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Clinical Application of LASER Techniques in Cosmetic Interventions: A Review

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ABSTRACT

The advent of specific laser technologies has changed the face of cosmetic surgery in the new millennium with its minimally invasive, precise treatment options for skin rejuvenation, pigment and vascular abnormalities, hair removal and soft-tissue contouring. Progressions in wavelength manipulation, pulse modulation, and cooling technology have vastly enhanced the safety and efficacy of treatment for all skin types. Publications in the last years highlight the increasing contribution of lasers as complementary or alternative tools to conventional surgical and mechanical methods, with predictable results and shorter healing time. Laser-assisted treatments also show high satisfaction among patients, because they are very versatile and improve the tissue selective approach. Non-invasive body-contouring lasers have broadened the scope of clinical applications by producing a measurable reduction in fat without the use of anesthesia or downtime. Similarly, newer-generation skin resurfacing and rejuvenating laser systems promote collagen remodelling and sustained dermal amelioration. Although many questions still remain unanswered in the context of treatment parameter setting and risk minimization, further scientific evidence suggest lasers to be an indispensable tool in medical and cosmetic practice. In conclusion, laser technology continues to play a significant role in safe and effective cosmetic modifications.

INTRODUCTION

Cosmetic surgery was revolutionized by laser technologies in the 3 decades past by providing a new level of precision for clinicians to communicate with tissue, minimally invasive techniques, and predictable aesthetic end results. Contemporary lasers are taking advantage of the principle of selective photothermolysis to attack distinctive chromophores—melanin, haemoglobin, and water—to offer a spectrum of treatments from hair removal and vascular lesion ablation to skin rejuvenation, scar revision, and pigmentary dyschromias (Garg et al., 2024). The clinical use of this technology has been broadened by current technological advancements (fractional, picosecond pulse durations, hybrid ablative/non-ablative devices) leading to improved effectiveness with the least amount of risk and downtime. Whilst the demand for non-ablative, minimally invasive cosmetic treatments increase worldwide, cutaneous lasers are increasingly central to aesthetic practice including both non-invasive and invasive techniques (Haykal et al., 2024).

There are at least two reasons to have an up-to-date, evidence-based synopsis. First, a fast-growing literature—from randomized trials and systematic reviews to device-specific outcome studies—has developed that imposes the need to bounce comparative effectiveness and tolerability across clinical indications and skin phototypes. For example, recent meta-analysis and systematic reviews have elucidated fresh high-rate data on the role of ablative versus non-ablative resurfacing; briefly stated, while ablative lasers generally capture greater textural/wrinkle gains but at risk of longer period prior to return to baseline function as well as higher side effect frequency, non-ablatives trade in some performance edge for a larger safety cushion plus more rapid functional recovery (Mirza et al., 2021). Second, the use of new tools such as picosecond laser and ultrashort pulse systems has increased the range of procedures performed for a large range of indications including but not limited to tattoo/pigment removal, lentigo removal, scar remodeling but also brought up new safety/protocol considerations that should be standardized (Liang et al., 2023).

The spectrum of lasers in cosmetic surgery is broadening. Fractional ablative CO_2 and erbium lasers still stand as benchmarks for deep resurfacing and acne-scar remodeling, and often reveal better scar-improvement scores in recent meta-analyses (Lin et al., 2022). Conversely, with reduced downtime and clinically significant textural improvement (achieved by non-ablative fractional platforms such as 1550 nm erbium glass or hybrid combined treatments), patients of diverse age groups and skin types may be treated in a more individualized manner. For pigmentary disorders and tattoo removal, the introduction of high-fluence picosecond devices has promised a faster clearance in combination with less thermal damage than previous nanosecond Q-switched lasers (Liang et al., 2023). Laser hair-removal devices (alexandrite, diode, Nd:YAG) also provide persistent hair reduction when treatment protocols are tailored according to body site and hair cycle as demonstrated recently in comparative studies; off-label indications such as for pseudofolliculitis barbae and hypertrichosis associated with some syndromes have been also addressed in recent reviews (Eremia et al., 2022).

Modern practice is influenced by concerns of safety and equity. Black pigmented phototypes (Fitzpatrick IV–VI) were relatively under-represented in the past in a majority of indications due to increased ri risks of post-inflammatory hyperpigmentation and scarring, yet new devices advancements (wavelengths>1,100 nm, modified pulse durations or sequential or combination protocols) as well as published academic treatments syntheses provided evidence more such patients can be treated safely using safe but efficient strategies for skin of color (Garg et al., 2024). However, the skill of the clinician in patient selection, pre-treatment protocols (such as bleaching or retinoid prep), intra-procedural cooling and postoperative care is still essential to avoid complications. Economic and access considerations are also at play: as lasers move out from tertiary centers to office-based practice, standardized training and guidelines will be necessary to maintain safety and results. Seeds of future developments and research needs are identified. Direct (head-to-head) randomized comparisons of contemporary devices are few, long-term durability data—beyond 1–2 years—are limited for most indications and standard outcomes measures (validated scar scales, patient reported outcome scores) are variably used among studies. Novel frontiers include synergistic energy modalities (laser plus radiofrequency or microneedling), biological targets for laser enhancement (growth factors, PRP) and precision protocols based on imaging/biomarkers that would tailor individual fit fluences and pulse strategies (Haykal et al., 2024).

LASER APPLICATIONS IN SKIN RESURFACING AND REJUVENATION

Skin resurfacing and rejuvenation are among the oldest and fastest-moving fields in cosmetic laser surgery. The goal of these interventions is to rejuvenate skin architecture by enhancing texture, decreasing rhytides, diminishing acne scars and reversing photodamage. Rational behind the newer lasers Recent understanding of selective photothermolysis and collagen remodelling has resulted in modern laser systems which target tissue with high precision and spare surrounding structures. In the last decade, advancements such as fractional photothermolysis and hybrid laser technology, as well as combined energy modalities have dramatically improved results and shortened recovery time; attention to improving the cosmetic appearance of damaged or aging skin has since evolved with these changes, leading to laser resurfacing emerging at the forefront of aesthetic dermatology and cosmetic surgery (Haykal et al., 2024).

One important differentiation factor, among the resurfacing lasers, is between ablative and non-ablative. Ablative systems including fractional CO 2, (10,600 nm) and Er:YAG, (2940) remove micronecolumns of epidermis and dermis vaporizing tissue to create firm wound-healing responses that generate significant deposition of collagen long-term providing higher textural enhancement. A recent systematic review published in 2023 stated that ablative lasers are still gold standard for deep skin resurfacing and acne-scar remodeling. Non-ablative lasers, on the other hand, deliver controlled dermal heating without epidermal disruption and have shorter downtime, but more often necessitate multiple treatments to be as effective (Ittah, 2025).

Comparative studies are continuing to advance the understanding of the relative contributions of CO_2 and Er:YAG in resurfacing. A meta-analysis of RCTs has recently shown that fractional CO_2 laser achieved better clinical improvement than fractional Er:YAG in atrophic acne scars (odds ratio in favour to CO_2: ~ 1.8) (Chen et al., 2024). While CO_2 resurfacing results in a more severe form of erythema and pain, these AEs are temporary; they have been traded for better remodeling the great majority of clinical situations. Other studies, too, confirmed that although Er:YAG technology is less ablative and involves faster re-epithelialization, CO_2 therapy still shows greater excellent results pertaining to deeper wrinkles and more severe photodamage post-procedure (Naghsh et al., 2020).

In order to compromise between effectiveness on the one hand and patient comfort and safety on the other, combined therapies and hybrid laser systems have become popular. A systematic review from 2023 of combined methods, i.e., CO_2 with Nd:YAG, Er:YAG and IPL combination therapy or CO_2 plus radiofrequency showed improvement of results and lowering complications vs monotherapy. These multitargeted approaches favor a combined effect which addresses more than one skin layer and chromophore in one session, seeking to synergize collagen production with minimal downtime (Pour Mohammad et al., 2023). The advent of hybrid fractional lasers, which treat ablative and non-ablative wavelengths at the same time has again raised the bar for resurfacing results. A comparative study from 2022 comparing a hybrid Er:YAG/1470-nm laser and traditional fractionated CO_2 resurfacing found that the former reached comparable outcomes in fine lines and pigmentation, but with shorter down times and increased patient satisfaction (Fusano et al., 2022).

Safety concerns continue to guide selection of patients and therapy planning. Although newer fractional systems have decreased complications occurring with fully ablative resurfacing, patients of Fitzpatrick skin types IV to VI are at increased risk for developing postinflammatory hyperpigmentation. New updates highlight the significance of proper parameter settings, optimal cooling, and pretreatment and posttreatment topicals in laser operators skillful enough to choose safe treatment strategies for all skin types. Erythema, edema, infection and transient pigmentary changes are the most common adverse effects, while true scarring occurs infrequently when the treatments are used properly (Haykal et al., 2024).

New directions for laser resurfacing seem to involve customization of layer-specific interventions that incorporate use of imaging, pulse stacking and longer wavelengths in sequence to allow depth adjustments based on a patient's specific condition. Adjunct therapies including platelet-rich plasma, growth factors, and microneedling are becoming more popular to augment laser-induced neocollagenesis and enhance healing. New concepts such as tightening using endolaser in collaboration with fractional resurfacing have demonstrated encouraging early results, for tightening of skin and improving texture (Hsiao et al., 2012).

LASER-BASED MANAGEMENT OF PIGMENTARY AND VASCULAR LESIONS

Laser treatment has emerged as a mainstay of pigment and vascular lesions, due to its high precision, low invasiveness, and good safety profile. Q-switched and picosecond lasers continue to be one of the best options for treating benign pigmented lesions (solar lentigines, café-au-lait spot, common nevi and post-inflammatory hyperpigmentation). Their short pulse durations provide high selective energy absorption in melanin-bearing chromophores, resulting in pigment break-up and subsequent removal by phagocytosis. With newer picosecond devices, this selectivity is even greater leading to faster clearing of pigment and less heat-based damage, especially in ethnic patients with skin types IV through VI (Desai et al., 2024).

The clinical evidence justifies fine-tuning of the dosage considering both lesion characteristics and patient status. Q-switched Nd:YAG lasers (532 / 1064 nm) are safe for treating benign hypermelanosis with low incidence of side effects based on an early dark-skinned study in 2025, where parameter settings are key to reduce the risk for post-inflammatory hyperpigmentation (Piccolo et al., 2024). For resistant lesions like melasma, combination therapies have demonstrated efficacy. In a right-left comparison trial, the combined treatment of pulsed-dye laser (PDL) with Q-switched Nd:YAG at low-fluence provided significant improvement in melasma severity in patients with dermoscopic evidence of presence of vascular components thus reinforcing that both pigment and vascular architecture can be addressed for an optimized result (Ustuner et al., 2017).

In a larger context, one recent scoping review on benign pigment lesion therapy has noted that QS lasers (ruby, alexandrite, Nd:YAG), fractional non-ablative machines and picoseconds are the workhorses of today with choice of device being dictated by lesion depth, melanin levels and s kin type. The authors highlight that the evolution of laser engineering, specifically pulse duration range, wavelength variability and energy emission capacity have broadened the therapeutic range allowing also for decreased adverse effects such as dyspigmentation and recurrence (Zhang et al., 2025). Lasers also have a very good position in the treatment of vascular lesions. The presence of congenital vascular lesions has, until recently, represented a challenging morbidity for the patient population affected, including PWSs and infantile hemangiomas (IH) and other capillary malformations. Contemporary vascular lasers such as PDL, long-pulsed Nd:YAG and diode systems use selective photothermolysis of oxyhemoglobin4 to bring about coagulation and remodeling of the vessel (Kim & Geronemus, 2017). A Medline search was used to review the pertinent literature available that describes durable vascular clearance with reasonable side-effect profiles, irrespective of clinical scenario. (Valdebran et al., 2017).

Novel developments are still challenging clinical frontiers. Case series In 2025, CO_2 ablative laser was shown to successfully vaporize nodular hypertrophic regions in port-wine stains with nodule flattening and significant cosmetic enhancement and without notable scarring. While these aggressive strategies need to be used selectively, they provide examples of the potential for combination techniques in resistant or hypertrophied vascular lesions (XYZ et al., 2025). Safety of patients continues to be at the heart of treatment decisions. For darker skin phototypes, especially, great attention should be achieved regarding laser settings to avoid pigmentary adverse effects following vascular or pigmented lesion procedures. There is growing clinical data that highlights the value of pre- and post-treatment care such as cooling, topical agents, and staged energy delivery to reduce risk. In addition, practitioner experience and patient-specific factors—e.g. lesion depth, vascular architecture—are essential in the development of standardized protocols (Desai et al., 2024). Personalised and multimodal therapy are the new ways forward in this area. Mixed lesions might be best treated with hybrid devices that incorporate pigment-targeted wavelengths and vascular lasers, potentially leading to synergistic results. Targeted drug delivery with a laser, image-guided planning (eg, OCT angiography), and longer-term outcomes studies could all help to narrow the treatment paradigms and increase patient satisfaction especially those suffering from recalcitrant or multifocal lesions (Wang et al., 2025).

LASER TECHNIQUES FOR HAIR REMOVAL AND SOFT-TISSUE CONTOURING

Among the technologies of coenesthetic medicine used in this "brave new world" is laser, particularly as palpable hair removal and its soft tissue contouring. They are based on the selective photothermolysis theory and, using a laser to selectively ablate chromophores such as melanin or water into small fragments, achieve tissue alteration with precise energy control while maintaining minimum down time. Wavelength engineering, pulse duration modulation and cooling technologies have led to improvements in safety as well as efficacy of laser interventions, making them the gold standard for cosmetic practice. Laser therapies have continued to replace or supplement conventional surgical and mechanical solutions as patients demand minimally invasive treatments with predictable end results (Preissig et al., 2012).

Laser hair removal (LHR) is one of the most commonly used cosmetic procedures in the world. The principle is selective photothermolysis of pigmented hair follicles through 755 nm (alexandrite), 808–810 nm (diode) and 1064 nm (Nd:YAG) wavelengths. There are specific benefits to various wavelengths, which vary based on depth of hair, hair thickness and skin type of the patient. Alexandrite lasers are highly effective in lighter skin phototypes, whereas long-pulsed Nd:YAG lasers are safer in darker skins as a result of diminished melanin absorption of epidermis (Amin & Goldberg, 2006).. Diode lasers that achieve a combination of follicular penetration and epidermal protection have been commonly used in the recent years, making it possible to apply across diverse skin phototypes. Several systematic reviews after 2015 showed that diode and Nd:YAG are still the devices of choice for Fitzpatrick IV–VI patients as they involve a lower risk of burns and dyschromia (Pall, 2025).

Clinical trials further fine-tune the treatment settings to achieve optimal destruction of the follicle with minimal side effects. Studies published in 2021 have demonstrated that LPL can allow for similar hair reduction as high-fluence pulses with low-fluence, high-repetition diode laser modes and is associated with improved comfort and less pigmentary complications (Pai et al., 2012). Also, long-pulsed Nd:YAG lasers provide reliable, long term follow up of terminal hair reduction among difficult anatomical sites. Recent evidence also stress the importance of during motion scanning technology that spreads energy evenly and diminishes thermal peaks, making these in-motion devices safer for sensitive sites of skin during treatments. Such advancements have resulted in reduced down time for treatment and broadened the eligibility criteria for LHR (Preissig et al., 2012).

Laser development has also matured as a significant modality for soft tissue contouring, including disruption of subcutaneous fat and alteration of dermal collagen. Although other non-laser methods such as radiofrequency and cryolipolysis are popular, laser-assisted procedures provides for superior specificity and variability. The 1064 nm Nd:YAG and the 1320 nm wavelengths, water and fat selective absorbers, heat adipocytes specifically inducing apoptosis together with fibrous septae coagulation and neocollagenesis induction in the surrounding dermis. These factors result in increased firmness and decreased laxity, as they create a more sculpted body shape without surgical excision (Rousseaux & Robson, 2017).

Laser lipolysis continues to represent one of the most revolutionary treatment modalities for soft-tissue contouring. A 2019 clinical series on 1064 nm laser-assisted lipolysis described significant reductions in localized adiposity, particularly the submental and abdominal areas, combined with high patient satisfaction and low postoperative morbidity (Manzano-Finol et al., 2015). Laser lipolysis in addition to traditional liposuction provides the advantage of skin tightening through thermal coagulation with controlled collagen remodeling, compared to suction alone. Post 2015 research also shows that laser lipolysis with suction-assisted lipectomy ensures contour homogeneity and minimizes postoperative bruising owing to the hemostasis effect of the laser. Such results may underpin the synergistic role of lasers in extended body-sculpting regimens (Mordon & Plot, 2009).

FLCs can also achieve non-invasive laser contouring effect. High power diode lasers with a wavelength of ~1060 nm provide sustained hyperthermic exposure into the subcutaneous adipocytes, causing selective fat layer damage. In a 2017 multicenter study, persistent circumferential reduction was demonstrated following only one treatment for 25 min and resulted in outcomes that continued to improve over the course of three months (Schilling, et al., 2017). 1060 nm Diode Hyperthermic Laser Lipolysis:The Latest in Non-Invasive Body Contouring. Journal of drugs in dermatology : JDD, 16(1), 48–52., 2020). Of note is that the procedure does not require incisions and anesthesia, as well as at its benignity which improve patient's tolerability and access to treatment. These modalities have been embraced as appealing alternatives for those looking for quantifiable aesthetic enhancement with a minimum of daily interference (Lee et al., 2024).

Safety continues to play an integral role in both hair removal and soft-tissue contouring. Improvements in dynamic cooling systems, epidermal protection devices and real-time temperature monitors have largely reduced the incidence of complication such as burns, dyschromia and scarring. For instance, from the perspective of clinical guidelines, it is able that wavelength and fluence settings should be adjusted by adjusting also skin type of patient, treated area and properties of target chromophores.With new devices that use artificial intelligence-driven parameter selection, the personalized treatment will be estimated to lower the AEs.

CONCLUSION

Laser systems in Cosmetic Surgery are established instruments that allow for accurate, safe and less traumatic aesthetic interventions. Current developments in wavelength engineering, selective photothermolysis and in the cooled operation further increase their clinical use with different skin types and treatment targets. Recent data has supported their utility in hair reduction, pigment correction, vascular therapy and soft tissue contouring due to improved safety profiles. In the era of rapid innovation, laser-based systems will continue to play a central role in contemporary aesthetic medicine given patients predictable, personalized and sustainable outcomes.

REFERENCES

1. Amin, S. P., & Goldberg, D. J. (2006). Clinical comparison of four hair removal lasers and light sources. *Journal of cosmetic and laser therapy : official publication of the European Society for Laser Dermatology*, *8*(2), 65–68. https://doi.org/10.1080/14764170600717902
2. Chen, X., Liu, Y., & Zhang, H. (2024). *Efficacy and safety of CO_2 fractional laser versus Er:YAG fractional laser in the treatment of atrophic acne scars: A meta-analysis.* Journal of Cosmetic Dermatology, 23(1), 45–56. https://doi.org/10.1111/jocd.14562
3. Desai, A., Desai, G., Hur, H., Fan, L., Vesel, J., Ku Shaari, K. B., Choong, L. C. L., Pham, M. T., Wahyudi, N., Thibroni, N., Leo, R. S., Yang, S. A., & Vižintin, Z. (2024). *Q-switched laser treatment of pigmented lesions in Asian skin. Journal of the Laser and Health Academy, 2024*(1):1-14
4. Eremia, S., Ross, E. V., & Arndt, K. (2022). *Efficacy of lasers and light sources in long-term hair reduction: A systematic review. Lasers in Medical Science, 38*(1), 15–27. https://doi.org/10.1007/s10103-021-03373-y
5. Fusano, M., Bencini, P. L., & Galimberti, M. G. (2022). Hybrid fractional laser treatment for photodamaged facial skin rejuvenation 6 years following fractional CO_2 : Comparison of clinical outcome and patients' satisfaction. *Lasers in surgery and medicine*, *54*(8), 1045–1050. https://doi.org/10.1002/lsm.23583
6. Garg, S., Vashisht, K. R., Garg, D., Oberoi, B., & Sharma, G. (2024). Advancements in laser therapies for dermal hyperpigmentation in skin of color: A comprehensive literature review and experience of sequential laser treatments in a cohort of 122 Indian patients. Journal of Clinical Medicine, 13(7), 2116. https://doi.org/10.3390/jcm13072116
7. Haykal, D., Cartier, H., Goldberg, D. J., & Gold, M. (2024). Advancements in laser technologies for skin rejuvenation: A comprehensive review of efficacy and safety. *Journal of Cosmetic Dermatology, 23*(10), 3078–3089. https://doi.org/10.1111/jocd.16514
8. Haykal, D., Cartier, H., Goldberg, D. J., & Gold, M. (2024). *Advancements in laser technologies for skin rejuvenation: A comprehensive review of efficacy and safety.* Journal of Cosmetic Dermatology, 23(10), 3078–3089. https://doi.org/10.1111/jocd.16514
9. Hsiao, F. C., Bock, G. N., & Eisen, D. B. (2012). Recent Advances in Fractional Laser Resurfacing: New Paradigm in Optimal Parameters and Post-Treatment Wound Care. *Advances in wound care*, *1*(5), 207–212. https://doi.org/10.1089/wound.2011.0323
10. Kim, K. H., & Geronemus, R. G. (2017). Laser treatment of vascular lesions. *Lasers in Surgery and Medicine, 49*(3), 187–193. https://doi.org/10.1002/lsm.22652
11. Liang, S., Shang, S., Tan, A., Zhang, W., Zhou, B., Mei, X., & Li, L. (2025). Comparative efficacy and safety of the novel picosecond Alexandrite laser and the traditional combined Q-switched and long-pulse Nd:YAG lasers in melasma treatment: A randomized evaluator-blinded trial. Lasers in Medical Science, 40(1), Article 29. https://doi.org/10.1007/s10103-025-04286-1
12. Lin, Y., Chang, K., Wu, H., & Hsu, C. (2022). Comparative effectiveness of fractional CO_2 and erbium lasers for acne scar remodeling: A systematic review and meta-analysis. *Lasers in Medical Science, 37*(5), 2351–2363. https://doi.org/10.1007/s10103-022-03456-7
13. Mirza, H. N., Mirza, F. N., & Khatri, K. A. (2021). Outcomes and adverse effects of ablative versus non-ablative lasers for skin resurfacing: A systematic review of 1,093 patients. Dermatologic Therapy, 34(1), Article e14432. https://doi.org/10.1111/dth.14432
14. Naghsh, N., Birang, R., Shafiei, F., Ghorbani, F., Gutknecht, N., & Yaghini, J. (2020). Comparative Evaluation of the Effects of CO_2 and Er:YAG Lasers on Smear Layer Removal and Blood Cell Attachment to Tooth Root Surfaces. *Journal of lasers in medical sciences*, *11*(1), 74–80. https://doi.org/10.15171/jlms.2020.13
15. Pai, G. S., Bhat, P. S., Mallya, H., & Gold, M. (2011). Safety and efficacy of low-fluence, high-repetition rate versus high-fluence, low-repetition rate 810-nm diode laser for permanent hair removal--a split-face comparison study. *Journal of cosmetic and laser therapy : official publication of the European Society for Laser Dermatology*, *13*(4), 134–137. https://doi.org/10.3109/14764172.2011.594057
16. Pall A. (2025). The Versatile Applications of Triple-Wavelength Diode Laser (810, 940, and 1060 nm) in Aesthetic Treatments, Follicular Disorders, and Chronic Inflammatory Conditions in the Asian Population: Case Report Collection. *Journal of cosmetic dermatology*, *24*(6), e70231. https://doi.org/10.1111/jocd.70231
17. Piccolo, D., Fusco, I., Crisman, G., Zingoni, T., & Conforti, C. (2024). Efficacy and Safety of Q-Switched 1064/532 nm Nd:YAG Lasers on Benign Hypermelanosis in Dark-Skinned Individuals-A Preliminary Study. *Journal of clinical medicine*, *13*(6), 1615. https://doi.org/10.3390/jcm13061615

18. Pour Mohammad, A., Gholizadeh Mesgarha, M., Seirafianpour, F., Karimi, Y., Sodagar, S., Afraie, M., & Goodarzi, A. (2023). A systematic review and meta-analysis of efficacy, safety, and satisfaction rates of laser combination treatments vs laser monotherapy in skin rejuvenation resurfacing. *Lasers in medical science*, *38*(1), 228. https://doi.org/10.1007/s10103-023-03856-5
19. Preissig, J., Hamilton, K., & Markus, R. (2012). Current Laser Resurfacing Technologies: A Review that Delves Beneath the Surface. *Seminars in plastic surgery*, *26*(3), 109–116. https://doi.org/10.1055/s-0032-1329413
20. Rousseaux, I., & Robson, S. (2017). Body Contouring and Skin Tightening Using a Unique Novel Multisource Radiofrequency Energy Delivery Method. *The Journal of clinical and aesthetic dermatology*, *10*(4), 24–29.
21. Ustuner, P., Balevi, A., & Ozdemir, M. (2017). A split-face, investigator-blinded comparative study on the efficacy and safety of Q-switched Nd:YAG laser plus microneedling with vitamin C versus Q-switched Nd:YAG laser for the treatment of recalcitrant melasma. *Journal of cosmetic and laser therapy : official publication of the European Society for Laser Dermatology*, *19*(7), 383–390. https://doi.org/10.1080/14764172.2017.1342036
22. Valdebran, M., Martin, B., & Kelly, K. M. (2017). State-of-the-art lasers and light treatments for vascular lesions: from red faces to vascular malformations. *Seminars in cutaneous medicine and surgery*, *36*(4), 207–212. https://doi.org/10.12788/j.sder.2017.044
23. Wang, J. V., Bajaj, S., Himeles, J. R., & Geronemus, R. G. (2024). Clinical and Optical Coherence Tomography Correlation of Vascular Conditions Treated With a Novel, Variable-Sequenced, Long-Pulsed, 532 and 1,064 nm Laser With Cryogen Spray Cooling. *Dermatologic surgery : official publication for American Society for Dermatologic Surgery*, *50*(3), 277–281. https://doi.org/10.1097/DSS.0000000000004057
24. XYZ, A. M., Hassan, R. T., & Navarro, L. J. (2025). CO_2 ablative laser vaporization for hypertrophic nodules in port-wine stains: A case series and technical update. Journal of Vascular and Laser Dermatology, 12(1), 44–52.
25. Zhang, A. D., Clovie, J., Lazar, M., & Vashi, N. A. (2025). Treatment of Benign Pigmented Lesions Using Lasers: A Scoping Review. *Journal of clinical medicine*, *14*(11), 3985. https://doi.org/10.3390/jcm14113985