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Therapeutic Options For Xanthelasma Palpebrarum: Pharmacological Approaches, Surgical Procedures, And Laser Therapy

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ABSTRACT

Xanthelasma palpebrarum is a benign skin lesion consisting of a yellowish periorbital plaque due to lipid accumulation, often associated with hyperlipidemia, although primarily an aesthetic complaint. This study aimed to evaluate the effectiveness, complications, and recurrence factors of three main modalities: surgical excision, CO2 laser, and LASIK.$_2$, and TCA. Using a qualitative systematic literature review approach based on PRISMA, the population included publications from 2021-2025 in Google Scholar, PubMed, and Scopus. The purposive sample consisted of 16 articles (500+ patients) with inclusion criteria of interventional studies and lipid profiles. The PRISMA protocol instrument and thematic content analysis identified patterns of effectiveness through triangulation and MMAT quality appraisal. The results showed that CO laser$_2$most effective (100% resolution, 13-16% recurrence), followed by surgical excision (3-60%), and TCA 70% for small lesions (25-39% recurrence) with a 33% risk of pigmentation. Conclusions recommend individualization of therapy based on lesion size, skin type, and systemic lipid management to minimize recurrence.

Keywords: Ablative Laser, Surgical Excision, Hyperlipidemia, TCA Therapy, Xanthelasma Palpebrarum

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INTRODUCTION

Xanthelasma palpebrarum appears as a benign skin lesion in the form of a yellowish plaque in the periorbital eyelid area, especially the medial part, due to subcutaneous lipid accumulation from impaired lipid metabolism (Hu et al., 2024). This condition is most often found in individuals with hyperlipidemia, where high lipoproteins trigger lipid infiltration into the interstitial tissue through increased vascular permeability (Zhimin et al., 2020). Although it does not cause significant physical symptoms, this lesion attracts attention due to its disturbing aesthetic impact, prompting patients to seek cosmetic treatment (Laftah & Al-Niaimi, 2018, as cited in Malekzadeh et al., 2023).

The pathophysiology of xanthelasma involves phagocytosis of oxidized LDL by macrophages via scavenger receptors, forming the characteristic foam cells of the lesion, supported by chronic inflammation with increased cytokines such as TNF-α, IL-6, and IL-8 (Katz et al., 2019, as cited in Scarano et al., 2021). Impaired reverse cholesterol transport also contributes, where HDL dysfunction inhibits lipid efflux from macrophages, leading to the histopathologically persistent accumulation of unesterified cholesterol, esters, and phospholipids (Hu et al., 2024). Clinical studies have shown a prevalence of up to 50% in patients with non-familial hyperlipidemia, with genetic factors such as LDLR variants exacerbating this process (Zhimin et al., 2020; Kaur et al., 2023).

The main problem in xanthelasma treatment is the high risk of recurrence, which reaches 25-60% depending on the modality, especially if the underlying hyperlipidemia is uncontrolled, so that the lesions often recur at the margins or bilaterally (Laftah & Al-Niaimi, 2018, as cited in Widiatmoko & Ajie, 2021). Surgical excision is effective for large lesions but carries the risk of scarring, ectropion, and hyperpigmentation, while topical TCA is simple but requires repeated sessions with post-inflammatory

pigmentation of up to 33% (Malekzadeh et al., 2023; Mani et al., 2025). CO2 laser therapy superior in effectiveness (recurrence 13-16%) but expensive and has the potential for atrophic scarring in dark skin (Wang et al., 2025).

Variation in patient response adds complexity, with small lesions responding well to TCA 70% of the time while deep lesions require laser or surgery, with factors such as age under 40 years signaling urgent metabolic screening for early detection of atherosclerosis (Saragih et al., 2023a; Saragih et al., 2023b). The lack of an individualized approach leads to aesthetic dissatisfaction and high costs, especially without systemic lipid management such as statins, which reduce inflammation but carry the risk of myopathy (Latif et al., 2022). This emphasizes the need for comprehensive studies comparing modalities to minimize complications.

This study aims to review the treatment options for xanthelasma palpebrarum—surgical excision, CO laser, TCA, and combination approaches—and evaluate the advantages, disadvantages, effectiveness, and recurrence factors for patient-based selection guidance. The urgency lies in the increasing prevalence of aesthetic procedures and the association with cardiovascular dyslipidemia, where timely treatment prevents long-term complications such as atherosclerosis (Kaur et al., 2023; Wang et al., 2025). The novelty lies in the recent synthesis (2021-2025) that integrates genetic data and innovations such as fractional photothermolysis with holistic lipid management, providing more tailored, practical recommendations than previous reviews (Scarano et al., 2021; Mani et al., 2025).

METHOD

Types and Methods of Research

This study used a qualitative approach with a systematic literature review method to analyze treatment options for xanthelasma palpebrarum from a pharmacological, surgical, and laser therapy perspective (Sugiyono, 2023). This approach was chosen because of its comprehensive nature in synthesizing the latest scientific evidence regarding the effectiveness, complications, and recurrence factors of various treatment modalities, in accordance with the study title which emphasizes the comparison of therapeutic approaches (Laftah & Al-Niaimi, 2018, as cited in Malekzadeh et al., 2023). The systematic review method allows for the identification of patterns of therapeutic effectiveness such as TCA 70% (recurrence 25-39%), surgical excision (recurrence 3-60%), and CO2 laser(recurrence 13-16%) through structured narrative analysis, in line with the principles of descriptive qualitative research for complex medical topics (Creswell & Poth, 2022; Widiatmoko & Ajie, 2021).

Data Analysis Instruments and Techniques

The main research instrument is a literature search protocol based on PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) which includes the Google Scholar, PubMed, and Scopus databases with the keywords "xanthelasma palpebrarum", "TCA therapy", "laser", "surgical excision", and "recurrence risk" for the period 2021-2025 (Emzir, 2024). The data analysis technique used thematic content analysis with manual coding to group findings based on indicators of effectiveness (percentage of lesion resolution), safety (side effects such as hyperpigmentation 9-33%), and sustainability (recurrence 6-16 months), supplemented by source triangulation from 16 primary references including clinical studies by Wang et al. (2025) and Mani et al. (2025) (Sudaryono, 2022). The validity of the analysis was maintained through peer debriefing between authors and quality appraisal using the MMAT (Mixed Methods Appraisal Tool) scale, ensuring that only studies with an active DOI and a high level of evidence were analyzed (Hu et al., 2024; Kaur et al., 2023).

Population and Sample

The study population included all scientific publications on xanthelasma palpebrarum therapy indexed in international and national databases for the period 2021-2025, with a focus on clinical studies, reviews, and case series involving adult patients with periorbital lesions (Saragih et al., 2023a). The sample was determined purposively with the following inclusion criteria: (1) original studies with therapeutic effectiveness data (n=12 studies, total 500+ patients), (2) English/Indonesian publications with an active DOI, (3) primary outcomes of lesion resolution and recurrence, and (4) relevance to

normolipidemic/hyperlipidemic conditions (Latif et al., 2022). The final sample consisted of 16 high-quality articles including 7 interventional studies (surgical excision, CO2 laser$_2$, TCA), 5 systematic reviews, and 4 lipid profile studies, representing 95 surgical cases and 50+ laser patients from retrospective reviews (Malekzadeh et al., 2023; Wang et al., 2025). This purposive sampling technique is suitable for in-depth literature reviews to achieve thematic saturation (Sugiyono, 2023; Scarano et al., 2021).

Research Procedures

The procedure began with literature identification through a systematic search (January 2025) using the Boolean string "xanthelasma AND (TCA OR laser OR excision) AND (recurrence OR efficacy)", followed by screening of title/abstract (n=250) and full-text eligibility (n=50) based on the PRISMA flowchart (Creswell & Poth, 2022). Data were extracted using a standardized form covering patient demographics, treatment modality, clinical outcomes (resolution, recurrence, complications), and risk factors such as dyslipidemia (Zhimin et al., 2020; Saragih et al., 2023b). Thematic analysis was performed iteratively: (1) open coding to identify themes (efficacy of TCA 70% vs. CO2 laser$_2$), (2) axial coding for cause-effect relationships (hyperlipidemia→relapse 50%), and (3) selective coding for the synthesis of individualized therapy recommendations (Emzir, 2024; Mani et al., 2025). Validation was conducted through discussions with the author team and cross-checking with the CONSORT guidelines for intervention studies, ensuring high reliability before the final narrative synthesis (Sudaryono, 2022; Laftah & Al-Niaimi, 2018).

RESULTS AND DISCUSSION

Xanthelasma palpebrarum is a yellowish lesion that commonly appears on the eyelids. Although benign and not causing any physical symptoms, this condition often raises concerns due to its impact on appearance and its possible association with lipid metabolism disorders.

The discussion focuses on various therapeutic options that have been used in the treatment of Xanthelasma Palpebrarum. These methods include surgical excision, laser therapy such as the CO2 laser, and laser therapy.$_2$and Er:YAG lasers, as well as the use of chemicals such as trichloroacetic acid (TCA).

Each therapeutic method is briefly reviewed based on its implementation procedure, results, and advantages and disadvantages. This description aims to provide a systematic overview of therapeutic approaches that can be considered in treating Xanthelasma Palpebrarum.

This article discusses various methods used to treat Xanthelasma Palpebrarum. It begins by outlining the indications and contraindications for each therapy, then continues with pharmacological approaches, which, although limited, remain part of the treatment options. Several key techniques, such as surgical procedures and laser therapy, are briefly described, including their effectiveness and considerations. Furthermore, potential complications, side effects, and factors that may trigger recurrence after therapy are discussed.

In addition, the use of combination approaches in practice was also discussed, as well as the latest innovations that are continuously being studied to improve treatment outcomes.

Indications and Contraindications of various ModalitiesXanthelasma Palpebrarum Therapy

As the medical world advances, various therapeutic options are available to treat this condition. However, each method has its own unique benefits and potential risks. Therefore, it's important to understand the indications and contraindications of each therapy before deciding which is most appropriate.

The type of treatment chosen usually depends on the size and location of the lesion, the patient's skin condition, personal preference, and available budget. Small lesions usually respond well to chemical treatments such as trichloroacetic acid (TCA), while larger or frequently recurring lesions are better treated with lasers or surgery. However, patients with sensitive skin should be cautious due to the risk of hyperpigmentation after laser therapy or chemical peels. Meanwhile, those prone to keloids are advised to choose non-invasive methods such as depigmentation creams. In terms of cost, CO2 lasers are preferred.$_2$ and Er:YAG are more expensive but effective, while

TCA and cryotherapy are more affordable although they require several sessions.

Furthermore, the patient's age and health are also important considerations. If xanthelasma appear before the age of 40, metabolic screening to detect hyperlipidemia is highly recommended. Patients with diabetes or cardiovascular disease should be evaluated before undergoing any specific treatment. Each method has its advantages and disadvantages—for example, TCA is suitable for fair skin but carries risks for darker skin, while laser and surgery provide the best results for large lesions but must be tailored to the patient's condition to minimize side effects.

Pharmacological Approach in the Treatment of Xanthelasma Palpebrarum

Common topical medications used to treat xanthelasma include trichloroacetic acid (TCA) and creams containing retinoids. TCA works by eroding the affected skin layer, while retinoids help exfoliate the skin and improve the appearance of the lesions. However, the effectiveness of these two treatments varies, and they are usually more effective for smaller lesions. Therefore, it is important to consult a doctor before starting any topical treatment.

TCA works by coagulating proteins in the epidermis, which causes the cells that form the lesions to die. This process not only helps reduce the size of xanthelasmas but also stimulates new skin growth. After TCA application, damaged skin is lifted, allowing healthier skin to emerge. While TCA can be effective, results depend heavily on the size and depth of the lesions, as well as the individual's response to treatment.

In addition to TCAs, topical statins may also be an option for treating xanthelasma, especially for those with high cholesterol levels. Statins work by inhibiting an enzyme involved in cholesterol synthesis, thereby lowering lipid levels in the cells that contribute to xanthelasma formation. Additionally, statins have anti-inflammatory effects that can help reduce inflammation in the affected area.

Statin use is often part of a holistic approach to lowering cholesterol levels and improving a patient's blood lipid profile. Therefore, both TCAs and statins can be valuable options in the treatment of xanthelasma, depending on the individual patient's condition.

Surgical Procedure for Xanthelasma Palpebrarum

Surgical excision is an effective method for removing xanthelasma lesions, especially in large cases or those that frequently recur after non-surgical therapy. This method is usually recommended for lesions larger than 1.5 cm, lesions that return after laser therapy or chemical peels, and patients who desire permanent results. Furthermore, surgical excision may also be considered if the lesion causes functional impairment due to its size.

Several surgical excision techniques can be used. One is excision with natural healing (healing by secondary intention), in which the lesion is removed without additional reconstruction, allowing the area to heal naturally. This technique is suitable for small to medium-sized lesions and has a low risk of complications. For better aesthetic results, excision with primary closure is performed by cutting the lesion and closing it with sutures. In cases of large lesions, excision is often combined with procedures such as blepharoplasty or skin grafting to prevent eyelid deformity.

Although effective, surgical excision carries several risks, including scarring, ectropion (an outward-drawing of the eyelid), and skin discoloration such as hyperpigmentation or hypopigmentation, especially in patients with dark skin. Recurrence can also occur if underlying conditions, such as hyperlipidemia, are not controlled.

Compared to laser therapy, surgical excision has a lower recurrence rate (less than 5%), but is more invasive and carries the risk of scarring. Meanwhile, laser therapy more often causes skin discoloration. The combination of surgical excision with

Pharmacological treatments such as statins can help reduce the risk of relapse in patients with dyslipidemia.7 This approach provides better long-term outcomes and minimizes the likelihood of relapse.

Laser Therapy for Xanthelasma Palpebrarum

The CO2 laser is one of the most effective methods for treating xanthelasma and is

considered the gold standard in ablative laser therapy. The process works by vaporizing the water within the cells, allowing the skin layers to be gradually removed. Studies have shown excellent results, with most patients achieving complete healing without scarring. The ultrapulse CO2 laser, for example, vaporizes a thin layer of tissue while allowing the surrounding tissue time for thermal relaxation, thus minimizing damage. In a study of 23 patients, all lesions were successfully healed with a recurrence rate of 13% after ten months. To prevent recurrence, treatment is recommended in the early stages of lesion development.

In another study comparing super-pulsed (SP) laser with fractional CO2 laser, results showed that SP laser provided significantly more improvement than fractional laser. However, scarring and recurrence rates were higher in the SP group. CO2 laser was also compared with trichloroacetic acid (TCA) therapy. Research showed that CO2 laser was more effective for severe lesions due to its widespread coagulative effect, while TCA was more suitable for mild lesions. The recurrence rate of CO2 laser at six months was 16%, lower than TCA's 34.8%.

The Er:YAG laser is another alternative that offers faster healing times and a lower risk of complications than the CO2 laser. Studies have shown that all lesions are successfully removed without scarring or skin discoloration. However, for deeper lesions, the CO2 laser remains the preferred choice due to its hemostatic properties. The Q-switched Nd:YAG laser has been used to treat xanthelasma, but results are less consistent. Most patients do not achieve complete clearance, so this method is not recommended. Treatment with an argon laser has also shown positive results, with approximately 85% of cases responding well to therapy. However, recurrence rates remain high, especially in larger lesions. The potassium titanyl phosphate (KTP) laser and the pulsed dye laser are also being evaluated as treatment options. The KTP laser has shown efficacy of up to 85.7% without significant side effects, while the pulsed dye laser has resulted in over 50% healing in most patients, although side effects such as purpura and post-inflammatory hyperpigmentation can occur.

Overall, laser therapy offers a variety of options for treating xanthelasma. The choice of laser should be tailored to the condition of the lesion and the risk of recurrence to achieve the best results.

Comparison of the Effectiveness of Various Xanthelasma Therapy Modalities Palpebrarum

Xanthelasma palpebrum (XP) is a benign, asymptomatic lesion, not associated with skin complications; however, treatment is often sought for cosmetic reasons, there is limited evidence in

The literature examines effective treatments for normolipidemic XP. Commonly cited treatments include topical trichloroacetic acid (TCA), laser ablation, and surgical excision.

A. Pharmacology

TCA is a form of destructive therapy, used topically at concentrations of 50%–100%. The approach is relatively simple, applied in a circular motion, carefully ensuring the greatest amount of TCA is applied to the lesion margin. The treatment area is then neutralized with sodium bicarbonate. 4 The efficacy and tolerability of various TCA concentrations in the treatment of XP patients. Concentrations of 35%, 50%, and 70% TCA were tested. 70% TCA was found to be the most effective concentration. This concentration was well tolerated and associated with significant clinical efficacy. This concentration required the fewest number of sessions in the treatment of XP. Furthermore, 70% TCA was found to be particularly useful in treating papular lesions, while 50% TCA was effective for macular xanthelasma. A study by Haque and Ramesh mirrored these findings. They also concluded that 70% TCA was effective in treating flat plaques; however, 100% TCA was required for papulonodular lesions.

Overall, TCA therapy for XP has been found to be more effective for smaller lesions, with repeated procedures resulting in pigmentation and scarring. In general, post-inflammatory hyper- and hypopigmentation with TCA have been reported with a frequency of 9%–12.5% and 21.5%–33.4%, respectively. It is also important to note that if TCA is applied near the eyelid, there is a risk of scar formation and the development of ectropion. The available literature indicates recurrence rates ranging between 25% and 39%, with a 34.5% recurrence rate at 6 months follow-up.

B. Surgery

Surgical excision has generally been used and often produces excellent cosmetic results. Various surgical techniques have been advocated. Blepharoplasty can be used for xanthelasma excision using a serial staged approach, while the Le Roux technique involves a modified blepharoplasty approach. However, recurrence is common, with reported rates of up to 40% for primary excision and 60% for secondary excision.

A 4-year retrospective review of patients undergoing surgery for XP was conducted. Ninety-five cases were reviewed, 70% of which were treated with simple excision in conjunction with blepharoplasty. The remaining 30% were treated with a combination of simple excision and local flap or skin graft. There were no associated complications other than postoperative scar contracture (4.2%) in patients with grade III or IV. Recurrence was reported in 3.1% of patients at 12 months, regardless of grade. However, the incidence of recurrence increases with incomplete excision and has been reported to be up to 40% after primary surgical excision, 60% after secondary excision, and 80% with bilateral upper and lower eyelid involvement.

C. Laser

CO2 is the gold standard ablative laser. Vaporization of water within cells results in layer-by-layer ablation of the skin. Overall results of studies using CO2 lasers have been excellent, with complete early resolution achieved in the majority of cases. A large case series of 23 patients receiving high-energy ultrapulsating CO2 laser therapy was published. All lesions were successfully removed, with no associated scarring and a recurrence rate of 13% at 10 months. It is recommended that treatment be initiated early in the development of XP to prevent recurrence. A comparative study using 30% TCA and CO2 laser for the treatment of XP in 50 patients showed that both modalities are effective treatments for clinically mild lesions. The laser group achieved complete resolution in all patients, in contrast to the TCA group, which achieved a complete resolution rate of 56%. At 6 months, the recurrence rate with TCA was 34.8%, consistent with existing literature reporting rates ranging from 25% to 39%. The recurrence rate with CO2 at 6 months in this study was 16%. Reported recurrence rates in other literature for CO2 vary from no recurrence after 4 years to 13% at 10 months.

Argon laser coagulation of xanthelasma lesions is an alternative laser treatment. Basar et al. treated 40 eyelids in 24 patients with XP using an argon green laser. They found that all lesions responded to therapy with good cosmetic results in 85% of cases. The treatment was well tolerated without associated complications or functionally relevant scar development. Minimal scarring and slight dyschromia were seen in 13.3% of patients, and visible scarring and marked dyschromia were seen in 3.3% of patients. However, the major reported disadvantage of argon laser photocoagulation is a significant recurrence rate of 50% in the first 12–16 months after treatment, with most occurring at the margins.

In conclusion, pharmacological therapy using 70% TCA has been shown to be effective for small lesions, with a recurrence rate of 25% to 39%. Although the procedure is simple and minimally invasive, TCA can cause post-inflammatory pigmentation and scarring, as well as the risk of scar formation or ectropion if applied near the eyelid. On the other hand, surgical therapies such as blepharoplasty provide excellent cosmetic results and are effective in removing lesions, but have a relatively high recurrence rate, especially with secondary excisions, which can reach 60%. Post-operative complications are rare, but there is a risk of scar contracture in patients with severe lesions. Meanwhile, CO2 laser therapy offers the best results with a lower recurrence rate (around 16% at 6 months) and without significant scarring. This laser is very effective for mild lesions, but requires treatment at an early stage to prevent recurrence. The argon laser is also effective, with good cosmetic results in 85% of cases, although it has a relatively high recurrence rate (50% at 12-16 months). Overall, CO2 laser is the most effective and safe option, while TCA is more suitable for small lesions, and surgery remains an option for those who want immediate treatment despite the high risk of recurrence.

D. Complications and Side Effects of Various Xanthelasma Palpebrarum Therapy Modalities

The risk of hyperpigmentation and scarring are common side effects after Xanthelasma Palpebrarum treatment. While some methods have proven effective, each option carries potential complications that must be considered.

1.Surgical Excision

Surgical excision is an effective method for permanently removing xanthelasma, but it carries some risks of complications. Hypertrophic scarring and keloids can occur, especially in patients with a genetic predisposition. Furthermore, hyperpigmentation or hypopigmentation often occurs due to the inflammatory response, particularly in dark-skinned individuals. Ectropion, an outward pulling of the eyelid due to the removal of excess tissue, can also occur, leading to impaired eyelid function. Therefore, proper surgical technique and consideration of risk factors are crucial to minimize these complications.

2. Laser Therapy

CO2 laser$_2$Er:YAG lasers are used in xanthelasma ablation due to their high precision, but they carry the risk of side effects. Hyperpigmentation or hypopigmentation is common in patients with Fitzpatrick skin types IV-VI due to post-procedural melanocyte changes. Excessive laser use can lead to atrophic scarring, where the treated area appears sunken. Furthermore, secondary infections can occur due to minor burns that weaken the skin's defenses. Therefore, proper laser parameter selection and post-procedure care are crucial to reduce the risk of side effects.

3. Pharmacology

Furthermore, pharmacological therapy for xanthelasma carries the risk of systemic side effects that require careful attention. Pharmacological therapy aims to address the underlying dyslipidemia of xanthelasma with statins, fibrates, and niacin, but carries the risk of systemic side effects. Statins (e.g., simvastatin, atorvastatin) can cause myopathy and rhabdomyolysis, as well as liver dysfunction characterized by elevated transaminase levels. Fibrates (gemfibrozil, fenofibrate) increase the risk of gallstones and, when combined with statins, can cause myositis. Niacin (vitamin B3) often causes flushing, gastrointestinal disturbances, and hyperuricemia, which can trigger gout. Therefore, clinical monitoring is essential to reduce the risk of these side effects.

Risk Factors for Recurrence of Xanthelasma Palpebrarum after Therapy

Although various treatment methods are available, relapse remains a major challenge, often caused by poor lipid control and unhealthy lifestyle.

One of the main factors in xanthelasma recurrence is inadequate lipid control. Research shows that nearly 50% of patients with xanthelasma also have hyperlipidemia, characterized by high levels of LDL cholesterol and triglycerides. Xanthelasma lesions form due to the accumulation of cholesterol in dermal macrophages. If lipid levels remain high after treatment, the risk of recurrence increases significantly. Patients who do not undergo lipid-lowering therapy after surgical excision are more susceptible to early recurrence. Statins such as atorvastatin effectively lower LDL levels and prevent further lipid accumulation. Furthermore, a low-fat diet and regular lipid monitoring are essential to reduce the likelihood of recurrence. Research also shows that individuals with high total and LDL cholesterol levels have a greater risk of recurrence than those with normal lipid levels. Genetic factors also play a role; patients with a family history of familial hyperlipidemia are more likely to experience recurrence despite appropriate therapy.

Lifestyle plays a significant role in preventing xanthelasma recurrence. A diet high in saturated fat and cholesterol can accelerate lipid accumulation in tissues, increasing the risk of recurrence. Patients are advised to adopt a healthy diet, replacing saturated fats with unsaturated fats, and increasing fiber intake from fruits and vegetables. Physical activity such as walking, jogging, or cycling for at least 150 minutes per week can help lower LDL cholesterol and increase good HDL cholesterol. Smoking and excessive alcohol consumption should also be avoided, as they can

worsen lipid metabolism.

Chronic stress also contributes to the recurrence of xanthelasma because it can disrupt hormonal balance and lipid metabolism. Relaxation techniques such as yoga, meditation, or cognitive therapy can help manage stress and improve overall health.

For patients who have undergone xanthelasma treatment, lifestyle changes are crucial to prevent future recurrence. Without significant lifestyle changes, the effectiveness of previous treatments may diminish over time. Therefore, education about lipid control and a healthy lifestyle should be part of a comprehensive approach to long-term xanthelasma management.

Combination Approach in Xanthelasma ManagementPalpebrarum

A combination of pharmacological and surgical therapies has proven effective in managing xanthelasma palpebrarum. Surgery remains the primary method for removing large, deep lesions. Excision techniques are often combined with blepharoplasty and reconstruction using skin grafts or local flaps, aiming to reduce the risk of deformity and complications such as ectropion.

Pharmacological therapies such as trichloroacetic acid (TCA) are also used as adjuncts, especially for small to medium-sized lesions. TCA can be applied before or after excision to improve cosmetic results and prevent recurrence. Intralesional injections of drugs such as bleomycin or pingyangmycin are also being used as alternatives to accelerate lesion resolution.

Laser therapy is also an effective adjunct option after surgery. The combination of excision with a CO2 laser$_2$or Er:YAG lasers have shown excellent results, with improvements of over 75% in many patients. These lasers work by destroying accumulated fat cells and coagulating blood vessels in the treated area, thereby helping to prevent recurrence. Compared to TCA, CO2 lasers$_2$proven to be more effective and helps accelerate wound healing and reduce the risk of hyperpigmentation and scarring.

Latest Prospects and Innovations in the Treatment of Xanthelasma Palpebrarum

A new development in therapy for xanthelasma is the use of Fractional Photothermolysis (FP). This method uses a fractional laser to create microthermal columns within the skin, which stimulate collagen repair and new skin cell regeneration.
without damaging surrounding tissue. The advantages of FP include minimal invasiveness, shorter recovery times, a low risk of side effects, and effectiveness on a wide range of skin types.

Overall, the combination of pharmacological, surgical, and laser therapies provides a comprehensive approach to xanthelasma management. This strategy is expected to improve cosmetic outcomes while minimizing the likelihood of recurrence. A tailored approach for each patient is essential for achieving optimal results.

CONCLUSION

This study found that the CO laser$_2$is the most effective treatment modality for xanthelasma palpebrarum with a nearly 100% lesion resolution rate and low recurrence (13-16% at 6-10 months), followed by surgical excision (3-60% recurrence depending on completeness) and 70% TCA, which is optimal for small lesions, although it carries a risk of post-inflammatory pigmentation of up to 33%. Treatment selection should be individualized based on lesion size, Fitzpatrick skin type, and lipid status, with systemic hyperlipidemia management such as statins essential to prevent recurrence in up to 50% of at-risk patients. Combination approaches (excision + laser/TCA) and the innovation of fractional photothermolysis promise superior cosmetic results with minimal invasiveness. Practical implications include clinical guidelines for early metabolic screening in patients <40 years of age and lifestyle education (low-fat diet, 150 minutes of exercise/week) to optimize aesthetic and cardiovascular outcomes (Wang et al., 2025; Mani et al., 2025).

Limitations of this study include reliance on a literature review without primary data, resulting in underrepresentation of Indonesian ethnic variations, and the lack of long-term studies >2 years to compare absolute recurrence rates between modalities. Recommendations for further research include prospective RCTs with 5-year follow-up in Southeast Asian populations, cost-effectiveness evaluations,

and integration of LDLR genetic biomarkers for predicting therapy response (Hu et al., 2024; Kaur et al., 2023).

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