LATAŁA, Aleksandra, WĄS, Marcin, ZOZULA, Natalia, TOMCZEWSKA, Zuzanna, RYKUCKA, Aleksandra, KIEŁBASA, Justyna, KOWALCZYK, Agata, BIL, Katarzyna, ŚLESICKA, Iga, PRZESTRZELSKA, Magda and WINIARSKA, Natalia. The use of aesthetic medicine in the treatment of rosacea. Quality in Sport. 2024;21:54278. eISSN 2450-3118.
https://dx.doi.org/10.12775/QS.2024.21.54278
https://apcz.umk.pl/QS/article/view/54278

The journal has had 20 points in Ministry of Higher Education and Science of Poland parametric evaluation. Annex to the announcement of the Minister of Higher Education and Science of 05.01.2024. No. 32553.
Has a Journal's Unique Identifier: 201398. Scientific disciplines assigned: Economics and finance (Field of social sciences); Management and Quality Sciences (Field of social sciences).
Punkty Ministerialne z 2019 - aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 r. Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398.
Przypisane dyscypliny naukowe: Ekonomia i finanse (Dziedzina nauk społecznych); Nauki o zarządzaniu i jakości (Dziedzina nauk społecznych).

The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 13.08.2024. Revised: 25.08.2024. Accepted: 09.09.2024. Published: 10.09.2024.

The use of aesthetic medicine in the treatment of rosacea

Aleksandra Latała [AL]
District Medical Center in Grójec Piotra Skargi 10 street, 05-600 Grójec
Poland
https://orcid.org/0009-0007-1701-2728
aleksandra.latala10@gmail.com
Marcin Wąs [MW]
District Medical Center in Grójec Piotra Skargi 10 street, 05-600 Grójec
Poland
https://orcid.org/0009-0004-8645-0121
mos1@vp.pl
Natalia Zozula [NZ]
District Medical Center in Grójec Piotra Skargi 10 street, 05-600 Grójec
Poland
https://orcid.org/0009-0009-9741-5061
nataliazozula0@gmail.com
Zuzanna Tomczewska [ZT]
Provincial Specialist Hospital named after Blessed Father Jerzy Popiełuszko in Włocławek, Wieniecka 49, 87-800 Włocławek
Poland
https://orcid.org/0000-0002-4327-3311
ztomczewska@gmail.com
Aleksandra Rykucka [AR]
Rear Admiral Professor Wiesław Łasiński 7th Military Navy Hospital with Outpatient Clinic named after in Gdańsk Polanki 117 street, 80-305 Gdańsk Poland
https://orcid.org/0009-0003-0171-8647
aleksandra.rykucka@wp.pl

Justyna Kiełbasa [JK]
Independent Public Healthcare Complex in Pruszków 2/4 Armii Krajowej Avenue, 05-800 Pruszków
Poland
https://orcid.org/0009-0002-0616-7402
justynakielbasa1b@gmail.com
Agata Kowalczyk [AK]
Mazovian Specialized Hospital in Ostrołęka of Józef Psarski, Jana Pawła II 120A, 07-410 Ostrołęka
Poland
https://orcid.org/0009-0007-9497-0970
agata.kowalczyk95@gmail.com
Katarzyna Bil [KB]
Independent Public Specialist Western Hospital named after St John Paul II,
Daleka 11, 05-825 Grodzisk Mazowiecki
Poland
https://orcid.org/0009-0003-6518-1711
katarzynabil2503@gmail.com
Iga Ślesicka [IŚ]
Mazovian Specialized Hospital in Ostrołęka of Józef Psarski, Jana Pawła II 120A, 07-410 Ostrołęka
Poland
https://orcid.org/0000-0001-7282-4875
igaslesicka@gmail.com
Magda Przestrzelska [MP]
Faculty of Medicine Collegium Medicum Uniwersytet Kardynała Stefana Wyszyńskiego w Warszawie
Wóycickiego 1/3, 01-938 Warszawa
Poland
https://orcid.org/0009-0009-8688-7047
magda.przestrzelska123@gmail.com

Natalia Winiarska [NW]
Department of Methodology, Medical University of Warsaw
Banacha 1B st. 02-091 Warsaw
Poland
https://orcid.org/0009-0008-5951-0431
natalia.winiarska@hotmail.com

Abstract

Introduction and purpose:

Rosacea is a chronic inflammatory dermatosis. It mainly affects the central parts of the face and manifests itself with redness, erythema, telangiectasia, and papulopustular lesions. The aim of the work is to review current rosacea therapy techniques, detailing aesthetic medicine treatments.

Material and methods:
In order to create the review, the PubMed and Scopus databases were searched in April and May 2024. The searches took place between April 24 and May 15, 2024 and consisted of a critical analysis of the acquired sources of knowledge.
State of knowledge:
The introduction of lasers to the market has revolutionized the therapy of rosacea and appropriately selected parameters and patient qualification for the treatment ensure therapeutic success. Botulinum toxin is a potent neurotoxin that blocks the release of acetylcholine from the presynaptic vesicle. Appropriate home care is an extremely important factor in maintaining the disease in the remission phase.
Conclusion
Among the possibilities of aesthetic medicine, rosacea therapy is definitely dominated by laser therapy. There are several lasers available on the market today, the most commonly used of which is IPL. Ablative lasers are used to treat a deformed nose caused by rhinophyma. Botulinum toxin is administered as an intradermal injection, thanks to which it reduces erythema and redness of the skin. After appropriate treatment by a dermatologist and aesthetic medicine doctor, well-selected home care plays a key role in maintaining the disease in the remission phase.

Key words: rosacea, erythema, laser therapy, botulinum toxin

1. Introduction and purpose

Rosacea (Acne rosacea) is a chronic inflammatory dermatosis that occurs with periods of relapses and remissions. The prevalence of the disease in the general population is estimated at up to 10%. It most often affects adults aged 30-50, but it can occur at any age. Ocular rosacea can be seen in children as young as 22 months old [1]. However, this is very rare and most often occurs in patients with a family history. Rosacea is much more often recorded in people of Celtic origin with phototype I or II than in people of yellow or black race. However, in people with a darker phototype, the disease is often unrecognizable or incorrectly diagnosed as erythema or telangiectasia. There is controversy about the frequency of acne in

women and men. Some authors believe that more women are affected, but there are also reports that rosacea occurs in a similar frequency in both sexes. However, in men, a severe course in the form of hypertrophy of the nasal tissues - rhinophyma - is much more common [2, 3].

Rosacea mainly affects the central parts of the face - nose, chin, cheeks and forehead. It manifests itself with telangiectasia, redness, erythema, inflammatory papules, pustules and nodular lesions. There is also an ocular form - it causes inflammation of the conjunctiva, eyelids, cornea and telangiectasia of the eyelid edges[4,5].

To this day, the etiology of rosacea is not fully understood. There are several probable causes, which include infectious, genetic, immunological or environmental factors [6].

Recent advances in basic science research have highlighted the role of the innate and adaptive immune systems, as well as the neurovascular dysregulation underlying the spectrum of clinical features of rosacea. Endogenous and exogenous stimuli (such as temperature changes, physical exercise, ultraviolet radiation, spicy food, alcohol) may initiate and exacerbate skin lesions in patients with acne. Microorganisms also implicated in the pathophysiology of rosacea include Demodex species, Bacillus oleronius, Staphylococcus epidermidis, Helicobacter pylori, and Bartonella quintana [3,7,8].

Rosacea may also develop as a symptom of systemic diseases. Obesity, smoking and inflammatory bowel disease pose a significant risk of developing this disease [9]. In addition, metabolic, neurological, psychiatric disorders and some malignant tumors, medications and dietary elements also show a significant association with rosacea [2].

Due to the fact that rosacea occurs on the face, it has a negative impact on patients' well-being and quality of life. In addition to general skin care, there are several approved treatment options available, both topical and systemic. Therapeutic benefits also include laser therapy (several lasers are already on the market to help reduce erythema and redness), botulinum toxin and mesotherapy [10].

The aim of this study is to indicate the methods of treating rosacea according to the latest recommendations. Particular attention is paid to the possibilities of aesthetic medicine in this area and a holistic approach to the patient.

2. Material and methods

The main goal of evidence-based medicine is to use the best available scientific information for application in clinical practice. Interpreting and understanding scientific evidence requires analysis of available sources, with systematic reviews and meta-analyses of clinical trials at the top of the evidence pyramid. The process of analyzing available publications should be carefully planned and developed in order to obtain clinical studies that constitute the highest class of evidence [11].

Criticism of the source of knowledge is the research method used in this work. To create the review, the PubMed and Scopus databases were searched in April and May 2024. The search took place from April 24 to May 17. It involved a critical analysis of the acquired information sources. The phrases "rosacea", "rosacea treatment", "laserotherapy", "botulism toxin" were mainly used. The aim of the search was to find articles containing information on modern methods of treating rosacea, with particular emphasis on laser therapy. Time constraints regarding the publication date of research papers were not taken into account. The results were carefully analyzed and described in detail in the work.

3. State of knowledge

Rosacea therapy

Laser therapy

The introduction of lasers and intense light sources allowed for the effective use of such therapy in dermatology and aesthetic medicine to treat many vascular lesions, both congenital and acquired. Appropriate selection of parameters is the basis for a well-performed procedure.

Also, a wrong diagnosis or poor preparation of the patient for laser treatment increases the risk of side effects. This may result in scars, discoloration or increased pain [12].

Laser therapy and light therapy have been used with great success for years in the treatment of rosacea. He enjoys great therapeutic success and patient satisfaction with the results. These include intense pulsed light (IPL, 500–1200 nm), pulsed dye laser (PDL, 585–595 nm), potassium titanium phosphate laser (KTP, 532 nm) and long-pulse neodymium yttrium aluminum garnet laser (Nd:YAG, 1064 nm). Additionally, ablative lasers such as the erbium-yttrium-aluminum-garnet (Er:YAG) laser are useful in the treatment of rosacea. Light-based therapies are particularly effective in treating a variety of vascular lesions such as erythema, skin redness and telangiectasia [2].

IPL

Good effects in the treatment of erythematous lesions and telangiectasia have been described after irradiation using an IPL (Intense Pulsed Light) laser. The laser is extremely effective as monotherapy. It can also be combined with other treatments for erythematous telangiectatic acne and rosacea [7]. Over the years, its role in the treatment of redness, telangiectasia and persistent erythema has been successfully demonstrated. It stands out from other lasers by generating light pulses of various lengths. Produces an incoherent beam of light with a wavelength of 500 to 1200 nm using cut-off filters of 515, 550, 560, 570 and 590 nm for vascular lesions. The clinical effectiveness of the device can be improved by using longer wavelengths, which can penetrate much deeper into the tissue. The skin cooling effect can be achieved by dividing the energy into two or three pulses. The emitted light beam affects primarily pigmented lesions and dilated superficial blood vessels. The laser does not destroy the epidermis. Unfortunately, the procedure does not prevent the formation of new lesions, even though a significant part of the vessels is destroyed [2,13,7].

In addition, the IPL laser is effective in alleviating the symptoms of dry eye syndrome [13].

PDL

PDL is a laser that emits yellow light. The device uses rhodamine dye as the laser medium. Lesions eligible for PDL laser therapy include rosacea, port wine stains, telangiectasia,

hemangiomas, and spider angiomas [14,15]. Pulsed dye laser (PDL) is used to relieve both clinical symptoms and signs of rosacea. It generates a beam with a wavelength of 585–595 nm corresponding to the absorption peak of oxyhemoglobin directed to superficial vessels.

Both of these lasers (PDL and IPL) show similar effectiveness in reducing erythema, telangiectasia and other symptoms [2, 16,17].

KTP

The titanium-phosphate-potassium laser is quite effective in the treatment of telangiectasia in patients with rosacea. This laser interacts with surface chromophores, which is used in the treatment of various shallow vascular lesions. It generates green light with a wavelength of 532 nm, which is produced by transmitting Nd:YAG light through a KTP crystal, which reduces its wavelength by half. The PDL laser is more effective than the KTP laser in reducing telangiectasia, while the KTP laser treatment itself is less painful. The clinical improvement of the patient's condition after the KTP laser is comparable to IPL. The KTP laser causes greater tissue heating [2].

ND-Yag

The Nd-YAG laser generates a beam of 1064 nm, which can penetrate to a depth of 3–3.5 mm. It is most often used in the erythematous form with telangiectasia of rosacea. Large, deep skin vessels with a bluish tint seem to be particularly effective at reducing [2, 18, 7].

Ablative lasers

CO2 laser (10,600 nm) and erbium-yttrium-aluminum-garnet laser (Er:YAG, 2940 nm) are used to correct the deformed shape of the nose in rhinophyma. Treatment may be complicated by the appearance of crusts, swelling and erythema. The patient should be informed about the

risk of scarring and pigmentation disorders and possible delayed healing. A particular advantage of treatments using ablative lasers is the dry operating field, which helps in properly contouring distorted areas. This technique allows you to achieve satisfactory cosmetic results after just a few treatments [2,16,4].

Botulin toxin

Intradermal administration of botulinum toxin is a relatively new method of treating refractory facial erythema and redness in rosacea [19]. It is a strong neurotoxin produced by the bacterium Clostridium botulinum. It blocks the release of acetylcholine from the presynaptic vesicle. In addition to inhibiting acetylcholine secretion, botulinum toxin also modulates several other neuropeptides, including vasoactive intestinal peptide, substance P and calcitonin gene-related peptide. Acetylcholine and vasoactive intestinal peptide are the main mediators of redness and vasodilation, therefore inhibiting their secretion is the key task of botulinum toxin in rosacea therapy. However, the mechanism of action of botulinum toxin on the immune system in rosacea is still not fully understood [2,20].
Intradermal injections of botulinum toxin may be associated with complications such as bruising or slight pain. In addition, some patients may experience stiffness and limited activity of the facial muscles [19].

Mesotherapy

Occasionally, active substances are administered through the skin using mesotherapy techniques (intradermal microinjections) to alleviate the symptoms of rosacea. These treatments increase the penetration of active substances into the skin. Several substances have been studied so far, such as antifibrinolytics (tranexamic acid), antioxidants and angioprotectors (vitamin C), organic silica, amino acids and hyaluronic acid [21].

Skin care

An extremely important task of the doctor is not only to apply appropriate therapy in the acute phase of the disease, but also to select the correct care to use at home in order to maintain the disease in the remission phase. Detailed recommendations also concern lifestyle and an appropriate diet. The continuity and comprehensiveness of therapy significantly reduce the risk of relapses and, consequently improve the patient's comfort in everyday functioning.
Selecting appropriate home care turns out to be quite complicated due to poor tolerance of many active substances. The skin of rosacea patients is characterized by dryness, tendency to erythema and swelling, hypersensitivity and tendency to inflammatory reactions. Patients also complain of burning, burning and occasionally itching of the skin [22].

You should avoid using active ingredients that may cause skin irritation, such as acetone, benzyl alcohol, propylene glycol, butylene glycol and acids (alpha, beta-hydroxy acids) [23].

You should also eliminate the use of heating masks, products containing camphor, peppermint or eucalyptus oil. The use of chemical and mechanical peels is also not recommended due to the risk of disturbing the continuity of the stratum corneum [22].

Also, the application of waterproof cosmetics that can only be removed with irritating cleaning agents is not recommended.

The physiological pH of the stratum corneum is acidic (4–6), and inside the body it ranges from neutral to slightly alkaline (~7.4). Disturbance of the pH balance on the skin surface may result in inhibition of lipid processing and lead to dysbiosis, which promotes inflammatory diseases. Cleansing preparations with an increased pH may deprive the stratum corneum of essential ingredients, such as natural moisturizing factor, lipids and proteins [23].

An effective and safe skin cleanser is designed to remove impurities and harmful bacteria from the skin without disrupting or removing beneficial lipids, proteins that contribute to the integrity and proper functioning of the skin barrier.
For daily skin washing, we recommend gentle products dedicated to sensitive and vascular skin, mainly micellar fluids, that do not disturb the continuity of the lipid barrier. Thermal water can be used instead of tonic due to its gentle effect.

Patients with rosacea should avoid exposure to ultraviolet (UV) rays, therefore it is recommended to use daily creams with a filter protecting against UV radiation in the range of both A (320-400 nm) and B (280-320 nm), preferably containing protective silicones (dimethicone, cyclomethicone) or preferably two of these ingredients in combination. The above ingredients are added to soothe often irritated skin. During periods of intense sunlight (although you should remember to protect yourself all year round), you should use creams with the highest UV protection indicators, at least SPF 30 and higher [24-].

Vitamin C plays a key role because it has a protective and antioxidant effect and neutralizes free radicals. Additional advantages include brightening and anti-aging properties, as well as strengthening blood vessels and reducing rednes [21].
In the rosacea remission phase, products intended for the care of vascular skin containing antioxidant, moisturizing and anti-inflammatory substances are recommended, while during exacerbations, creams for sensitive and allergic skin should be used. For patients who experience discomfort in the form of dry skin, creams with a light consistency that are non-clogging, lipid-based and rebuilt the epidermal barrier are recommended.

In order to protect the eyes and alleviate symptoms, it is recommended to use physiological moisturizing drops and, above all, to use sunglasses with good-quality protective filters that inhibit both UVA and UVB radiation [21,25].

Another factor determining the maintenance of the disease in the phase of clinical remission is an appropriate lifestyle. The skin of people with rosacea is particularly sensitive to extreme temperatures and solar radiation. Therefore, they should avoid staying in the sauna, air-conditioned rooms and solariums. In winter, exacerbation of the symptoms of the disease may result from staying in sub-zero temperatures and cold winds for too long, as well as sudden changes in temperature. Erythema may also intensify during intense sports [26]. Therefore, during a physical examination of the patient, the circumstances and risk factors that may result in the exacerbation of the disease should always be identified, discussed with the patient and the elimination process initiated [22,7,25].

Drug treatment

The choice of topical agents is based on numerous factors, such as skin type, predominant signs and symptoms, mechanism of action, drug effectiveness and tolerability, and previous treatment.

Current topical therapies for rosacea include:

- Gel with azelaic acid (15%)
- Metronidazole (0.75% gel, cream and lotion and 1% cream and gel)
- Sodium sulfacetamide/sulfur (10%/5%) gel, cleanser, lotion, suspension and cream
- Brimonidine tartrate (0.33%) gel
- Oxymetazoline hydrochloride (1%), cream
- Ivermectin (1%), cream
- other topical medications such as calcineurin inhibitors (tacrolimus and pimecrolimus), benzoyl peroxide and topical antibiotics (clindamycin and erythromycin) are used as second-line medications [3,4,27,28].

Oral treatment includes the use of:

- tetracyclines
- macrolides (erythromycin, aziromycin, clarithromycin)
- isotretinoin
- metronidazole
- zinc [4,25,29,30].

4. Conclusions

Effective rosacea therapy is very important for patients due to the fact that the disease significantly reduces self-confidence and, consequently, quality of life. The disease cannot be cured, but with appropriate pharmacological treatment, aesthetic medicine treatments and recommended home care, dermatosis can be put into remission.

Dermatological treatment is selected individually depending on the stage of the disease, skin type and leading symptom. The most frequently used is external treatment using azelaic acid gel 15%, metronidazole in various forms (gels, creams and balms with various concentrations of the active substance are available), sodium/sulfur sulfacetamide, brimonidine tartrate,

oxymetazoline hydrochloride and ivermectin. Oral treatment usually involves taking antibiotics (tetracyclines, macrolides, metronidazole) and isotretinoin.

Among the possibilities of aesthetic medicine, rosacea therapy is definitely dominated by laser therapy. There are several lasers available on the market today. These are IPL (intense pulsed light) laser with a wavelength of 500-1200 nm, PDL (pulsed dye laser) 585-595 nm, KTP (potassium titanium phosphate laser) 532 nm and Nd:YAG (neodymium-yttrium-aluminum laser -navy blue with a long pulse) 1064 nm.

Ablative lasers are also used in rosacea therapy. CO2 laser (10,600nm) and erbium-yttrium-aluminum-garnet laser (Er:YAG, 2940nm) are used to treat a deformed nose caused by rhinophyma.

Botulinum toxin is a relatively new method used in rosacea. It is administered as an intradermal injection, thanks to which it reduces erythema and redness of the skin.

After appropriate treatment by a dermatologist and aesthetic medicine doctor, well-selected home care plays a key role in maintaining the disease in the remission phase. Irritating and drying cosmetics containing alcohol, propylene glycol or alpha/beta-hydroxy acids should be avoided because the natural hydrolipid barrier of the skin is easily damaged. Facial cleansers should be gentle and intended for sensitive skin. Moisturizing creams should have a light consistency, supporting the hydrolipid barrier of this skin that requires special attention.

Mechanical and chemical peelings are not recommended as they may disturb the continuity of the stratum corneum of the epidermis. Patients with rosacea should avoid exposure to ultraviolet (UV) radiation whenever possible, therefore the use of sunscreen creams (SPF min 30) is the basis for therapeutic success. Vitamin C in the form of serum has beneficial effects in reducing erythema and redness due to its antioxidant properties.

Disclosures

Author’scontribution:

Conceptualization: Aleksandra Latała, Marcin Wąs, Zuzanna Tomczewska

Methodology: Natalia Zozula

Software: Aleksandra Rykucka

Check: Justyna Kiełbasa, Magda Przestrzelska, Natalia Winiarska

Formal analysis: Iga Ślesicka, Magda Przestrzelska

Investigation: Katarzyna Bil, Agata Kowalczyk

Resources: Zuzanna Tomczewska

Data curation: Aleksandra Rykucka

Writing–rough preparation: Justyna Kiełbasa, Natalia Zozula

Writing–review and editing: Natalia Zozula, Agata Kowalczyk

Visualization: Katarzyna Bil

Supervision: Iga Ślesicka, Natalia Winiarska

Project administration: Aleksandra Latała, Marcin Wąs

All authors have read and agreed with the published version of the manuscript.

Funding Statement: This Research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflict of Interests: The authors declare no conflict of interest.

Acknowledgments: not applicable

References

1. Patel, Nikunj V; Gupta, Nidhi; Shetty, Rohit. Preferred practice patterns and review on rosacea. Indian Journal of Ophthalmology 71(4):p 1382-1390, April 2023.
doi: https://doi.org/10.4103/IJO.IJO_2983_22

2. Sharma A, Kroumpouzos G, Kassir M, Galadari H, Goren A, Grabbe S, Goldust M. Rosacea management: A comprehensive review.
First published: 01 February 2022
doi: https://doi.org/10.1111/jocd.14816

3. Kang C, Shah M, Tan J. Rosacea: An Update in Diagnosis, Classification and Management By STL Volume 26 Number 4 -August 1, 2021

4. Narbutt J, Skibińska M. Nowoczesne leczenie ogólne w dermatologii cz.2
PZWL Warszawa 2020 page 51-60

5. Searle T, Al-Niaimi F, R Ali F. Rosacea
First published: 21 February 2021
https://doi.org/10.12968/hmed.2020.0417

6. Buddenkotte J , Martin Steinhoff M. Recent advances in understanding and managing rosacea 2018 Dec 3:7:F1000 Faculty Rev-1885
doi: https://doi.org/10.12688/f1000research.16537.1

7. Rudnicka L, Olszewska M, RakowskaA, Sar-Pomian M.
Współczesna dermatologia 2 PZWL Warszawa 2022 page 29

8. Dopytalska K, Lipa K, Sobolewski P. Artykuł przeglądowy. Znaczenie Demodex folliculorum w dermatologii.
Dermatol Rev/Przegl Dermatol 2019, 106, 507-514 doi: https://doi.org/10.5114/dr.2019.89998

9. Yuan X, Yin D. Association between rosacea and smoking: A systematic review and meta-analysis. Dermatol Ther2021 Mar;34(2):e14747.
doi: https://doi.org/10.1111/dth.14747

10. Zuuren E, Arents B, Linden M, Vermeulen S, Fedorowicz Z. Rosacea: New Concepts in Classification and Treatment. Am J Clin Dermatol. 2021; 22(4): 457–465. Published online 2021 Mar 23.
doi: https://doi.org/10.1007/s40257-021-00595-7

11. Linares-Espinós E, Hernández V , Domínguez-Escrig J , Fernández-Pello S, Hevia V. Methodology of a systematic review. Actas Urol Esp (Engl EdP 2018 Oct;42) Epub 2018 May 3
doi: https://doi.org/10.1016/j.acuro.2018.01.010

12. Kwiek B, Walecka I, Kaszuba A, Borzęcki A. Artykuł specjalny Zastosowanie laserów w dermatologii. Rekomendacje Polskiego Towarzystwa Dermatologicznego. Część II. Leczenie zmian naczyniowych.Dermatol Rev/Przegl Dermatol 2022, 109, 165-184.
First published: 21 October 2022

13. WoźniackaA, Czuwara J, Krasowska D, Chlebus E. Trądzik różowaty. Rekomendacje diagnostyczno-terapeutyczne ekspertów Polskiego Towarzystwa Dermatologicznego. Część 1. Epidemiologia, klasyfikacja i obraz kliniczny Dermatol Rev/Przegl Dermatol 2022, 109, 101-121.
First published: 8 July 2022
doi: https://doi.org/10.5114/dr.2022.117981

14. Forbat E, Al-Niaimi F. Nonvascular uses of pulsed dye laser in clinical dermatology Epub 2019.
First published: 19 April 2019
doi: https://doi.org/10.1111/jocd.12924

15. Geng R, N Bourkas A, Sibbald G. Rosacea: Clinical Aspects and Treatments. Adv Skin Wound Care 2023 Dec 1;36(12):626-634.

doi: https://doi.org/10.1097/ASW.0000000000000065.

16. Paasch U, Zidane M, Baron J. S2k guideline: Laser therapy of the skin
First published: 13 September 2022
doi: https://doi.org/10.1111/ddg.14879

17. Tüzün Y, Wolf R, Kutlubay Z, Rosacea and rhinophyma. Clinics in Dermatology

Volume 32, Issue 1, January–February 2014, Pages 35-46
doi: https://doi.org/10.1016/j.clindermatol.2013.05.024

18. Bennardo L, Patruno C, Zappia E. Combination of Specific Vascular Lasers and Vascular Intense Pulsed Light Improves Facial Telangiectasias and Redness
Medicina 2022, 58(5), 651.
First published: 13 July 2022
doi: https://doi.org/10.3390/medicina58050651

19. He G , Yang Q, Wu J, Huang Y. Treating rosacea with botulism toxin: Protocol for a systematic review and meta-analysis.
First published: 21 August 2023 https://doi.org/10.1111/jocd.15962

20. Eun Choi J, Werbel T, Wang Z. Botulinum toxin blocks mast cells and prevents rosacea like inflammation. Dermatol Sci. 2019 Jan(1):58-64 doi: https://doi.org/10.1016/j.jdermsci.2018.12.004

21. Nowicka D, Skincare in Rosacea from the Cosmetologist's Perspective: A Narrative Review J. Clin. Med. 2023, *12*(1), 115
First published: 23 December 2022

22. Woźniacka A, Czuwara J, Krasowska D, Chlebus E. Trądzik różowaty – rekomendacje diagnostyczno-terapeutyczne Polskiego Towarzystwa Dermatologicznego. Część 2. Leczenie. Dermatol Rev/Przegląd Dermatol 2022, 109, 397-416.
First published: 21 April 2022
doi: https://doi.org/10.5114/dr.2022.126600

23. Baldwin H, Alexis A. Evidence of Barrier Deficiency in Rosacea and the Importance of Integrating OTC Skincare Products into Treatment Regimens, Published online March 16

24. Buddenkotte J. Recent advances in understanding and managing rosacea
First published online: 2018 Dec 3.
doi: https://doi.org/10.12688/f1000research.16537.1

25. Zalewska-Janowska A, Błaszczyk H. Dermatologia w gabinecie lekarza Podstawowej Opieki Zdrowotnej PZWL Warszawa 2023 page 202-207

26. S. Q. Geng R, N. Bourkas A, Mufti A. Rosacea: Pathogenesis and Therapeutic Correlates J Cutan Med Surg. 2024 Mar-Apr; 28(2): 178–189.
doi: https://doi.org/10.1177/12034754241229365

27. Thiboutot D, Anderson R, Cook-Bolden F, Draelos Z, L Gallo R, D Granstein G, Macsai M, Stein Gold L, Tan J. Standard management options for rosacea: The 2019 update by the National Rosacea Society Expert Committee J Am Acad Dermatol 2020 Jun;82(6):1501-1510.
https://doi.org/doi: 10.1016/j.jaad.2020.01.077.

28. Reszke R, Szepietowski J. Artykuł przeglądowy. Kwas azelainowy w lecznictwie dermatologicznym w świetle aktualnego stanu wiedzy.
Przegl Dermatol 2016, 103, 337–343
doi: https://doi.org/10.5114/dr.2016.61785

29. Placek W, Wolska H. Artykuł przeglądowy. Trądzik różowaty – aktualne poglądy na etiopatogenezę i leczenie. Przegl Dermatol 2016, 103, 387–399
doi: https://doi.org/10.5114/dr.2016.62891

30. W Marson J, E Baldwin H. Rosacea: a wholistic review and update from pathogenesis to diagnosis and therapy. Int J Dermatol2020 Jun;59(6):e175-e182.
doi: https://doi.org/10.1111/ijd.14757