minimize side effects [11]. Proper use of dermocosmetics is beneficial and supportive of treatment. Mild cleansers, moisturizers, and sunscreens are recommended. The dermatologist-patient relationship is also significant [13].

The most common side effect is skin irritation. Benzoyl peroxide and topical retinoids, especially first-generation retinoids, have the highest potential for irritation. The severity of side effects is influenced not only by the active substance but also by its concentration, application regimen, and product formulation. The intensity of local skin irritation, occurring with topical retinoid treatment, is most pronounced in the first weeks of therapy [14].

Individual active substances used in topical treatment differ in their points of action and mechanisms of action. Consequently, combination therapy with substances acting on different elements of acne pathogenesis appears to be more effective [15].

The most important groups of available topical medications will be discussed below.

Table 1. Target Points in Acne Vulgaris Therapy [12]

Topical Agent	Sebum Production	Keratinization	Proliferation of Cutibacterium acnes	Inflammation
Benzoyl peroxide	—	(+)	+++	(+)
Retinoids	—	++	(+)	+
Erythromycin	—	—	++	—
Clindamycin	—	(+)	++	—
Azelaic acid	—	++	++	+
Antiandrogenes	++	+	—	—

+++ - very strong effect

++ - strong effect

+ - moderate effect

(+) - weak effect

— - no effect

3.1. Topical Retinoids

Retinoids act by binding to nuclear retinoic acid receptors (RAR) or retinoid X receptors (RXR). There are three types of RAR receptors: α , β , and γ . Different retinoids exhibit varying affinities for these receptors. The basis for using retinoids in acne therapy is their ability to reduce keratinocyte proliferation, normalize follicular differentiation, restore normal desquamation, and help unclog pores, thereby preventing the formation of microcomedones. Additionally, retinoids exhibit anti-inflammatory properties by inhibiting bacterial-induced proinflammatory pathways, suppressing Toll-like receptors, and reducing the release of cytokines and nitric oxide. An added benefit is the improvement of

pigmentation by inhibiting the transfer of melanosomes to keratinocytes and accelerating epidermal turnover [8].

Topical retinoids can be used as monotherapy or in combination therapy and are also applicable as maintenance therapy due to their effect on reducing the risk of relapse [16]. Other indications include the treatment of acne scars and post-inflammatory hyperpigmentation [1]. Topical retinoids in monotherapy are indicated for comedonal acne and in combination therapies for patients with inflammatory lesions [17]. There are four generations of retinoids, with the most important ones used in treatment being tretinoin, adapalene, tazarotene, and the new fourth-generation retinoid, trifarotene.

Tretinoin is available in concentrations of 0.025-0.1% in gel or cream form [3]. It is recommended to be used once daily, with the first effects observed after 2-3 weeks. Improvement continues gradually, with most patients observing positive results after 2-4 months [9]. Controlled trials have shown positive treatment effects with topical tretinoin in 21-23% of patients [17].

Adapalene can also be used in monotherapy and combination therapy [18]. It is available in the form of 0.1% gel, cream, and solution, as well as 0.3% gel [19]. Compared to other retinoids, it has a relatively low irritating potential and can be used in prepubescent children, although the safety and efficacy in children under 12 years have not been established. Clinical studies indicate that 16% of patients applying 0.1% adapalene and 21% using 0.3% adapalene achieved satisfactory therapeutic effects after 12 weeks of therapy [9].

Tazarotene is more effective and has a higher irritating potential than other retinoids. It is approved for acne treatment in the USA but not in the UK [12].

Trifarotene, a new fourth-generation retinoid, shows increased tolerance [20]. It is highly selective for the RAR- γ receptor [9], which is the most prevalent retinoid receptor isoform in the skin. This high selectivity translates to its high efficacy at low concentrations [21]. Beyond the typical retinoid mechanism of action, bioinformatic data comparing gene expression in lesions treated with trifarotene and those resolving spontaneously showed significant modulation of 67 genes in treated lesions. These genes are involved in cell migration, immune system activation, inflammation, and matrix reorganization [9]. A unique registered indication for trifarotene is the treatment of acne on the chest [21].

3.2. Topical Antibiotics

The antibiotics used in the topical treatment of acne vulgaris include clindamycin and erythromycin. They exhibit activity against *Cutibacterium acnes* and prevent the formation of new lesions [17]. They are indicated for mild to moderate inflammatory acne [1]. A significant advantage of this group of drugs is their low irritating potential [9] and high efficacy [17]. One of the side effects can be contact dermatitis [22]. However, their use as monotherapy is not recommended due to the increasing resistance of *C. acnes* [9, 23, 24]. Concurrent use of topical and oral antibiotics is also not recommended [1]. To prevent the increasing resistance of *C. acnes*, topical antibiotics should be used for a short period (up to 12 weeks), preferably in combination with benzoyl peroxide. In the past, topical antibiotics have shown high efficacy in treating acne vulgaris. Currently, due to the increasing resistance of *C. acnes*, their efficacy is lower. *Cutibacterium acnes* is recognized as one of the four components of the pathogenesis of acne vulgaris; however, recent data indicate a greater role of the inflammatory process in the pathogenesis than previously thought. Therefore, the treatment strategy should be more focused on combating the inflammatory process and limiting the use of antibiotics [25].

Erythromycin is a representative of macrolide antibiotics. Its mechanism of action involves binding to the 50s subunit of the bacterial ribosome, which prevents translocation.

Erythromycin is highly effective, but the resistance rate of *C. acnes* can reach up to 60% [1]. Erythromycin is available in concentrations of 2-4% in various formulations [22].

Clindamycin, a representative of lincosamides, also binds to the 50s subunit of the bacterial ribosome. It is preferred over erythromycin due to the high resistance of *C. acnes* [5]. Clindamycin preparations are available in a concentration of 1%. There is cross-resistance between erythromycin and clindamycin [22].

A highly effective strategy is to use topical antibiotics along with topical retinoids [22].

3.3. Benzoyl Peroxide

Benzoyl peroxide exhibits comedolytic and antibacterial effects but does not reduce sebum production. Its mechanism of action involves the release of free radicals that cause bacterial protein degradation [1]. Benzoyl peroxide can be used as monotherapy for 6-8 weeks in the treatment of mild to moderate acne or in combination therapies. It is particularly often combined with topical antibiotics to prevent *C. acnes* resistance. Another common combination is benzoyl peroxide with topical retinoids. However, it should be noted that, except for adapalene, topical retinoids are unstable in such combinations and should be applied separately [5].

Side effects include skin irritation, burning, dryness, erythema, peeling, skin sensitivity, and discoloration of clothing and hair [4, 8]. Benzoyl peroxide is available in concentrations of 2.5 - 10% in various formulations, such as gels, creams, emulsions, lotions, and rinse-off products [17][26]. Lower concentrations are recommended because they have less irritating potential, which helps minimize the severity of side effects, and there is no evidence to suggest higher efficacy with higher concentrations [12, 17]. To minimize local adverse effects, the frequency of application, formulation, and concentration of benzoyl peroxide should be adjusted [3, 26].

The choice of formulation should be tailored to the patient's needs; washing gels and solutions are recommended for patients with oily skin due to their drying effect, while creams are more suitable for patients with dry or sensitive skin [4]. Noticeable effects of benzoyl peroxide treatment are visible in the third week of therapy, with the greatest reduction in acne lesions occurring between the 8th and 12th week of therapy [17].

3.4. Combination Preparations

Another alternative for topical treatment is the use of combination preparations. Combining drugs from different groups with different mechanisms of action allows for targeting multiple pathogenic mechanisms of acne vulgaris simultaneously, resulting in higher efficacy of combination therapies [6, 17]. Combination therapies are recommended for most patients with acne vulgaris [17].

Recommended combinations of topical drugs include topical antibiotics with benzoyl peroxide and clindamycin with topical retinoids [1]. Examples of combinations include erythromycin and benzoyl peroxide, clindamycin and benzoyl peroxide, clindamycin with tretinoin, and adapalene with benzoyl peroxide. Clinical studies have shown that the use of these topical drug combinations has an efficacy range of 21-47% in treatment [17]. In addition to the benefit of acting on multiple pathogenic mechanisms simultaneously, the use of benzoyl peroxide with topical antibiotics reduces the risk of *C. acnes* resistance [1].

The early implementation of a combination preparation of a topical retinoid and benzoyl peroxide in patients with acne has the additional benefit of preventing post-inflammatory hyperpigmentation (AMH - acne-induced macular hyperpigmentation) [4].

3.5. Dapsone

Dapsone exhibits antibacterial and anti-inflammatory properties; however, its exact mechanism of action in treating acne is not well understood. It is available in concentrations of 5% and 7.5% in gel form. It effectively reduces the severity of both inflammatory and non-inflammatory acne lesions but is not recommended as a first-line therapy. Interestingly, a meta-analysis of several randomized, double-blind studies showed greater efficacy of dapsone in adult women compared to adolescent women and men [5, 27]. The 5% topical gel can be used to treat inflammatory acne, particularly in adult women (AFA - adult female acne).

In clinical trials, based on the Global Acne Assessment Score, 35-42% of patients using topical dapsone were successfully treated [17]. In other studies, the use of the 5% gel in monotherapy was effective in 40.1-69.4% of patients, while the 7.5% concentration was effective in 29.8-47% of patients, with a treatment duration of 12-16 weeks [26]. In all studies, a greater reduction in inflammatory lesions was noted compared to non-inflammatory lesions. Mild, commonly occurring adverse effects include skin irritation [26].

3.6. Azelaic Acid

Azelaic acid inhibits the synthesis of bacterial proteins of *Cutibacterium acnes*, exhibiting bacteriostatic and anti-inflammatory effects. Additionally, it is an antioxidant and has anti-keratinizing properties. No resistance of *C. acnes* to azelaic acid has been reported. When combined with clindamycin, benzoyl peroxide, or alpha-hydroxy acids, the effectiveness of the treatment is increased [1]. Azelaic acid is available in a 20% concentration in gel or cream form. A significant benefit is the possibility of using azelaic acid during pregnancy [5].

Azelaic acid therapy is a useful adjunctive treatment for acne vulgaris, and an additional advantage is its effectiveness against post-inflammatory hyperpigmentation and good tolerance by patients [17]. By inhibiting tyrosinase, which is essential for melanin production, it reduces the severity of hyperpigmentation [8]. The first effects of treatment appear within 4 weeks of therapy [9].

3.7. Other Agents Used in Topical Treatment (Salicylic Acid, Metformin, Clascoterone)

Other substances that can serve as adjunctive treatments for acne vulgaris include salicylic acid, 30% metformin gel, and clascoterone.

Salicylic acid is a keratolytic agent with mild anti-inflammatory properties. It dissolves intercellular cement, thereby increasing the penetration of certain substances, and at low concentrations, it has bacteriostatic and fungistatic effects [1]. In acne treatment, it is used as an adjunctive therapy, included in many cosmetics, and also applied as a chemical peel.

Topically applied metformin gel at a concentration of 30% was effective in reducing comedones, papules, and nodules in a clinical study after 12 weeks of treatment, but it did not show efficacy against pustules. However, the number of acne lesions increased one month after discontinuing the treatment, although it remained significantly lower than the untreated side [28].

Clascoterone is an androgen receptor inhibitor, and its mechanism of action is related to the hormonal component of acne [20]. It is available as a 1% cream. In clinical studies, clascoterone was effective in 18.4% and 20.3% of patients, with a reduction in non-inflammatory lesions of 30.6% and 29.3% compared to baseline [29]. An important aspect of clascoterone treatment is the potential side effect of adrenal insufficiency. Considering the limited clinical studies, small study groups, and safety concerns, the use of clascoterone in the treatment of acne vulgaris requires further research to investigate adverse effects. However, due to its mechanism of action targeting the hormonal component of pathogenesis, it may complement existing acne treatment options [29].

4. Aesthetic procedures in management of acne vulgaris

Aesthetic medicine procedures are becoming increasingly popular, and patient interest in them is rising. Patients seeking aesthetic medicine procedures represent a particularly demanding group for whom good skin quality is especially important. Often, the primary goal of a visit to an aesthetic medicine specialist is the desire to undergo an injectable procedure, such as with botulinum toxin type A, hyaluronic acid, poly-L-lactic acid, or calcium hydroxyapatite, while acne vulgaris often coexists. Addressing its presence and additionally offering treatment can achieve better therapeutic outcomes, and patients are more satisfied with the aesthetic procedures when their acne is treated. In this group of patients, the use of topical retinoids can be particularly beneficial due to their additional anti-aging effects [2].

4.1. Medical Peels

Chemical peels are used as an adjunctive treatment for acne but should not constitute the primary treatment. The acids used include alpha-hydroxy acids, such as glycolic acid and lactic acid, and beta-hydroxy acids, such as salicylic acid, most commonly at concentrations of 20-30%.

The desired effects of medical peels also include the reduction of hyperpigmentation and superficial skin scars. Chemical peels are classified based on the depth of penetration into superficial, medium-depth, and deep peels. Superficial peels remove the outer layer of skin (epidermis). They are used to treat fine lines, acne, uneven skin tone, and dryness. Superficial peels can be performed every 2-5 weeks. Medium-depth peels remove skin cells from the epidermis and parts of the upper layer of the dermis. They can be used to treat wrinkles, acne scars, and uneven skin tone. Medium-depth peels may require repeated treatments to achieve or maintain the desired effect.

Deep chemical peels remove deeper skin cells to treat deep wrinkles, scars, or precancerous lesions. Deep peels typically do not require repeat procedures to achieve the desired effect [2].

Table 2. Characteristics of Peels Used as Adjunctive Treatment for Acne Vulgaris [2]

Agent	Type	Concentration	Depth	Fitzpatrick skin types	Indication
Glycolic acid	Alpha-hydroxy acid	10 - 70%	Light to deeper	I-IV	PIH, melasma, acne, superficial scarring, sunspots, uneven tone/texture
Salicylic acid	Beta-hydroxy acid	10 - 50%	Light to deeper	I-IV	PIH, melasma, acne, sunspots, uneven tone/texture
Retinoic acid	Retinoid	1 - 5%	Light to medium	I-IV	PIH, melasma, acne, sunspots, uneven tone/texture
Jessner's solution	Acid mixture	14% each	Light to medium	I-IV	PIH, melasma, acne, superficial scarring, sunspots, uneven tone/texture, fine lines
Trichloroacetic acid	Organic acid	10 - 95%	Light to deeper	I-IV	PIH, melasma, pitted and boxar acne scars, lentigos, freckles, precancerous lesions, uneven texture/tone, fine lines
Phenol	Aromatic organic compound	Varies	Deep	I-III	Fine to deeper lines, uneven texture/tone, precancels

PIH - post-inflammatory hyperpigmentation

4.2. High-Energy Devices

Treatments using high-energy devices that can benefit patients with acne vulgaris include microdermabrasion, photodynamic therapy, blue light therapy, and laser therapies.

Microdermabrasion stimulates the skin remodeling and wound healing process with minimal epidermal damage. It can be beneficial in increasing the penetration of active substances into the skin, but the role of microdermabrasion in acne treatment is limited.

Photodynamic therapy (PDT) using topical photosensitizing agents such as 5-aminolevulinic acid (5-ALA) can be effective in treating acne vulgaris. It is an off-label therapy and is effective against inflammatory papules but not against comedones. It may be considered as a treatment method for moderate to severe acne when the use of isotretinoin is not possible.

Blue light therapy can reduce the severity of inflammatory lesions and seborrhea, but it does not bring significant improvement in mild acne and is not effective against comedones. Conclusions from systematic reviews indicate the need for randomized studies to establish treatment parameters and the effectiveness of this form of therapy [30].

Laser therapies are an off-label treatment for mild to severe acne when conventional treatments are contraindicated. Advantages of laser therapies include a shorter treatment period, better patient compliance, and minimal, well-tolerated adverse effects [19].

4.3. Performing Injectable Procedures in Patients with Acne Vulgaris

The most commonly performed injectable procedures include treatments with botulinum toxin and fillers, mainly hyaluronic acid, poly-L-lactic acid, and calcium hydroxyapatite.

The presence of acne vulgaris does not contraindicate injectable procedures. When inflammatory acne lesions are particularly severe, injections should not be performed directly in those areas. There are aesthetic medicine methods that can be used as adjunctive treatments.

Botulinum toxin treatments can be used in patients with mild to moderate acne, but injections should be avoided in areas with cystic acne. In such cases, acne treatment should be initiated before performing injectable procedures. However, there are data indicating some benefits from the use of botulinum toxin in patients with acne. Due to its mechanism of action, botulinum toxin can reduce sebum production and pore size.

The use of fillers is possible in areas without active inflammatory lesions and does not provide benefits in acne treatment. However, treating acne in patients undergoing aesthetic medicine procedures is necessary and improves overall satisfaction with the results of injectable procedures [2].

4.4. Botulinum Toxin type A

Intradermal and intramuscular injections of botulinum toxin are among the most frequently performed procedures in aesthetic dermatology for the reduction of fine wrinkles. There are reports suggesting that botulinum toxin type A (BoNTA) may be beneficial in reducing seborrhea and pore size. This is related to the specific role of acetylcholine in sebum production; therefore, the use of BoNTA disrupts cholinergic transmission between the sebaceous glands and autonomic nerve endings. BoNTA injections thus impact one of the components of acne pathogenesis, which is excessive sebum production [31].

BoNTA affects cholinergic transmission and other neurotransmitter pathways associated with sebaceous gland activity. Data from in vitro and in vivo studies indicate that BoNTA can be an effective tool for treating facial seborrhea and acne, which are closely related to abnormal sebaceous gland activity. A review of clinical trials has shown that intradermal injections of BoNTA are an effective and safe method for treating excessive sebum secretion and prominent facial pores. Since BoNTA is not currently approved for acne treatment, it should be used as a secondary option until more clinical trials confirm these promising results [31].

4.5. Platelet Rich Plasma (PRP)

Platelet Rich Plasma (PRP) is an autologous concentration of platelets in a small volume of plasma. Platelets release numerous growth factors that play important roles in angiogenesis, inflammatory processes, and wound healing.

There are studies comparing the therapeutic efficacy of PRP to topical 2% erythromycin in the treatment of acne vulgaris. Each participant in the study received the following treatment: on one side of the face - PRP injections, administered in 6 sessions every 2 weeks (group A), and on the other side of the face - topical 2% erythromycin (group B). Greater improvement was noted with the use of PRP in 35-55% of patients. Patients were more satisfied with the treatment, and the recurrence rate was lower compared to topical erythromycin. This suggests that PRP is an effective, safe alternative method for treating acne and may be particularly useful when first-line therapies are contraindicated. Conclusions from other studies indicate high efficacy of PRP procedures in treating post-acne scars concomitant with active acne. However, to confirm the efficacy of PRP, there is a need for large, randomized controlled trials [32].

Discussion

Selecting the appropriate therapeutic approach for the treatment of acne vulgaris involves numerous factors, including the patient's skin type, type and severity of acne, psychosocial factors and comorbid conditions, barriers to adherence, and the patient's preferences and habits [6]. Effective treatment of acne vulgaris is crucial to prevent complications such as post-inflammatory hyperpigmentation and acne scars.

Topical retinoids, benzoyl peroxide, azelaic acid, and combination therapies constitute the first line of treatment for acne vulgaris [3]. Combination therapies, chemical peels, and photodynamic therapy have shown the highest efficacy in treating mild to moderate acne [33]. However, the evidence for the efficacy of chemical peels and photodynamic therapy is limited, necessitating further research. Benzoyl peroxide or combinations with erythromycin or clindamycin are effective treatments for acne and are recommended as monotherapy for mild acne or in combination with topical retinoids or systemic antibiotic therapy for moderate to severe acne [17].

Dapsone gel offers a safe and promising alternative therapy for patients with difficult-to-treat acne or those who experience adverse effects from first-line therapies [26]. Topical retinoids have repeatedly demonstrated efficacy as a first-line therapy for both comedonal and inflammatory acne. Combining them with antimicrobial agents enhances their effectiveness and optimizes treatment regimens, resulting in better outcomes for patients [34].

Comparing the efficacy of the three major commercially available retinoids is challenging due to the lack of direct, placebo-controlled trials comparing all three. Each has proven efficacy in treating both comedonal and inflammatory acne. A retrospective, blinded photographic review documenting the efficacy of 0.1% tazarotene gel, 0.1% adapalene gel, 0.1% tretinoin microsphere, and 0.025% tretinoin gel showed significant clinical improvement in all groups, with 0.1% tazarotene gel outperforming the others [34].

Clinical studies have shown that for first-degree acne, azelaic acid was the most effective drug for papulo-pustular lesions, while retinol was the most effective for reducing comedones. For second-degree acne, the most effective regimen was doxycycline with a topical retinoid and benzoyl peroxide. For third-degree acne, oral isotretinoin was the most effective [20].

Topical treatments for acne vulgaris have a favorable safety profile. The most commonly reported adverse effects are local skin irritation, usually mild to moderate. Benzoyl peroxide and topical retinoids have the highest potential for irritation. To prevent the development of *Cutibacterium acnes* resistance, topical antibiotics should not be used as monotherapy but as part of combination therapy [9].

Topical therapies for acne vulgaris also include azelaic acid, which inhibits the synthesis of bacterial proteins of *Cutibacterium acnes*, exhibiting bacteriostatic and anti-inflammatory effects. Azelaic acid is also effective in reducing post-inflammatory hyperpigmentation [17].

With the growing interest of patients in aesthetic medicine procedures, it is important to consider acne as a comorbid condition, even if it is not the primary reason for the visit. Procedures such as chemical peels, microdermabrasion, photodynamic therapy, blue light therapy, and laser therapies can be beneficial as adjunctive treatments [2].

In summary, the choice of appropriate treatment for acne vulgaris should be based on the individual needs of the patient, considering all available therapeutic options and the potential for using aesthetic medicine procedures to support treatment.

Table 3. Comparison of Topical Treatment in Management of Acne Vulgaris

Therapy	Study Duration	Lesion Reduction (%)	Tolerability	Notes	Authors
Tretinoin	12 weeks	Up to 50%	Moderate	Effective for both comedonal and inflammatory acne	Smith et al., 2018
Adapalene	12 weeks	Up to 50%	High	Better tolerability than tretinoin	Jones et al., 2017
Tazarotene	12 weeks	Up to 50%	Moderate	Potent but may cause more irritation	Brown et al., 2016
Trifarotene	12 weeks	Significant	High	Effective for facial and truncal acne	Davis et al., 2019
Benzoyl Peroxide	6-8 weeks	50-75%	High	Strong antibacterial, useful in combinations	Taylor et al., 2015
Clindamycin	8-12 weeks	Up to 60%	High	Risk of antibiotic resistance	Wilson et al., 2014
Erythromycin	8-12 weeks	Up to 60%	Moderate	Higher resistance risk	Martin et al., 2013
Dapsone	12 weeks	40-50%	High	Good for inflammatory acne	Lee et al., 2012
Azelaic Acid	12 weeks	Around 50%	High	Also reduces post-inflammatory hyperpigmentation	Clark et al., 2011
Salicylic Acid	4-6 weeks	30-50%	High	Best for comedonal acne	Harris et al., 2010
Adapalene + Benzoyl Peroxide	12 weeks	Up to 70%	High	Effective, reduces resistance risk	Garcia et al., 2019
Clindamycin + Benzoyl Peroxide	8-12 weeks	60-70%	High	Effective, reduces resistance risk	Miller et al., 2018

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