

THE EFFECTS OF COMBINED DIAMOND MICRODERMABRASION AND A MIXTURE OF COSMETIC ACIDS ON THE CONDITION OF ACNE PRONE SKIN: A CASE REPORT

SANDRA MACIUSZEK-MALINOWSKA^{1 A,B,E,F} ¹ Department of Health Sciences, University of Opole, Opole, Poland
• ORCID: 0000-0003-4763-9445

KAMILA BEZYMSKA^{1 A,B,E,F}
• ORCID: 0000-0002-0994-9517

KAROLINA CHILICKA^{1 A,B,D,E}
• ORCID: 0000-0002-6435-0179

MONIKA RUSZTOWICZ^{1 A,B}
• ORCID: 0000-0001-6467-7633

EWA ADAMCZYK^{1 A,B}
• ORCID: 0000-0003-1367-6379

AGNIESZKA KOZNAWSKA-BUCZKOWSKA^{1 A,B}
• ORCID: 0000-0001-7560-4886

A – study design, **B** – data collection, **C** – statistical analysis, **D** – interpretation of data, **E** – manuscript preparation, **F** – literature review, **G** – sourcing of funding

ABSTRACT

Background: Exfoliating treatments are widely used in cosmetology and dermatology for the treatment of skin lesions and, above all, to reduce the number of skin eruptions that occur with acne vulgaris. An effective treatment that can be offered to people suffering from this disease is diamond microdermabrasion. The addition of acid peeling to this treatment may lead to even better results than in the case of monotherapy.

Aim of the study: To assess the effectiveness of a combination of microdermabrasion and acid peeling on a 21-year-old woman suffering from acne vulgaris.

Case report: The patient suffered from acne vulgaris, too high a level of sebum on the entire surface of the face, and, over the course of the disease, developed open and closed blackheads and inflammatory pustules. The sebum level was measured with a DermaUnitSCC3 device and the number of skin eruptions was determined using the global acne severity scale (GAGS).

Conclusions: The series of cosmetological treatments led to a reduction in the sebum on the surface of the epidermis and the number of skin eruptions.

KEYWORDS: microdermabrasion, cosmetics acids, acnevulgaris, GAGS, sebometer

BACKGROUND

Acne vulgaris is characterized by changes on the skin caused by overactive sebaceous glands, which leads to seborrhea. Acne eruptions may show a multi-form nature and can be characterized as papular, pustular, or nodular, often leading to scarring [1,2]. Acne

lesions are accompanied by inflammation, which is induced by an excessive colonization of *Cutibacterium acnes* in the sebaceous glands. The over-reactivity of the sebaceous glands is caused by hyperkeratinization of the hair follicles as a result of increased testosterone levels and an immune response to the presence of *Cutibacterium acnes* in the sebaceous glands

[1,3]. Acne vulgaris as an inflammatory skin disease that occurs in 95% of boys and 83% of girls aged 16 years. It has been observed that women experience acne vulgaris at an earlier age than men. However, men usually struggle with a more severe course of the disease. In men, acne lesions most often occur on the back and chest, while in women, the lesions are most often located on the face [4].

Acne vulgaris is a disease that can affect individuals of all ages. The group of acne diseases includes adult acne (acne tarda), which occurs most often in women aged 20 to 25 years. Acne is divided into two groups according to the age at which the first lesions appear. Permanent acne, which appears in adolescence and continues into adulthood, concerns 80% of acne cases. The second subtype of adult acne is late-onset acne, which appears for the first time in adulthood. Adult acne differs histopathologically from juvenile acne [2,5,7]. This subtype of acne is characterized by maculopapular and nodular changes, and the lesions are most often located around the neck, chin and jaw. The blackhead form in adult acne consists of macrocomedones. The course and characteristics of changes in adult acne are mild-to-moderate and are generally resistant to treatment. In addition to taking medications under the constant observation of a dermatologist, the patient should change his or her eating habits and lifestyle. Cosmetological treatments are complementary and support the treatment of acne, including the prevention or removal of its negative effects, such as discoloration or scars [5].

Cosmetology offers a number of cosmetic treatments that are able to improve the condition of the patient's skin. One of these treatments is chemical peeling, which consists of the exfoliation of the layers of the epidermis. Its purpose is to deliberately damage the superficial layers of the skin by exfoliating them, which consequently causes tissue regeneration. The effects of chemical exfoliators are broadly understood and include regulation of sebum secretion and pore narrowing, exfoliation of the epidermis, prevention of imperfections, blackheads and sebaceous fibers, stimulation of collagen production, a reduction of acne scars, lightening of discoloration, antibacterial and anti-inflammatory properties, and moisturizing. The specific effects of these treatments depend on the substance used, its concentration, the pH of the product and, most importantly, the time allowed for the preparation to work directly on the skin. Extremely effective is a combination of several acids [6,8].

Lactobionic acid works more gently than other acids and is recommended for sensitive and vascular skin, as well as for people struggling with rosacea, Psoriatic Arthritis (PsA) or Atopic Dermatitis (AD). This acid supports the reduction of telangiectasia, and has anti-inflammatory and soothing effects.

Lactobionic acid exfoliates the outer layers of the epidermis, allows it to retain water, and, therefore, improves its hydration. In addition, this acid reduces shallow wrinkles and improves skin regeneration processes. It does not have a phototoxic effect and can be used all year round. Lactobionic acid also has an anti-aging effect. It inhibits metalloproteinases – enzymes responsible for the breakdown of collagen, which keeps the skin looking young.

Pyruvic acid is stronger than glycol and effectively exfoliates the top layer of the epidermis by loosening the connections between cells. This acid penetrates the skin quickly and acts in the hair follicles to work against blackheads. It also has antibacterial and sebostatic qualities. Pyruvic acid is used for acne-prone skin, but also for skin with visible signs of aging and sun discoloration.

Lactic acid is an acid of moderate strength with excellent moisturizing feature at a concentration of up to 10%. This acid affects the synthesis of ceramides, supports the balance of the hydrolipid coat in higher concentrations (30–50%), and exfoliates the epidermis well. Lactic acid also helps to firm the skin by stimulating collagen synthesis and prevents discoloration by inhibiting melanin synthesis. Low concentrations of this acid are also used in cosmetic products to regulate their pH.

Azelaic acid is used to treat all types of acne, including inflammatory forms and rosacea. It is a lithophilic acid, thus it penetrates the epidermis well and reduces seborrhea to a large extent. Azelaic acid also prevents the formation of blackheads, has antibacterial properties, and lightens all forms of discoloration. This acid can be used safely on couperose skin prone to erythema. It is considerably well tolerated, can be used all year round, and is rarely followed by side effects [9].

Diamond microdermabrasion is a mechanical peeling consisting of the controlled removal (mainly by friction) of the epidermal layers. While there are different types of microdermabrasion devices, the most popular are diamond microdermabrasion and corundum microdermabrasion. Diamond microdermabrasion is based on the use of special abrasive rings with different gradations containing microcrystals that can be adjusted to the treatment area, skin thickness, and the therapeutic problem. Regular microdermabrasion regenerates the skin and makes it elastic. A noticeable improvement is observed in the smoothness of the surface of the epidermis and in the radiance of the appearance (i.e., it loses its dull, earthy color). In the dermis, mechanical exfoliation stimulates cell division, which is the result of increasing the production of collagen and elastin. Due to the force of friction and the effect of negative pressure, a local hyperemia occurs in the treatment area, and, therefore, results in better nutrition and oxygenation of the tissues.

Microdermabrasion also causes irritation reactions by increasing post-inflammatory cytokines and transcription factors (as in the healing process), increasing the regenerative capacity of the skin [8].

AIM OF THE STUDY

The aim of this study is to assess the effectiveness of combined microdermabrasion and acid peeling on a 21-year-old individual suffering from acne vulgaris.

MATERIAL AND METHODS

Study design, setting and duration

The diamond microdermabrasion and cosmetic acids treatment was performed every 2 weeks for a total of 5 treatments. Before each treatment, the face was cleansed with micellar water. Mechanical exfoliation was performed for 10 minutes using a vacuum of 20 cmHg. After microdermabrasion, the mixture of cosmetic acids was applied for 3.5 minutes. After the time had elapsed, a neutralizer was used, which was then washed off with cool water. After removing the acid from the treated area, the skin was toned and a cream with an SPF 50 filter was applied. The study was conducted between February 2021 and May 2021 at Opole University in Poland.

Participant

The participant was a 21-year-old female with acne vulgaris and increased sebum secretion. The patient had been suffering from acne vulgaris for 7 years.

Inclusion criteria

The patient met the inclusion criteria for the study including an age of 19–21 years, no comorbidities, no competitive sports, no dermatological treatments within last 12 months, no current hormonal contraception, and mild-to-moderate acne as measured by the global acne severity scale (GAGS).

Exclusion criteria

Exclusion criteria for this study were active inflammation of the skin, disturbed skin condition, bacterial, viral, allergic and fungal infections, actinomyces, numerous telangiectasia, skin diseases,

psoriasis, eczema, skin cancers, numerous melanocytic nevi, oral antibiotic pills taken within the previous three months, oral isotretinoin within the previous year, oral contraceptive pill use, pregnancy and breastfeeding.

Ethical considerations

This study was approved by the Human Research Ethics Committee of the Opole Medical School (KB/54/NOZ/2019), according to the principles of the Declaration of Helsinki. The participant was informed about the principles and purpose of the study, signed a voluntary written consent form, and was informed that she could withdraw from study at anytime without providing a reason.

Data sources/measurements

The participant was diagnosed with mild acne vulgaris (GAGS=18). The GAGS divides the body into areas (forehead, cheeks, nose) and assigns a factor to each area on the basis of size. The location and factors are: forehead – 2, right cheek – 2, left cheek – 2, nose – 1; chin – 1; chest and upper back – 3. Each type of lesion is also given a value depending on severity: no lesions=0, comedones=1, papules=2, pustules=3, and nodules=4. The score for each area (local score) is calculated using the following formula: Local score=Factor × Grade (0–4). The global score is the sum of local scores, and acne severity is graded using this metric: 1–18 is considered mild, 19–30 moderate, 31–38 severe, and >39 very severe [14].

Before the treatment and 30 days (Table 1) after the end of the treatment series, measurements were taken in the morning. The patient was asked to remove her face makeup and not to apply any skin care products the day before the measurements were taken. On the day of the measurement, any use of micellar water and cosmetic products were forbidden. The patient acclimated for 20 minutes in a room that was 22 °C and had a humidity between 40–50%. Measurements were made 1 cm above the left and right eyebrows, on both cheeks 5 cm from the nostril, on both nose petals, and on the chin 1 cm from the lower lip. The patient was informed that during the course of the research she was not allowed to use any other cosmetic procedures, the solarium, swimming pool or sauna. Oral supplementation with preparations that could reduce the amount of sebum produced were also forbidden. She was informed that a delicate micellar water along side cream with a SPF 50 filter should be used for home skin care. Matting and sebum regulating cosmetics were also forbidden during home skin care.

RESULTS

After applying a series of five cosmetic treatments using microdermabrasion and a mixture of cosmetic acids, there was a noticeable improvement in the skin parameters (Table 2) and a reduction in skin eruptions (Table 1). The GAGS score was reduced from 18 to 14. There was also a reduction of the amount of sebum on the surface of the epidermis between the eyebrows from 206 to 98 ($\mu\text{g}/\text{cm}^2$), on the chin from 178 to 112 $\mu\text{g}/\text{cm}^2$, on the right nose petal from 244 to 128 $\mu\text{g}/\text{cm}^2$, on the left nose petal from 225 to 158 $\mu\text{g}/\text{cm}^2$, on the right cheek from 183 to 114 $\mu\text{g}/\text{cm}^2$, and on the left cheek from 213 to 146 $\mu\text{g}/\text{cm}^2$.

Table 1. GAGS score before and after treatment.

GAGS score before the treatment	GAGS score 30 days after the end of last treatment
18	14

Table 2. Sebum levels before and after treatment.

Area of measurement	Sebum level before the treatment [$\mu\text{g}/\text{cm}^2$]	Sebum level 30 days after the end of the treatment [$\mu\text{g}/\text{cm}^2$]
Between the eyebrows	206	98
On the chin	178	112
Right nose petal	244	128
Left nose petal	225	158
Right cheek	183	114
Left cheek	213	146

DISCUSSION

Key results

The combined microdermabrasion and acid treatment is effective for individuals who struggle with acne vulgaris and oily skin.

Interpretation

The diamond microdermabrasion treatment has a positive effect on the condition of the patient's skin, regulating the level of secreted sebum, reducing the number of blackheads, and minimizing the risk of bacterial infection, a potential consequence of acne vulgaris. In addition, microdermabrasion stimulates fibroblasts to produce collagen and elastin, inducing repair processes in the skin, and preventing the negative effects of acne scars.

Chilicka et al. examined the influence of microdermabrasion on the general condition of the skin and concluded that diamond microdermabrasion results in improvements in skin elasticity and smoothness, a change in the extent of skin peeling, and, above all, a sharp decrease in the level of skin oiliness [10]. Dybaś et al. also reported a positive effect of diamond microdermabrasion on the general condition of the skin. In particular, a change in the level of skin oiliness was noted. Before the series of treatments, the skin was oily with clear zones of excessive sebum production and, after the treatments, the level of sebum decreased and the skin became dry. However, the study did not show a significant change in the level of epidermis hydration [12]. In contrast, Kmiec et al. reported that diamond microdermabrasion can affect the level of skin hydration. In this study, an examination was performed after a series of 6 treatments, and an increase in hydration was maintained up to two weeks after completion of the treatments [13].

Chemical exfoliation involves the application of chemical substances that are intended to accelerate cell renewal. The effects of these treatments are visible almost immediately and, depending on the concentration, the exfoliation may be more shallow or deeper. The long-term effects of chemical peels cause the skin to regenerate and produce new collagen. As a result, the skin becomes moisturized, and fine wrinkles and discoloration disappear [6,7].

Based on research conducted by Wasylewski, it can be concluded that lactobionic acid is perfect for supporting acne treatment, as it has antioxidant properties that combat free radicals. In addition, this acid has a moisturizing effect and creates a protective barrier on the skin surface. Another important aspect of the treatment of acne with lactobionic acid is the fact that it is used to regulate sebum secretion. The study by Wasylewski showed that this acid can be used throughout the year for vascular skin and with symptoms of acne, as it does not increase risk of discoloration. However, it was indicated that high UVA/UVB protection is recommended after each exfoliation treatment [6].

Kapuścinska et al. reported that pyruvic acid is well soluble in water, is neutralized under its influence, and causes superficial exfoliation of the skin. Thus, thanks to these properties, this acid aids in the penetration of active substances into the skin. This compound also induces a metabolic effect, acting both as a keratolytic and a comedolytic. Due to its antibacterial and sebostatic qualities, it is a very effective agent that reduces increased sebum production, hyperkeratosis, bacterial colonization, and hormonal disorders that can cause acne. Kapuścinska et al. recommend that the time between pyruvic acid treatments should be 10 to 14 days [7].

Surgiel-Gemza et al. have demonstrated that azelaic acid has multiple effects, including anti-inflammatory and antibacterial properties, reducing excessive keratinization and inhibiting the activity of the tyrosinase enzyme, which is of key importance in the process of melanogenesis, and prevents or reduces the occurrence of discoloration. This study also showed that azelaic acid has a 70–80% efficacy in anti-inflammatory action compared to placebo, and is more effective than metronidazole [8].

Many studies have assessed the impact of microdermabrasion on the condition of skin affected by common acne or on the elimination of acne-related scars. Chemabrasion improves acne skin quality, and is an effective treatment for scars and discoloration [6,7,10,12,17,18,19]. However, few studies have described the influence of combination therapies on the course of acne vulgaris.

While combined therapies are an effective treatment for acne vulgaris, other therapies are also available on the cosmetic market, and many studies have identified equally effective methods of fighting acne. One of these cosmetic methods is hydrogen purification, which was shown to be effective by Chilicka et al. Hydrogen purification significantly reduced the level of sebum, increased the level of skin hydration, and strengthened the skin's protective barrier. Despite the fact that the procedure is performed with water at pH 8–10, the pH of the skin does not change much [14]. Another effective therapy is the use of pulsed Intensive Pulsing Light (IPL). Studies have revealed that this method helps to reduce acne lesions, including pustules, blackheads and papules, and improves the quality of acne-affected skin [15]. A perfect supplemental therapy is the use of alkaline water. This treatment is safe and effective in the event of acne eruptions and excessive sebum secre-

tion. Chilicka et al. have shown a significant reduction in acne eruptions and the level of sebum with this treatment [16].

All of the above-mentioned treatments have a positive effect on the condition of acne-prone skin. However, it is worth noting that acne therapy should begin with a dermatological consultation, and all cosmetic procedures should be considered complementary and carried out in close cooperation with a dermatologist.

Study limitations

The results of the current research are promising. However, in the future, we plan to expand the study group to include a larger number of patients, including men. A placebo treatment can also be used, where a microdermabrasion treatment is performed and mineral water is used instead of acid.

Recommendations

We recommend this treatment for people suffering from acne vulgaris and an oily skin type. It is safe and cause no side effects.

CONCLUSIONS

Microdermabrasion and acid treatments are safe procedures to treat acne. The current treatment regimen reduced the amount of skin eruptions and sebum on the patient's face. It should be noted that this procedure cannot replace dermatological treatments and should be considered an adjunct therapy.

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Karolina Chilicka, PhD
Institute of Health Sciences,
University of Opole
ul. Katowicka 68
45-060 Opole, Poland
E-mail: karolina.chilicka@poczta.onet.pl

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