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The application of thermolysis and sonophoresis for vascular closure. Case report

Wykorzystanie termolizy oraz sonoforezy do zamykania naczyń krwionośnych. Opis przypadku

ABSTRACT

Modern skin care cosmetology provides an extensive array of techniques to enhance skin condition, particularly those related to dilated blood vessels.

The study aimed to assess the efficacy of combined therapy of thermolysis for occluding blood vessels and sonophoresis using ultrasound for skin regeneration and enhancement.

The conducted skin analyses indicated that the integration of these two procedures yields satisfactory outcomes in the management of erythema and in the occlusion of blood vessels.

Keywords: electrocoagulation, thermolysis, sonophoresis, ultrasound, vascular skin

STRESZCZENIE

Współczesna kosmetologia pielęgnacyjna oferuje szeroki zakres metod wspomagających poprawę kondycji skóry, również problemów związanych z rozszerzonymi naczyniami krwionośnymi.

Celem pracy była ocena skuteczności terapii łączonej: termolizy, wykorzystanej do zamknięcia i uszczelniania naczyń krwionośnych oraz sonoforezy z użyciem ultradźwięków na regenerację oraz poprawę stanu skóry.

Przeprowadzone analizy skóry wykazały, że połączenie tych dwóch metod daje zadowalające rezultaty w pielęgnacji skóry z problemem rumienia oraz w zamykaniu naczyń krwionośnych.

Słowa kluczowe: elektrokoagulacja, termoliza, sonoforeza, ultradźwięki, skóra naczyniowa

INTRODUCTION

Vascular skin is characterized by increased visibility of blood vessels, which manifest in telangiectasias and erythema of a temporary or permanent nature. In addition, these changes may be accompanied by itching and swelling of the skin, faster exfoliation of the epidermis, excessive reactivity of blood vessels to environmental factors such as exposure to the sun, wind or frost, and the effects of improper care. Vascular skin is usually thin, delicate, sensitive, and may be accompanied by cosmetic intolerance syndrome [1-4].

Dilated blood vessels can occur on stressed skin, as well as erythema resulting from excess adrenaline in the body. Consequently, in the case of sensitive or reactive skins, it may lead to the appearance of rosacea. These changes may also be the result of a genetic predisposition. Morover, cortisol is

implicated as an aggravating factor in various types of disease symptoms in rosacea, psoriasis, atopic dermatitis (AD) and acne vulgaris [1-5].

The most commonly used methods for reducing vascular problems include treatments using electric current, ultrasound, intense pulse light (IPL) and laser treatments. Cosmetic office treatments to improve vascular complexions also include a blue-filter irradiation lamp and low-energy light therapy (LED, *light emitting diode*) [1, 3, 4, 6].

The article discusses two techniques: electrocoagulation, which involves closing blood vessels using high-frequency current, and sonophoresis, which uses ultrasound waves to introduce active skin care ingredients deep into the skin.

Thermolysis

This effective therapeutic method uses high-frequency alternating current, allowing to achieve results in a short time. The mechanism of action is to generate a thermocoagulation effect, caused by raising the temperature of tissues to above 200°C. As a result of the heat, the lumen of a blood vessel is closed by permanently damaging its walls. The damaged structures are then resorbed by the circulatory and lymphatic systems, and the breakdown products are eliminated from the body. Small blood vessels usually close in one procedure, while larger ones may require a repetition. The procedure is carried out using a miniature probe made of surgical steel, the length of which is adjusted to the size of the vessel undergoing closure [4, 7, 8].

Sonophoresis

This treatment is based on the use of ultrasounds - the acoustic waves that generate vibrations in their area of influence. They are applied in several types of cosmetological treatments such as cavitation peeling, needle-free mesotherapy, non-surgical liposuction treatment, body contouring treatment, ultrasonic lifting, anti-cellulite treatment as well as sonophoresis. In cosmetology, ultrasound is most commonly used, with frequencies ranging from 750 kHz to 3 MHz and intensity of 0.5-2.0 W/cm² [1-3, 9].

Sonophoresis, using ultrasonic waves, supports the transport of active substances deep into the skin [1, 2]. The local effect of ultrasound waves, not only affects tissues by improving blood circulation, but it also increases the permeability of cell membranes and can affect the molecules of the cosmetic preparation facilitating absorption and better penetration of active ingredients [1, 3, 9]. The depth of penetration depends on the frequency of vibration, the power and the duration of the procedure [3, 10].

Both methods show high efficacy in reducing the number of dilated vessels and improving the overall condition of vascular skin.

MATERIAL AND METHODS

A 48-year-old woman approached the office with visible erythema and dilated blood vessels on her facial skin. Diagnosis consisted of visual and tactile examination and a cosmetic interview. Skin type, state and condition were assessed. Numerous telangiectasias of capillaries, known as spider veins, were found within the facial skin (Fig. 1). In addition, the client tended to experience erythema, redness of the skin with temperature changes, consumption of a hot meal/drink, contact with the sun or strong wind, and frost. The proband complained about a feeling of tension and mild itching after contact with water. To the touch, the skin was moderately elastic, not very tight and locally dry. On direct examination of the facial skin the characteristics for combination skin were found (depending on the zone, it is vascular, dry, shiny, delicate and sensitive). Vessels of intense color and thickness covered the cheeks and nose in significant numbers. Initially, they began to appear after the age of 35, gradually, in small amounts due to abnormal changes in the vascular system of the skin occurring with age. Neglect of skin care, use of inappropriate cosmetics and lack of support for blood vessels caused the weakened and sensitive vessels to gradually dilate.

It was challenging to distinctly determine which features were temporary and which were permanent. After a cosmetic interview, home care was found to be unsystematic, and cosmetics were inappropriately selected for the type of facial skin and its problems. After examining the skin, the client was advised to change her home care and take additional supplementation to strengthen her skin from within as well.

In order to close the dilated blood vessels, after ruling out contraindications, the woman was offered an electrocoagulation procedure based on the phenomenon of thermolysis. Three weeks before the first procedure, the woman began supplementing vitamin C, omega-3 acid and rutin to strengthen blood vessels. In addition, she increased her daily water intake from about 0.5 liters to almost 2.5 liters to ensure adequate hydration of the cells during regeneration. This enhanced the visibility of the therapeutic effects. Home skincare was evolved from a random, rudimentary approach to a regimen meticulously customised to address the specific demands of the skin. The daily care cosmetic line was created with ingredients that mitigate irritation and fortify blood vessels. The kit included:

- soothing skin cleansing oil, enriched with vitamin E, which formula was based on a complex of six natural oils: sweet almond, sunflower seed, grape seed, musk rose seed, borage seed and camellia oil;
- micellar water that gently cleanses vascular skin prone to irritation and redness. Active ingredients: horse chestnut extract, provitamin B5 (panthenol), natural moisturizing factor (NMF);

Fig. 1 Skin condition before treatments **Source**: Own archive

- an anti-wrinkle, soothing and redness-reducing day cream that contained: horse chestnut extract, ruscus spinosus extract, American cranberry extract, brown algae extract, hyaluronic acid, shea butter;
- a night cream with moisturizing, nourishing, stimulating skin cellular reconstruction, strengthening blood vessels properties, containing active ingredients: horse chestnut extract, ruscus spikensis extract, American cranberry extract, ginkgo biloba extract, acmelia (*Spilanthes acmella*) extract, shea butter;
- day and night repair concentrate, strengthening blood vessels, reducing the appearance of erythema on the skin, improving the process of epidermal protection. Active ingredients: troxerutin, acerola extract, hyaluronic acid, white lily extract, grape seed oil;
- protective day cream with sunscreen, containing a combination of organic filters that reflect and disperse UVA and UVB radiation, and a mineral filter that reduces the risk of allergic reactions and irritation. In addition, the cream contained vitamin E and troxerutin to reduce the formation of erythema.

After three weeks, a series of three thermolysis treatments, carried out at three-weeks intervals, began in order to close the dilated blood vessels on the face. After two weeks, due to the proper healing process of the skin, an ultrasound treatment was included in the therapy, which allowed the introduction of active ingredients tailored to the skin's individual needs. The client's skin regeneration proceeded smoothly and without side effects.

METHODOLOGY

Electrocoagulation

Treatments were performed on the cheek and nose areas, completing a series of three procedures at three-week intervals. In the treatment an electrocoagulator was used and a 3-mm-long needle recommended by the manufacturer for this type of procedure. The power of the device was set at 30%, and during the operation, the "large vessel" setting was selected as appropriate for the characteristics of the lesions to be treated. During the first treatment, the treated area included one cheek and half of the nose, since with the use of high-frequency alternating current, the duration of the procedure should not exceed 30 minutes (Fig. 2).

The second session focused on the other cheek and the other half of the nose (Fig. 3).

The third procedure allowed to close the remaining vessels on both cheeks and nose, which could not be closed previously (Fig. 4).

Before performing each of the three treatments, the procedure was as follows: disinfecting the station and equipment, washing hands and applying gloves, preparing products and the client for the treatment. After putting on a protective cap and securing clothing, the client proceeded to cleanse her face with a gentle micellar water, followed by skin toning with a mild tonic.

Local anesthesia was applied using a preparation containing lidocaine and prilocaine– local anesthetics of amide structure. The anesthetic cream was applied under the occlusion for 30

Fig. 2 The course of the first procedure of thermolysis of closing blood vessels by electrocoagulation a) before treatment, b) immediately after treatment, c) 3 days after treatment, d) after healing **Source**: Own archive

minutes, and then the skin was disinfected with a preparation suitable for this type of procedure.

The process of closing blood vessels took 30 minutes. After the procedure, the face was disinfected again and a cream was applied. For 24 hours, the client did not wash her face, only refreshed it with a gentle toner the day after the procedure. During the healing period, until scabs formed, the woman moisturised her face several times a day with SPF 50 cream, and used a soothing gel in the evening. After 4 days, she began using a series of daily home care products with soothing and erythema-reducing properties.

Immediately after each treatment, a significant swelling and redness were visible. The treated area was swollen, and "burned" areas could be noticed by the high temperature of the device. The woman felt pain during the treatment, and itching and tension on her face immediately after. After the first treatment, the proband felt a slight headache a few hours afterwards, which could be related to the features of the device used. During subsequent sessions, such symptoms no longer occurred. Recommendations before and after the treatment are shown in Table 1.

After completing a series of three treatments, a significant improvement in facial skin was observed. Most of the dilated blood vessels were reduced, and only mild pinking remained visible (Fig. 5). The woman rated the effects after the treatments highly, her self-esteem increased, and she also stopped using heavily covering foundation, as she no longer required it. However, she rated the pain during the procedure itself as very intense, and the healing process as long and clearly noticeable.

Table 1 Pre- and post-treatment recommendations

PRE-TREATMENT RECOMMENDATIONS	AFTER TREATMENT RECOMMENDATIONS
Do not moisturise the treatment area with self-tanner for 14 days	Apply UV sunscreen several times a day
Through one month do not perform cosmetological treatments such as chemical peels, microdermabrasion, etc.	Do not perform cosmetological treatments such as chemical peels, microdermabrasion, etc.
Do not tan the treatment area	Avoid sauna, pool for about 14 days
For 14 days, discontinue photosensitizing preparations and medications, creams with acids	Avoid direct contact of the treatment area with animals
	Avoid applying makeup for at least 24 hours after treatment.

Source: Own elaboration based on [7, 8]

Sonophoresis

The ultrasound (sonophoresis) treatment was performed between electrocoagulation vascular closure sessions, when the skin was sufficiently healed for the safety of the procedure. Six treatments were carried out on the face and neck area. The goal was to regenerate, nourish, hydrate, soothe and calm the skin, and gently brighten it.

Before performing each ultrasound treatment, the procedure was the same, that is: disinfection of the station, equipment, disinfection of hands, application of gloves, preparation of the station, cosmetics and thorough cleaning and preparation of the skin area to be treated. The treatment was performed in five steps.

1. Removing makeup with a gentle micellar gel containing squalene, trehalose, chia oil and witch hazel, D-panthenol and avocado oil.
2. Toning the skin with a gentle facial toner based on rose water, hyaluronic acid and witch hazel.
3. Performing sonophoresis procedure with an ultrasound head. The serum combined with ultrasound treatment gel was injected in circular motions. The working time of the device in each case was 15 minutes.
4. After the treatment, a cooling algae mask with vitamin C and rutin was applied.
5. Finally, a balancing and moisturizing cream was applied, rich in probiotics, prebiotics and lactic acid, beta-glucan, chia oil.

Immediately after each treatment, the facial skin was slightly brighten and smooth. The hydration, overall regeneration and improvement of the skin condition was noticed. These effects are presented in the Fig. 6 and 7.

After a series of six treatments a brightening of the face, general improvement in the condition and hydration of the skin were noticed, and the radiance and glowing appearance of the complexion was restored. The woman rated the treatments as very pleasant, relaxing and supportive of proper care for mature skin. She noticed that her skin became less oily daily (no longer shiny), was more resistant to external factors and irritation, and her makeup held up much better. These treatments, performed alternately with more invasive procedures, helped accelerate the skin's regeneration process.

DISCUSSION

The research study presented thermolysis as an effective method in closing dilated blood vessels on the face. A significant reduction in visible vessels was observed, while at the same time small side effects such as redness, swelling and scabs healed properly. Most of the vessels on the cheeks, nose and chin, were closed after just three series of treatment. Self-test analysis showed a great improvement on the face. In addition, the client indicated in the post-

Fig. 3 The course of the second vascular closure procedure by electrocoagulation a) before treatment, b) immediately after treatment, c) 3 days after treatment, d) after healing **Source**: Own archive

Fig. 4 The course of the third vascular closure procedure by electrocoagulation a) before treatment, b) immediately after treatment, c) 3 days after treatment, d) after healing **Source**: Own archive

Fig. 5 Comparison of the effect of treatments using an electrocoagulator to close vessels on the face after complete healing a) before, b) after, c) before, d) after
Source: Own archive

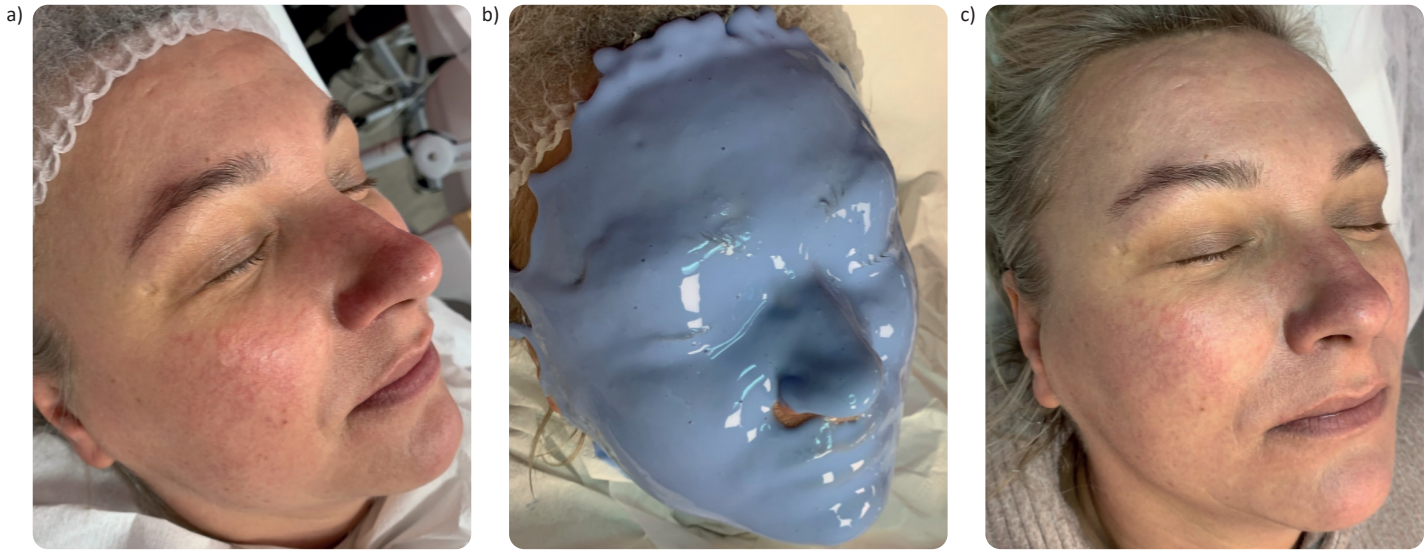

Fig. 6 The course of the first sonophoresis treatment a) before the treatment, b) mask applied during the treatment, c) immediately after the treatment **Source**: Own archive

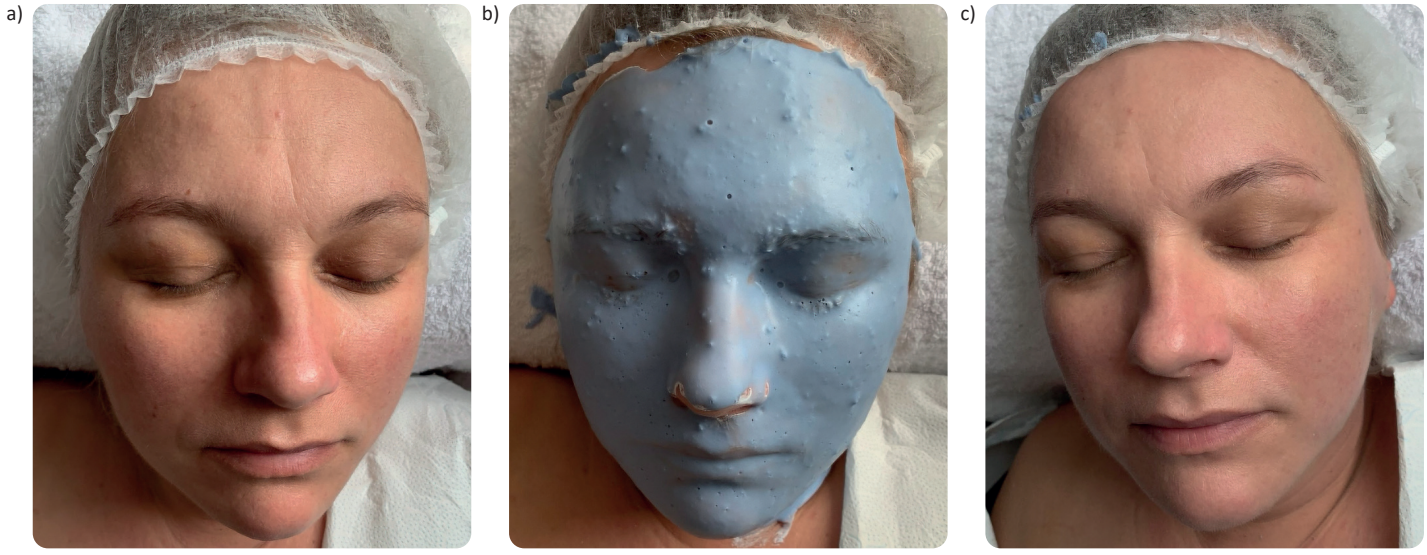

Fig. 7 The course of the sixth sonophoresis treatment a) before the treatment, b) mask applied during the treatment, c) immediately after the treatment **Source**: Own archive

treatment questionnaire an improved sense of well-being, increased comfort and high satisfaction with the results of the treatments performed. Scientific research confirmed the effectiveness of electrocoagulation thermolysis as a method of closing small blood vessels on the face, especially in the case of telangiectasias. The use of high-frequency current enables to precisely generate the thermocoagulation effect, leading to permanent closure of the vessel lumen. In clinical studies, traditional thermolysis were compared with more modern techniques such as lasers and IPL. Although laser therapy is now more commonly used, thermolysis is still an effective and economical alternative, especially for small lesions [11-13]. The literature also indicates that the effectiveness of thermolysis depends on precise application and the qualifications of the specialist performing the procedure. This method is particularly effective for small-diameter lesions, where satisfactory results are often obtained after the first treatment. Despite the development of new technologies, such as lasers for vessel sealing and erythema removal, thermolysis remains a valuable therapeutic tool in cosmetology and aesthetic medicine [4, 11-13]. Thermolysis is considered as a safe procedure, but it is not devoid of potential implications. Severe complications include burns and scarring, which may arise from inadequately performed procedures. Erythema and swelling are frequently noted immediately following the treatment [14].

The simultaneous application of sonophoresis facilitated skin regeneration and maintenance. The introduction of

active ingredients, such as vitamin C, hyaluronic acid and rutin, enabled to improve hydration, elasticity and brighten the skin. Sonophoresis treatments, rated as pleasant and relaxing, provided significant support for the treatment of vascular lesions, as confirmed by scientific results. Studies show that ultrasound increases the permeability of cell membranes, allowing deeper penetration of active substances resulting in more efective outcomes on the skin [1, 3, 15]. A study examining the impact of ultrasound on erythrocyte plasma membranes revealed an increase in permeability, which enhances the absorption of active substances. Moreover, sonophoresis is a technique that does not require thermal application, thus rendering it suitable for vascular and sensitive skin treatments [1, 3, 9].

CONCLUSIONS

1. Effective vascular skin care requires a thorough skin diagnosis, a detailed history (client chart), development of an individualized office therapy plan, implementation of home care recommendations and, if necessary, supplementation of therapy with supplementation.
2. Achieving lasting therapeutic results is possible due to cooperation between the cosmetologist and the client, regular monitoring of the progress of therapy and changing the recommendations depending on the results obtained.
3. The combination of therapeutic methods such as sonophoresis and electrocoagulation enables to achieve high treatment effectiveness. These techniques give satisfactory results in the process of closing blood vessels, reducing erythema, in improving the condition of the skin and high satisfaction with the treatment.
4. Despite being considered effective and safe, the electrocoagulation procedure can be associated with complications. Most often, they are the result of improper skin preparation or mistakes during the procedure. To minimize the risks, the procedure should be performed by specialists with the appropriate training, in-depth knowledge of the treatment technologies and experience in assessing and minimizing potential risks.

SUMMARY

A holistic approach to vascular skin care requires consideration of both the client's personality and skin problems. Accurate skin diagnosis, formulation of an in-office and home care regimen, and consideration of further interventions are essential. Maintaining optimal skin condition necessitates personalised care strategies. Optimal outcomes in the reduction of vascular lesions are attainable when the treating specialist comprehends the significance of a multi-faceted and multidisciplinary strategy to vascular skin issues, alongside effective collaboration between the cosmetologist and the client.

The study demonstrated that both sonophoresis and electrocoagulation are safe and effective treatments with significant therapeutic results. The integration of these two procedures yielded complete outcomes, encompassing the occlusion of the majority of visible blood vessels, enhancement of skin condition, and a high degree of patient satisfaction. The study's results confirm that a personalised approach to vascular skin care can considerably enhance both the aesthetics and functionality of the skin.

REFERENCES / LITERATURA

1. Krysiak-Zielonka I, Olga Kałużna O. Problemy cery naczyniowej – charakterystyka i niwelowanie zmian. *Kosmetologia Estetyczna*. 2019;8(4):427-432.
2. Goliszewska A, Gromek M, Padlewska K, et al. *Kosmetologia pielęgnacyjna*. Warszawa: Wyd. Wyższej Szkoły Zawodowej Kosmetyki i Pielęgnacji Zdrowia; 2014.
3. Janda K, Oliwia Lach O. Cera naczyniowa – przyczyny, pielęgnacja, leczenie. *Polski Przegląd Nauk o Zdrowiu*. 2014;1(38):48-54.
4. Zajączkowska W. Kosmetologia wobec problemów cery naczyniowej. https://violmedica.pl/publikacje/kosmetologia_wobec_problemow_cery_naczyniowej.pdf. Accessed 29.09.2024.
5. Prombonas M, Grdeń M. Nieinwazyjne terapie opóźniające procesy starzenia się skóry, *Kosmetologia Estetyczna*. 2016;5(4):399-402.
6. Placek W. *Dermatologia estetyczna*. Poznań. Termedia; 2016.
7. Pawlak M, Komendarczuk P. Elektrokoagulacja – czym jest, przebieg, zastosowanie, skutki uboczne. https://portal.abczdrowie.pl/elektrokoagulacja-przebieg-zastosowanie-przeciwwskazania. Accessed 18.04.2024.
8. Elektrokoagulacja. https://www.rubica.pl/---elektrokoagulacja_elektrokoagulator-rubica_105_144_1. Accessed.04.2024.
9. Wesołowska J, Iwan-Ziętek I, Mosiejczuk H, et al. Zastosowanie wybranych bodźców fizykalnych podczas profesjonalnych zabiegów kosmetologicznych. Część II. Fale ultradźwiękowe. *Pomeranian Journal of Life Sciences*. 2017;63(2):44-48.
10. Sobczyk A. Profesjonalna pielęgnacja cery dojrzałej w salonie kosmetycznym, in: Maciąg M, Maciąg K, eds. *Medyczne aspekty kosmetologii i dietetyki*. Lublin: Wydawnictwo Naukowe TYGIEL; 2018:39-52.
11. Rogóż M, Pulik A, Stasieńko-Tłuczek A. Charakterystyka i redukcja zmian naczyniowych występujących w obszarze twarzy. Cz. II. Zabiegi mało inwazyjne. *Kosmetologia Estetyczna*. 2017;6(4):399-403.
12. Zawodny P, Malec W, Gill K, et al. Assessment of the Effectiveness of Treatment of Vascular Lesions within the Facial Skin with a Laser with a Wavelength of 532 nm Based on Photographic Diagnostics with the Use of Polarized Light. *Sensors*. 2023;23(2):1010.
13. Gray M, Oakley A. *Facial red vein and vascular birthmark treatments*. Hamilton: Dermatologist; 1997.
14. Mlosek R, Malinowska S. Powikłania po zabiegach zamykania poszerzonych naczyń krwionośnych. *Kosmetologia Estetyczna*. 2016;5(4):421-424.
15. Sadowska A, Kamm A. Sposoby zapobiegania i niwelowania hiperpigmentacji skóry twarzy w gabinecie kosmetologicznym. Ocena aktualnego stanu wiedzy społeczeństwa. *Aesth Cosmetol Med*. 2020;9(4):363-382.

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