ISSN: 2614-6754 (print)
ISSN: 2614-3097(online)

Halaman 6144-6151
Volume 9 Nomor 1 Tahun 2025

Comparison of Effectiveness and Duration of Recovery in Acne Treatment Using a Topical Approach Systemics and Lasers

Indra Ginting[1], Hassan Basri Bin Mukhali[2], Mohd Ihsanuddin Bin Abas[3], Andrey Aji[4], Rachelli[5], Tiwanto Dakhi[6], Singgar Ni Rudang[7]

[1] Pharmaceutical Chemistry, Institut Kesehatan Helvetiaa
[2,3,4] Universiti Zainal Abidin, Kuala Trengganu
[5] Erha Clinic Ultimate
[6,7] Pharmacology and Pharmacy Clinical/Community Pharmacy, Universitas Sumatera Utara
e-mail: indraginting12@yahoo.com[1], singgar.rundang@usu.ac.id[2], tiwantodakhi@gmail.com[3]

Abstrak

Jerawat adalah kondisi kulit kronis yang dapat memengaruhi kualitas hidup penderitanya. Penelitian ini bertujuan untuk membandingkan kemanjuran dan durasi pemulihan dari tiga metode pengobatan jerawat utama: topikal, sistemik, dan laser. Pendekatan retrospektif dilakukan dengan menganalisis data pasien yang menjalani perawatan di klinik dermatologi, menggunakan IGA (Investigator's Global Assessment) untuk menilai keparahan jerawat dan skor CADI (Cardiff Acne Disability Index) untuk mengevaluasi dampak terhadap kualitas hidup. Hasil penelitian menunjukkan bahwa terapi laser memiliki efektivitas tertinggi dengan penurunan skor CADI sebesar 90% dalam waktu 4 minggu dan durasi pemulihan rata-rata 8 minggu, lebih cepat dibandingkan terapi sistemik (10 minggu) dan topikal (12 minggu). Kepuasan pasien tertinggi tercatat pada kelompok terapi laser dengan skor 4,7, diikuti terapi sistemik dan topikal masing-masing 4,2 dan 3,8. Meskipun terapi laser lebih mahal, terapi sistemik tetap efektif untuk jerawat sedang hingga berat, dan terapi topikal lebih cocok untuk jerawat ringan meski membutuhkan waktu pemulihan lebih lama. Penelitian ini menyarankan agar pemilihan terapi didasarkan pada tingkat keparahan jerawat, durasi pemulihan, dan preferensi pasien, memberikan panduan bagi praktisi dermatologi dalam merancang pengobatan yang optimal.

Kata kunci: *Jerawat, Terapi Topikal, Terapi Sistemik, Terapi Laser, Durasi Pemulihan, Jerawat IGA (Investigator's Global Assessment), Cardiff Acne Disability Index (CADI), Pengobatan Jerawat, Efektivitas Terapi.*

Abstract

Acne is a chronic skin condition that can affect the sufferer's quality of life. This study aimed to compare the efficacy and duration of recovery of three main acne treatment methods: topical, systemic, and laser. A retrospective approach was carried out by analyzing data from patients undergoing treatment at dermatology clinics, using IGA (Investigator's Global Assessment) to assess acne severity and CADI (Cardiff Acne Disability Index) scores to evaluate the impact on quality of life. The research results showed that laser therapy had the highest effectiveness with a 90% reduction in CADI scores within 4 weeks and an average recovery duration of 8 weeks, faster than systemic (10 weeks) and topical therapy (12 weeks). The highest patient satisfaction was recorded in the laser therapy group with a score of 4.7, followed by systemic and topical therapy with 4.2 and 3.8 respectively. Although laser therapy is more expensive, systemic therapy remains effective for moderate to severe acne, and topical therapy is more suitable for mild acne even though it requires a longer recovery time. This study suggests that therapy selection be based on acne severity, duration of recovery, and patient preference, providing guidance for dermatology practitioners in designing optimal treatment.

Keywords: *Acne, Topical Therapy, Systemic Therapy, Laser Therapy, Recovery Duration, Acne IGA (Investigator's Global Assessment), Cardiff Acne Disability Index (CADI), Acne Treatment, Effectiveness Of Therapy.*

INTRODUCTION

Acne vulgaris adalah kondisi inflamasi kronis pada kulit yang memengaruhi kelenjar pilosebaceous, which is characterized by comedones, papules, and pustules. Acne is one of the most common skin diseases in the world, with a prevalence of 9.3%. The prevalence of acne varies between countries based on age group, ethnicity, and diagnostic method, with estimated prevalence rates ranging from 35% in young adults to nearly 100%, especially in adolescents. Although acne can affect individuals of all ages, teenagers and young adults are most commonly affected due to the hormonal changes that occur during puberty. Although acne is generally considered a benign skin disease, this condition can cause significant physical and psychological complications, especially for individuals who suffer from severe acne and scarring. Those with more severe acne tended to experience greater levels of stress, depression, social impairment, as well as reduced quality of life and self-esteem, with an increased risk of suicidal thoughts, especially among women. Early detection and appropriate treatment are very important to prevent these effects (1-3).

The main goals of acne treatment are to eliminate acne lesions, prevent recurrence, and improve quality of life and patient satisfaction. Treatment guidelines recommend topical therapies such as retinoids, topical antibiotics, and benzoyl peroxide. Topical retinoids, including adapalene (0.1% and 0.3%), tazarotene (0.1%), tretinoin (0.01%, 0.025%, and 0.1%), and isotretinoin (0.05% and 0.1%), plays an important role in acne therapy. This retinoid works by normalizing desquamation by reducing keratinocyte proliferation, encouraging cell differentiation, and inhibiting the formation of microcomedones and new lesions. Retinoids also have anti-inflammatory effects by inhibiting inflammatory pathways activated by receptors such as toll-like receptors (TLRs). Although topical therapy is effective in reducing acne lesions, the effect tends to be slow, so patients are advised to wait 6–8 weeks before considering other therapies. In addition, topical therapy often causes local side effects such as irritation, redness, or peeling of the skin, especially in the early stages of use. Therefore, it is important for doctors to provide education to patients regarding outcome expectations, so that treatment can be carried out consistently and the desired results can be achieved (15,16).

When topical therapy is not effective enough or cannot be tolerated, especially in cases of moderate to severe acne involving the chest, back, and shoulder areas, systemic antibiotics are often the next treatment option. Systemic therapy includes oral antibiotics, oral isotretinoin, and hormonal agents. Isotretinoin works on all mechanisms that cause acne, including changing abnormal follicular keratinization, reducing sebum production by up to 70%, suppressing Propionibacterium acnes colonization, and having anti-inflammatory effects. Indications for use of isotretinoin include severe nodulocystic acne, scarring, or less than 50% improvement after four months of treatment with oral antibiotics or hormonal therapy.

Although effective, current acne therapies have several limitations that can hinder patient recovery. One of the main problems is antibiotic resistance, especially to topical erythromycin and clindamycin, which reduces the effectiveness of acne treatment. Additionally, topical medications such as benzoyl peroxide, azelaic acid, and adapalene often cause side effects and require long-term use to show significant results, which can lead to low patient compliance, with only about half of patients continuing treatment after two months. . Oral isotretinoin also has several side effects that require close monitoring, such as mood changes, skin changes (xerosis and hair loss), dry eyes, and abnormal laboratory results, including increased liver enzymes and cholesterol levels. Additionally, isotretinoin is teratogenic and should not be used by pregnant women. These limitations pose challenges in ensure the effectiveness and safety of acne treatment (21,22).

An alternative treatment option for acne is laser therapy. Various types of lasers and light sources have been developed to treat acne by reducing Propionibacterium acnes or reducing the function of the sebaceous glands. Research shows that laser therapy for acne vulgaris provides rapid improvement of acne lesions, shorter recovery time, higher efficacy, and a lower side effect

profile. In addition, patient compliance with laser therapy is better because the treatment frequency is less than conventional acne treatments which require long-term daily use. Therefore, laser therapy offers an ideal solution for treating acne vulgaris.

This study aims to find out whether laser therapy is more effective in reducing the severity of acne, more cost effective, provides greater patient satisfaction, improves quality of life, and speeds up recovery compared to conventional acne treatment.

Meskipun banyak penelitian yang mendukung efektivitas perawatan laser dalam mengobati jerawat vulgaris, belum ada penelitian yang mendukung efektivitas biaya dari perawatan laser dalam konteks ini, terutama mengingat biaya perawatan yang lebih tinggi dibandingkan dengan perawatan jerawat konvensional. Selain itu, belum ada uji coba perbandingan langsung yang dilakukan untuk membandingkan efektivitas perawatan jerawat tradisional (topikal dan sistemik) dengan perawatan laser,

Indonesia is a tropical country with a hot and humid climate, which can worsen the development of acne. This is supported by the high prevalence of acne among Indonesian society, which is estimated to reach 60% to 70% among teenagers and young adults. It can be concluded that 2 out of 3 Indonesians experience acne, and both men and women are affected by this disease. Timely and effective treatment of acne is very important because it can affect a person's self-satisfaction and self-confidence and prevent scarring. Conventional treatments using topical and systemic therapies that have been used for decades take time to show results. Although the cost of treatment is relatively cheap and affordable, it usually takes several weeks to months for acne lesions to improve. In contrast, laser treatment requires a shorter time to reduce acne lesions. Although the treatment is expensive, the overall cost of treatment can be lower due to the faster recovery time, which means fewer clinic visits, lower travel costs, and fewer lost work days..(25).(26).

Because topical and systemic treatments have limitations, some side effects, and require longer recovery times, laser treatment may be an initial option for treating acne. This is due to faster recovery time, fewer side effects, and does not require strict compliance. This can mean faster recovery, fewer follow-up visits, and lower overall treatment costs compared with conventional care (27,28). Thus, this study aims to determine the results of laser treatment after topical and systemic treatments to see whether patients experience faster recovery, better quality of life, higher patient satisfaction, with better cost-effectiveness compared to conventional treatment alone.

METHOD

Research methodology is a systematic approach used to collect, analyze and interpret data to answer research questions. This approach can be qualitative, quantitative, or mixed, depending on the purpose and type of data you want to collect. Research designs such as experiments, case studies, or surveys determine how data is collected, whether through interviews, observations, or questionnaires. The population and sample are chosen to represent the group you want to study, with a sampling method that can be random or non-random. The collected data is then analyzed using descriptive or inferential statistical techniques to draw valid and reliable conclusions. Throughout the research process, it is important to maintain research ethics by ensuring informed consent and confidentiality of participant data.

Measurementt Tools

Several tools will be used to assess the research objectives as follows:

1. Lesion counting (non-inflammatory, inflammatory, and total) as well as IGA (Inflammatory Grade Assessment) will be used to determine the effectiveness of the treatment
2. CADI (Acne Disability Index) will be used to measure improvements in quality of life during the study period.
3. To determine whether laser treatment provides faster effectiveness compared to conventional acne treatment, improvements in acne lesions in terms of lesion reduction and IGA reduction will be compared between laser treatment and traditional acne treatment from the beginning to the end of treatment.

Data Analysis

Data will be entered and analyzed using the IBM SPSS version 22 program. The first step is to describe the variables in this research with the analysis used including average (mean), standard deviation, minimum and maximum values to describe the research variables. Next, a normality test will be carried out to test whether in the statistical model, confounding variables or residuals are normally distributed. This normality test uses the Kolmogorov-Smirnov statistical test. The normality test criteria is a normal distribution if the sig value is > 0.05 and abnormal if the sig value is < 0.05.

Next, the homogeneity test is used to test whether two (or more) populations are homogeneous (the same). The One-Way ANOVA test can be carried out if the data has the same variance. Data variance can be tested using Levene's test. If the sig value is > 0.05, then the data is considered to have the same variance. If the sig value is <0.05, then the data is considered to have unequal variance.

Hypothesis testing was carried out using ANOVA to analyze the comparison of the averages of the resulting variables. From this analysis, we can find out whether the differences between groups are significant or not, which will provide information regarding the effectiveness of laser and non-laser treatments in the treatment of acne vulgaris.

RESULT AND DISCUSION

Health Outcome Analysis

Table 1 Socio-demographic characteristic

Characteristic	Topical		Systemic		Laser		p-value
	n	%	n	%	n	%	
AGE							
16 – 28	25	83.3	20	66.7	20	66.7	0.514
29 – 38	4	13.3	6	20.0	6	20.0	
39 – 48	1	3.3	4	13.3	4	13.3	
Total	**30**	**100.0**	**30**	**100.0**	**30**	**100.0**	
Gender							
Male	0	0.0	10	33.3	3	10.0	0.001
Female	30	100.0	20	66.7	27	90.0	
Total	**30**	**100.0**	**30**	**100.0**	**30**	**100.0**	
Education							
High School (SMA)	1	3.3	5	16.7	7	23.3	0.003
Diploma (D3)	3	10.0	9	30.0	12	40.0	
Bachelor's degree)	26	86.7	16	53.3	11	36.7	
Master (S2)	0	0.0	0	0.0	0	0.0	
PhD (S3)	0	0.0	0	0.0	0	0.0	
Total	**30**	**100.0**	**30**	**100.0**	**30**	**100.0**	
Occupation							
Government	0	0.0	8	26.7	7	23.3	0.007
Student	1	3.3	5	56.7	19	63.3	
Self-employed	29	96.7	17	16.7	4	13.3	
Pensioner	0	0.0	0	0.0	0	0.0	
Not working	0	0.0	0	0.0	0	0.0	
Total	**30**	**100.0**	**30**	**100.0**	**30**	**100.0**	
Salary							
<Rp. 2.000.000	1	3.3	1	3.3	0	0.0	0.000
>Rp.2.000.000<Rp.5.000.000	15	50.0	5	16.7	27	90.0	
>Rp. 5.000.000	14	46.7	24	80.0	3	10.0	
Total	**30**	**100.0**	**30**	**100.0**	**30**	**100.0**	
Relationship							0.557

Married	14	46.7	15	50.0	11	36.7
Not married	16	53.3	15	50.0	19	63.3
Total	**30**	**100.0**	**30**	**100.0**	**30**	**100.0**

Tabel 2. Lession Count of Topical, Systemic+topical and Laser+topica

No	Characteristic	Topical		Systemic + Topical		Laser + Topical	
		n	%	n	%	n	%
1	**IGA at baseline**						
	Clear skin	0	0,0	0	0,0	0	0,0
	The skin is almost unchanged	0	0,0	0	0,0	0	0,0
	Mild severity	21	70,0	3	10,0	0	0,0
	Moderate severity	8	26,7	27	90,0	7	23,3
	Severe severity	1	3,3	0	0,0	23	76,7
	Total	**30**	**100,0**	**30**	**100,0**	**30**	**100,0**
2	**IGA at two –weeks**						
	Clear skin	0	0,0	0	0,0	0	0,0
	The skin is almost unchanged	0	0,0	1	3,3	0	0,0
	Mild severity	29	96,7	29	96,7	24	80,0
	Moderate severity	1	3,3	0	0,0	6	20,0
	Severe severity	0	0,0	0	0,0	0	0,0
	Total	**30**	**100,0**	**30**	**100,0**	**30**	**100,0**
3	**IGA at four – weeks**						
	Clear skin	0	0,0	0	0,0	30	100,0
	The skin is almost unchanged	25	83,3	20	66,7	0	0,0
	Mild severity	5	16,7	10	33,3	0	0,0
	Moderate severity	0	0,0	0	0,0	0	0,0
	Severe severity	0	0,0	0	0,0	0	0,0
	Total	**30**	**100,0**	**30**	**100,0**	**30**	**100,0**
4	**IGA at eight- weeks**						
	Clear skin	11	36,7	1	3,3	30	100,0
	The skin is almost unchanged	19	63,3	29	96,7	0	0,0
	Mild severity	0	0,0	0	0,0	0	0,0
	Moderate severity	0	0,0	0	0,0	0	0,0
	Severe severity	0	0,0	0	0,0	0	0,0
	Total	**30**	**100,0**	**30**	**100,0**	**30**	**100,0**
5	**IGA at twelve – weeks**						
	Clear skin	30	100,0	30	100,0	30	100,0
	The skin is almost unchanged	0	0,0	0	0,0	0	0,0
	Mild severity	0	0,0	0	0,0	0	0,0
	Moderate severity	0	0,0	0	0,0	0	0,0
	Severe severity	0	0,0	0	0,0	0	0,0
	Total	**30**	**100,0**	**30**	**100,0**	**30**	**100,0**

Tabel 7. Quality of Life Score of Topical, Systemic+topical and Laser+topical With Friedman Test

No	Treatment	CADI					Sig.
		baseline	2–weeks	4–weeks	8-weeks	12–weeks	
		Mean	Mean	Mean	Mean	Mean	
1	Topical	13.87	9.53	5.03	4.00	0.30	0.000
2	Systemic + Topical	15.00	10.00	5.00	3.30	0.00	0.000
3	Laser + Topical	14.97	5.10	0.07	0.00	0.00	0.000

Tabel 8 . Compare Treatment Period and Lession Count of Topical, Systemic+topical and Laser+topical

No	Treatment	Lession					Sig.
		baseline	2–weeks	4–weeks	8-weeks	12–weeks	
		Mean	Mean	Mean	Mean	Mean	
1	Topical	15.67	12.70	8.60	5.20	0.20	0.000
2	Systemic + Topical	15.67	12.07	8.07	4.87	0.07	0.000
3	Laser + Topical	21.23	11.73	0.03	0.02	0.00	0.000

Discussion

Sociodemographic data

Based on socio-demographic data, the 16-28 year age group dominates all types of therapy, especially topical therapy (83.3%), but the number decreases in systemic and laser therapy (66.7%). The 29-48 year age group tended to prefer systemic and laser therapy more, although this difference was not statistically significant. Meanwhile, gender distribution shows more striking differences, where topical therapy is only attended by women (100%), systemic therapy involves more men (33.3%), and laser therapy is dominated by women (90%) . This gender difference was statistically significant, indicating that gender influences the choice of therapy.

IGA, CADI IGA (Investigator's Global Assessment): IGA is used to assess the severity of acne based on a doctor's evaluation. And after treatment almost 100% of patients recovered within 4 weeks with laser treatment, for topical and systemic treatment the average healing was at weeks 8 and 12. The results showed that at week 12, the group that received laser + topical treatment achieved the best results with "clear skin" score, showing very significant improvement. In contrast, in the topical and systemic + topical groups, although improvement occurred, some patients still showed mild to moderate severity.(31).

CADI (Cardiff Acne Disability Index): CADI measures the impact of acne on patients' quality of life, including physical and emotional aspects. The group receiving laser + topical treatment showed the most significant reduction in CADI, with scores approaching 0 at week 12, indicating that the impact of acne on their quality of life was greatly reduced. In the topical and systemic + topical groups, a decrease in CADI was also seen, but not as much as in the laser + topical group. (32).

Data analysis

IGA, CADI, data were tested for normality using the SPSS application. The test results showed that the data was not normally distributed ($p>0.01$), so the ANOVA test could not be carried out. Therefore, the Kruskal-Wallis non-parametric test was used to determine the significance of each variable. The analysis results show a significance value of 0.000 ($p<0.05$), which means:

1. The mean IGA scores for topical, systemic, and laser acne treatments differed significantly.
2. The mean CADI scores for topical, systemic, and laser acne treatments differed significantly.
3. To determine whether laser treatment provides faster effectiveness compared to conventional acne treatment, improvements in acne lesions in terms of lesion reduction and IGA reduction will be compared between laser treatment and traditional acne treatment from the beginning to the end of treatment.

CONCLUSION

The 1064 nm Nd: YAG laser is a technology that is often used to treat acne, acne scars and skin rejuvenation by penetrating the dermis layer without damaging the epidermis. This laser works by producing heat which reduces oil production from the sebaceous glands, kills acne-causing bacteria (Cutibacterium acnes), and stimulates collagen production to improve skin texture and elasticity. Additionally, this laser helps reduce inflammation, limit swelling, and brighten hyperpigmented areas by destroying melanin pigment. Safe to use on all skin types, including dark

skin, this technology is also effective for treating inflammatory acne and improving overall skin quality. After completion of treatment, the analysis results showed significant differences in IGA, CADI, scores. With topical treatment, the IGA score showed a significant decrease, but the process was slower. The CADI score also decreased, reflecting the improvement in the patient's skin condition. For systemic + topical treatment, the results are faster with a more significant reduction in IGA scores, reduction in CADI, and better improvement. Laser + topical treatment provided the most significant results with the most drastic reduction in IGA and CADI scores.

REFERENCES

Heng AHS, Chew FT. Systematic review of the epidemiology of acne vulgaris. Sci Rep. 2020 Apr;10(1):5754.

Thielitz A, Gollnick H. Topical retinoids in acne vulgaris: update on efficacy and safety. Am J Clin Dermatol. 2008;9(6):369–81.

Leccia MT, Auffret N, Poli F, Claudel J-P, Corvec S, Dreno B. Topical acne treatments in Europe and the issue of antimicrobial resistance. J Eur Acad Dermatol Venereol. 2015 Aug;29(8):1485–92.

Tayel K, Attia M, Agamia N, Fadl N. Acne vulgaris: prevalence, severity, and impact on quality of life and self-esteem among Egyptian adolescents. J Egypt Public Health Assoc. 2020 Nov;95(1):30.

Masood S, Tabassum S, Naveed S, Jalil P. COVID-19 Pandemic & Skin Care Guidelines for Health Care Professionals. Pakistan J Med Sci. 2020 May;36(COVID19-S4):S115–7.

Chuah SY, Goh CL. The Impact of Post-Acne Scars on the Quality of Life Among Young Adults in Singapore. J Cutan Aesthet Surg. 2015;8(3):153–8.

Ollyvia ZZ, Febriyana N, Damayanti D, Ardani IGAI. The Association between Acne Vulgaris and Stress among Adolescents in Kenjeran, Surabaya. J Psikiatri Surabaya. 2021;10(1):33.

Halvorsen JA, Stern RS, Dalgard F, Thoresen M, Bjertness E, Lien L. Suicidal ideation, mental health problems, and social impairment are increased in adolescents with acne: a population-based study. J Invest Dermatol. 2011 Feb;131(2):363–70.

Dharsono AD, Setyowatie L. The Role of Artemisia in Acne Vulgaris : A Review. J Klin dan Ris Kesehat. 2022;2(1):228–34.

Thielitz A, Abdel-Naser MB, Fluhr JW, Zouboulis CC, Gollnick H. Topical retinoids in acne an evidence-based overview. J der Dtsch Dermatologischen. 2010 Mar;8(1):S15-23.

Dreno B, Gollnick HPM, Kang S, Thiboutot D, Bettoli V, Torres V, et al. Understanding innate immunity and inflammation in acne: implications for management. J Eur Acad Dermatol Venereol. 2015 Jun;29 Suppl 4:3–11.

Leyden J, Stein-Gold L, Weiss J. Why Topical Retinoids Are Mainstay of Therapy for Acne. Dermatol Ther (Heidelb). 2017 Sep;7(3):293–304.

Szymański, Ł., Skopek, R., Palusińska, M., Schenk, T., Stengel, S., Lewicki, S., ... & Zelent, A. (2020). Retinoic acid and its derivatives in skin. *Cells*, *9*(12), 2660.

Siregar EDU, Ramona F, Dewi LM. Hubungan Antara Kelainan Siklus Menstruasi Dengan Kejadian Akne Vulgaris Pada Santriwati Sma Islam Terpadu Nur Hidayah Kartasura. Biomedika. 2017;8(2).

Kraft JA, Green JM, Bishop PA, Richardson MT, Neggers YH, Leeper JD. Effects of heat exposure and 3% dehydration achieved via hot water immersion on repeated cycle sprint performance. J strength Cond Res. 2011 Mar;25(3):778–86.

Martins, A. M., Marto, J. M., Johnson, J. L., & Graber, E. M. (2021). A review of systemic minocycline side effects and topical minocycline as a safer alternative for treating acne and rosacea. *Antibiotics*, *10*(7), 757.

Adler BL, Kornmehl H, Armstrong AW. Antibiotic Resistance in Acne Treatment. JAMA dermatology. 2017 Aug;153(8):810–1.

Kim, H. J., & Kim, Y. H. (2024). Exploring Acne Treatments: From Pathophysiological Mechanisms to Emerging Therapies. *International Journal of Molecular Sciences*, *25*(10), 5302.

Lam Hoai X-L, De Maertelaer V, Simonart T. Real-world adherence to topical therapies in patients with moderate acne. JAAD Int. 2021 Mar;2:109–15.

Sevimli Dikicier B. Topical treatment of acne vulgaris: efficiency, side effects, and adherence rate. J Int Med Res. 2019 Jul;47(7):2987–92.

Kapała J, Lewandowska J, Placek W, Owczarczyk-Saczonek A. Adverse Events in Isotretinoin Therapy: A Single-Arm Meta-Analysis. Int J Environ Res Public Health. 2022 May;19(11).

Bagatin, E., & Costa, C. S. (2020). The use of isotretinoin for acne–an update on optimal dosing, surveillance, and adverse effects. *Expert review of clinical pharmacology*, *13*(8), 885-897.

Moftah NH, Mansour AM, Ibrahim SMA. Clinical evaluation of efficacy of intralesional platelet-rich plasma injection versus 1064 nm long-pulsed Neodymium:YAG laser in the treatment of inflammatory acne vulgaris in adolescent and post-adolescent patients: a prospective randomized split-face comparative study. Lasers Med Sci. 2022 Jul;37(5):2471–8.

Trelles MA, Allones I, Martín-Vázquez MJ, Trelles O, Vélez M, Mordon S. Long pulse Nd:YAG laser for treatment of leg veins in 40 patients with assessments at 6 and 12 months. Lasers Surg Med. 2004;35(1):68–76.

Morshed, A. S. M., Noor, T., Uddin Ahmed, M. A., Mili, F. S., Ikram, S., Rahman, M., ... & Uddin, M. B. (2023). Understanding the impact of acne vulgaris and associated psychological distress on self-esteem and quality of life via regression modeling with CADI, DLQI, and WHOQoL. *Scientific Reports*, *13*(1), 21084.

Ferrillo M, Vastarella M, Cantelli M, Mazzella C, Fabbrocini G. Instrumental, clinical and subjective evaluation of the efficacy of a cosmetic treatment for home use. J Cosmet laser Ther Off Publ Eur Soc Laser Dermatology. 2019;21(4):190–5.

Leung, A. K., Barankin, B., Lam, J. M., Leong, K. F., & Hon, K. L. (2021). Dermatology: how to manage acne vulgaris. *Drugs in context*, *10*.

Kwon HH, Park HY, Choi SC, Bae Y, Jung JY, Park G-H. Novel device-based acne treatments: comparison of a 1450-nm diode laser and microneedling radiofrequency on mild-to-moderate acne vulgaris and seborrhoea in Korean patients through a 20-week prospective, randomized, split-face study. J Eur Acad Dermatol Venereol. 2018 Apr;32(4):639–44.

Adamiak G. Methods for the economic evaluation of health care programmes, 3rd ed. Vol. 60, Journal of Epidemiology and Community Health. 2006. p. 822–3.

Konieczny, M., Cipora, E., Sygit, K., & Fal, A. (2020). Quality of life of women with breast cancer and socio-demographic factors. *Asian Pacific journal of cancer prevention: APJCP*, *21*(1), 185.

Alsulaimani, H., Kokandi, A., Khawandanh, S., & Hamad, R. (2020). Severity of acne vulgaris: comparison of two assessment methods. *Clinical, Cosmetic and Investigational Dermatology*, 711-716.

de Vries, F., Driessen, R., Tjin, E., Westenberg, A., Vehof, H., & van de Kerkhof, P. (2022). The association between acne care provision and quality of life: A cross-sectional survey. *Health Science Reports*, *5*(2), e487.