GÓRSKA, Aleksandra, GNIAŹ, Natalia, GRELA, Wiktor, NIEWIADOMSKA, Jagoda, FURTAK, Daria, TULEJ, Dawid, MARKO, Natalia, DZIEDZIC, Alicja, MARCINIUK, Dominika and GŁOGOWSKA, Paulina. Exploring the Role of Tranexamic Acid in Dermatology: A literature Review. Journal of Education, Health and Sport. 2025;77:56921. eISSN 2391-8306.
https://doi.org/10.12775/JEHS.2025.77.56921
https://apcz.umk.pl/JEHS/article/view/56921

The journal has had 40 points in Minister of Science and Higher Education of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of 05.01.2024 No. 32318. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical culture sciences (Field of medical and health sciences); Health Sciences (Field of medical and health sciences).
Punkty Ministerialne 40 punktów. Załącznik do komunikatu Ministra Nauki i Szkolnictwa Wyższego z dnia 05.01.2024 Lp. 32318. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu).
The authors declare that there is no conflict of interests regarding the publication of this paper.
Received: 11.12.2024. Revised: 10.01.2025. Accepted: 20.01.2025. Published: 30.01.2025.

„Exploring the Role of Tranexamic Acid in Dermatology: A literature Review”

Authors:

Aleksandra Górska [AG]

ola.gorska6@gmail.com

ORCID 0009-0004-0141-2821

Medical University of Lublin, Poland

al. Racławickie 1, 20-059 Lublin, Poland

Natalia Gniaź [NG]

natalia.gniaz55@gmail.com

ORCID 0009-0008-3329-9770

Medical University of Lublin, Poland

al. Racławickie 1, 20-059 Lublin, Poland

Wiktor Grela [WG]
grelawiktor@gmail.com
ORDCID 0009-0000-5801-5756
Medical University of Lublin, Poland
al. Racławickie 1, 20-059 Lublin, Poland

Jagoda Niewiadomska [JN]
malwatexass@wp.pl
ORCID 0009-0003-2219-984X
Medical University of Lublin, Poland
al. Racławickie 1, 20-059 Lublin, Poland

Daria Furtak [DF]
dariafurtak@gmail.com
ORCID 0000-0003-0768-9800
Medical University of Lublin, Poland
al. Racławickie 1, 20-059 Lublin, Poland

Dawid Tulej [DT]
dawid.tulej2000@gmail.com
ORCID 0000-0002-5711-3423
Medical University of Lublin, Poland
al. Racławickie 1, 20-059 Lublin, Poland

Natalia Marko [NM]
markonatalia26@gmail.com
ORCID 0009-0004-7815-4592
Medical University of Lublin, Poland
al. Racławickie 1, 20-059 Lublin, Poland

Alicja Dziedzic [AD]
alicja.dziedzic1109@gmail.com
ORCID 0009-0001-0460-4106
Medical University of Lublin, Poland
al. Racławickie 1, 20-059 Lublin, Poland 0001-046

Dominika Marciniuk [DM]
marciniukd@gmail.com
ORCID 0009-0000-0710-8485
Medical University of Lublin, Poland
al. Racławickie 1, 20-059 Lublin, Poland

Paulina Głogowska [PG]
glogowska.paulina1@gmail.com
ORCID 0009-0002-3003-4466
Medical University of Lublin, Poland
al. Racławickie 1, 20-059 Lublin, Poland

ABSTRACT

Introduction

Tranexamic acid (TXA) is a synthetic plasmin inhibitor primarily used in treating bleeding disorders. However, its use in dermatology has gained increasing attention. Due to its anti-inflammatory properties and ability to inhibit tyrosinase activity, tranexamic acid has emerged as a promising agent for treating pigmentary disorders and inflammatory skin conditions.

Purpose

This review aims to identify and summarize the current applications of tranexamic acid in dermatology, including its mechanisms of action, effectiveness, and safety in treating common conditions such as melasma, hyperpigmentation, rosacea, psoriasis, angioedema, and in scar and discoloration therapies.

State of Knowledge

An analysis of the existing literature highlights the growing interest in TXA's dermatological applications. Clinical studies suggest that tranexamic acid effectively reduces hyperpigmentation and mitigates inflammation in rosacea cases. However, several studies exhibit limitations related to sample size and methodology, underscoring the need for further, more detailed research.

Conclusions

Tranexamic acid shows promising therapeutic potential in dermatology, particularly for pigmentary and inflammatory disorders. However, further research is needed to fully understand the mechanisms of TXA and its therapeutic potential, which could lead to the development of novel treatment strategies in dermatology.

Keywords: tranexamic acid, melasma, rosacea, hyperpigmentation, psoriasis, angioedema.

Introduction

Tranexamic acid (TXA) is a synthetic lysine analog used in various medical fields, particularly in the context of bleeding disorders. It functions as an antifibrinolytic agent, primarily during surgical, traumatic, and dental procedures. Due to its properties, TXA can support healing processes and reduce the risk of new pigmentation irregularities, making it a valuable tool in addressing uneven skin tone in dermatological conditions such as melasma, hyperpigmentation, and rosacea. [1]

This article discusses the applications of tranexamic acid, its mechanisms of action, and its impact on health and beauty, with a particular focus on its role in dermatology.

Materials and Methods

A literature search was conducted in the PubMed database using keywords such as: "tranexamic acid," "hyperpigmentation," "melasma," "dermatology," "rosacea," "psoriasis," and "vascular urticaria." Articles were included in the review if they addressed the efficacy of

TXA as a depigmenting agent, outlined its general mechanism of action, or focused on the aforementioned dermatological conditions. Studies published in languages other than English were excluded. The data analysis involved synthesizing the results from the selected studies, considering their methodology and outcomes.

Mechanism of Action

Tranexamic acid primarily acts as a plasmin inhibitor. By blocking the conversion of plasminogen to plasmin, it prevents fibrin breakdown and stabilizes blood clots, which is crucial in the treatment of bleeding. [2,3]

Additionally, TXA inhibits the activation of protease-activated receptor 2 (PAR-2), leading to reduced inflammatory responses and regulation of keratinocyte function. This substance reduces calcium influx into keratinocytes; excessive intracellular calcium can lead to dysfunction of the skin barrier, so its reduction helps stabilize the epidermis. TXA also exhibits anti-angiogenic effects, decreasing the number of CD31+ cells and lowering the expression of vascular endothelial growth factor. These mechanisms contribute to improving skin condition in patients with rosacea. [1]

Tranexamic acid shares structural similarities with tyrosinase, suggesting it may act as a competitive antagonist of this enzyme, thereby enhancing its depigmenting effect. [4]
It also exerts anti-inflammatory effects by limiting the activity of inflammatory mediators and reducing the production of pro-inflammatory cytokines that stimulate melanocytes. [1,4,5]

Methods of Administration

In the treatment of dermatological conditions, tranexamic acid can be applied topically in the form of creams, gels, or solutions. Another method involves injectable administration, where TXA is delivered intradermally or combined with other techniques, such as microneedling. [1,6,7,8,9,10]

TXA can also be administered orally in tablet form. Despite promising results in the oral treatment of melasma, there is insufficient evidence to fully support the safety of this approach. [11,12,13]

A study was conducted to compare the efficacy and safety of topical TXA combined with laser therapy and microneedling in women with melasma. Participants were divided into three groups: one group received treatment with fractional CO2 laser and TXA, the second

underwent microneedling combined with TXA, and the third group applied a 5% TXA cream topically. Treatment efficacy was assessed post-procedure using the modified Melasma Area and Severity Index (MASI) and patient satisfaction analysis. Improvement was noted in all groups, with the most significant results observed in those treated with CO2 laser and microneedling. Additionally, the study found that 20% of patients treated with fractional CO2 laser and 5% TXA did not experience any improvement. This lack of improvement may be attributed to the resistant nature of melasma and various exacerbating factors, particularly in patients with Fitzpatrick skin types III, IV, and V. Furthermore, 30% of patients in this group experienced hyperpigmentation as a side effect, suggesting that fractional CO2 laser may not be the most suitable option for individuals with higher Fitzpatrick skin types. [14]

The study results suggest that the use of tranexamic acid in combination with fractional CO2 laser or microneedling significantly enhances its transepidermal delivery. This combination not only improves treatment efficacy but also optimizes the absorption of the active ingredient, potentially leading to better therapeutic outcomes. However, it is important to note that appropriate patient selection and avoidance of sun exposure are crucial for achieving optimal therapy results. Previous studies have shown that fractional CO2 laser can increase TXA absorption in the skin, but due to the risk of post-inflammatory hyperpigmentation, caution is advised. [1,6,7,8,9,10,14]

Hyperpigmentation

Hyperpigmentation of the skin occurs as a result of excessive melanin production, the pigment responsible for skin color. Melanocytes, the cells responsible for producing melanin, can be stimulated by various factors such as UV radiation, hormonal changes, skin injuries, or inflammatory conditions. In response to these stimuli, melanocytes increase their activity, leading to the accumulation of melanin in the epidermis. As a result, darker spots or discolorations appear on the skin. [9,15,16]

Additionally, hyperpigmentation can be a potential side effect of certain medications, such as sertraline [17], or a consequence of laser therapy. [18]

A case report describes a 24-year-old male with panic disorder who developed hyperpigmentation on his face after 5 days of using sertraline at a dose of 100 mg/day. Physical examination did not reveal any other abnormalities, and the hyperpigmentation was considered a side effect of the medication. The sertraline dose was reduced to 75 mg and then to 50 mg, with the addition of propranolol (20 mg/day). The dermatologist recommended oral tranexamic

acid at a dose of 500 mg/day and a sunscreen (SPF 50). Dermatological treatment lasted for one month. After another month of follow-up, the patient's hyperpigmentation had significantly diminished. [17]

Another study describes the case of a 52-year-old woman who presented with a discolored scar on her face. The patient had a linear, depressed scar on her left cheek, previously treated with fractional CO2 laser, which resulted in complications in the form of pigmentation. The aesthetic appearance of the scar affected her social life more than the original lesion. Dermatological examination revealed a discolored lesion in the area of previous laser therapy, and dermatoscopy showed an excess of pigment and telangiectasia. The lesion was treated with two intradermal injections of tranexamic acid (10 mg/ml) at three-week intervals, leading to the complete resolution of the hyperpigmentation after two sessions, providing the patient with significant satisfaction. The treatment of hyperpigmentation following laser therapy typically involves the use of topical corticosteroids and depigmenting creams; however, tranexamic acid shows promising results. In this case, intradermal injections of tranexamic acid proved to be an effective therapeutic alternative, indicating the need for further research in this field. [18]

Rosacea

Rosacea is a chronic inflammatory dermatosis characterized by symmetric erythema, primarily in the central area of the face. Clinical symptoms include recurrent erythema, telangiectasia, papules, pustules, and rhinophyma - connective tissue hypertrophy in the nasal area. Patients often report sensations of irritation, dryness, and skin burning. This condition primarily affects women aged 30 to 50 years, with a global prevalence estimated at 5.5%. The pathogenesis of rosacea remains unclear, though there are hypotheses suggesting the influence of genetic factors, vascular dysfunction, immunological disorders, and environmental factors such as sun exposure and temperature changes. Rosacea is divided into four main subtypes: erythematotelangiectatic, papulopustular, phymatous, and ocular. [10,19]

Tranexamic acid has been introduced to dermatology as a promising therapeutic agent in the treatment of rosacea, particularly in the form of topical application. Its use in this context gained significance following initial studies conducted by Kim et al. in 2012, who were the first to demonstrate the effectiveness of a 10% tranexamic acid solution in patients with irritant contact dermatitis and papulopustular rosacea. In their study, a significant reduction in erythema and subjective symptoms such as itching and burning was observed, suggesting that topical tranexamic acid could be an effective treatment for this condition. Subsequent studies, such as

the 2015 retrospective study by Zhong and colleagues, confirmed these findings, showing a reduction in the number of inflammatory lesions and improvements in skin biophysical parameters in patients using a 5% tranexamic acid solution. Further analysis, including research by Jakhar et al. in 2019, demonstrated the beneficial effects of a 10% tranexamic acid solution on erythema and telangiectasia, emphasizing its versatility in treating various forms of rosacea. Topical tranexamic acid not only reduces clinical symptoms but also improves the overall condition of the skin, making it a crucial element in the treatment of this chronic dermatological disorder. [10]

In light of these observations, subsequent studies focused on evaluating the efficacy of different methods of tranexamic acid administration, including the use of microneedling.
In 2018, Bageorgou and colleagues compared the efficacy of a 10% tranexamic acid solution in monotherapy with combination therapy involving microneedling. The study was conducted on 20 women aged 27 to 65 years with rosacea. The women were divided into two groups. The first group was treated with a wet dressing soaked in a 10% tranexamic acid solution for 20 minutes every 15 days for four sessions. In the second group, combination therapy with microneedling was used. The results showed better outcomes in the combination therapy group. Notably, no adverse effects were observed in the group treated with only TXA. [20]

Another study aimed to evaluate the effectiveness of 10% topical tranexamic acid in the treatment of erythematotelangiectatic rosacea (ETR) with and without microneedling. This time, slightly different methods were employed. The study involved 45 women aged 20 to 48 years who received treatment on both sides of the face. The right side was treated with microneedling combined with 10% tranexamic acid, while the left side was treated with only 10% tranexamic acid. Patients underwent three treatment sessions at two-week intervals, and the effectiveness was assessed three months after the last session. Results indicated improvement on both sides, with the microneedling-treated side showing significantly better results. [19]

Tranexamic acid accelerates skin barrier regeneration and protects against epidermal hyperplasia by inhibiting pro-inflammatory cytokines and angiogenesis. Microneedling enhances drug penetration, which may lead to better therapeutic outcomes. These studies show that combining microneedling with topical tranexamic acid yields better clinical results and higher patient satisfaction than tranexamic acid therapy alone. While the results are promising, the small number of participants and the lack of long-term follow-up highlight the need for further research. [10,19,20]

Psoriasis

Psoriasis is a chronic, inflammatory skin disease characterized by excessive keratinocyte proliferation, leading to the formation of distinct red patches covered with silvery scales. It is an autoimmune condition in which the immune system mistakenly attacks healthy skin cells, resulting in chronic inflammation. The symptoms of psoriasis can vary depending on its type, with the most common form being plaque psoriasis. This condition not only affects the skin but also impacts the quality of life of patients, causing emotional and social challenges. Treatment for psoriasis includes various approaches, such as topical therapies, systemic treatments, and biologic therapies, all aimed at alleviating symptoms, improving skin condition, and controlling inflammation. Psoriasis can also have different triggering factors, such as stress, infections, or hormonal changes, making its management a complex process. In recent years, intensified research into the pathogenesis of this disease has contributed to the development of new, more effective treatment methods. [21]

A study was conducted to evaluate the effect of tranexamic acid on psoriasis. In the in vitro studies, HaCaT keratinocytes, isolated from human skin, were used. The study focused on the action of IL-17, which stimulates keratinocytes to undergo accelerated cell division - a process characteristic of psoriasis, where the skin cell lifecycle is shortened. The results showed that tranexamic acid reduced the expression of keratin 17 and inhibited the activation of the NLRP3 inflammasome, which plays a key role in the inflammatory processes associated with psoriasis. Additionally, TXA supports autophagy, contributing to the removal of damaged proteins and organelles.

Although the results of this study are promising, it is important to emphasize that it was conducted solely in vitro. Therefore, further clinical studies are needed to confirm these findings and evaluate the efficacy and safety of tranexamic acid in the treatment of psoriasis in humans. [22]

Melasma

Melasma is a chronic skin dyschromia characterized by symmetric hyperpigmented patches, most commonly localized on the face, particularly on the cheeks, forehead, nose, and upper lip. This condition primarily affects women. Hormonal factors, such as pregnancy and the use of oral contraceptives, play a key role in its development. Exposure to ultraviolet (UV) radiation is considered one of the main risk factors, as it stimulates melanogenesis, leading to

increased melanin production by melanocytes. Melasma is also associated with genetic predispositions. Its pathogenesis involves interactions between environmental factors and the skin's immune system. [23, 24] Individuals with Fitzpatrick skin types II and IV are most commonly affected. [25] From a histological perspective, the condition is classified as involving the epidermis (the form more amenable to treatment), the dermis, or both layers. A clinical diagnosis can be made using a Wood's lamp. [26]

Treatment of melasma is complex and often requires prolonged therapy, including the use of depigmenting agents such as hydroquinone and azelaic acid, as well as laser treatments. [27] In recent years, tranexamic acid has gained recognition as an effective therapeutic option for melasma. TXA works by regulating melanin production, reducing melanocyte activity, and influencing inflammatory and angiogenic mechanisms in the skin. Its use, both topically and orally, has shown promising results in reducing hyperpigmentation. [12]

The study was conducted to assess the effectiveness of mesotherapy in the treatment of melasma, with a particular focus on tranexamic acid at a concentration of 4 mg/ml. A meta-analysis of 16 studies showed that the use of TXA in mesotherapy results in a significant reduction in melasma severity after just four weeks. Tranexamic acid, a synthetic derivative of lysine, works by inhibiting plasmin activity, thereby reducing the production of factors that stimulate melanogenesis and influencing the reduction of erythema and blood vessels. Mesotherapy, especially when combined with TXA, appears to be a promising approach for managing hyperpigmentation issues, particularly in patients with diverse skin tones. [7]

In another double-blind, randomized controlled trial involving 20 individuals aged 18 to 60, the effectiveness of 3% tranexamic acid was compared to 4% hydroquinone (HQ) cream over 8 weeks. The modified melasma area and severity index (mMASI), melanin index, erythema index, side effects, and subjective improvement (measured by global patient assessment, PtGA) were analyzed. The results showed a significant decrease in mMASI in both groups after 4 and 8 weeks. In the intervention group, mMASI decreased by an average of 1.14 (29.0%) at week 4 and 2.08 (54.9%) at week 8. In the control group, the reduction was 1.05 (29.2%) at week 4 and 1.92 (53.5%) at week 8. No statistically significant differences were found in PtGA scores between the 3% TXA group and the 4% HQ group. The findings suggest that topical application of 3% TXA is equally effective and safe as 4% HQ in the treatment of melasma in the Indonesian population, with potentially fewer side effects. [28]

A research team from Sawangi Hospital conducted a comparative study on the effectiveness of two therapeutic strategies. The study examined the combination of oral tranexamic acid (500 mg) with a modified Kligman formula (0.01% fluocinolone acetonide, 0.05% tretinoin, and 2% hydroquinone) and the combination of oral tranexamic acid with 15% azelaic acid. The goal of the study was to determine which of these two methods was more effective in reducing hyperpigmentation associated with melasma. The study included male and female patients aged 18-50 years, diagnosed with melasma. Participants were divided into two groups. Group A patients took 500 mg of oral tranexamic acid once daily and applied the modified Kligman cream once daily at night. Group B patients took 500 mg of oral tranexamic acid once daily, applied 15% azelaic acid gel every evening, and used a sunscreen with SPF 30 every three hours. Follow-up visits were conducted at 4 and 8 weeks, during which clinical photographs were taken and the MASI score was calculated. The main outcome after two months was the reduction in MASI score and clinical analysis based on photographs. [13]

The results showed significant differences in melasma assessments between the groups after 8 weeks of treatment. The group using TXA with the Kligman formula achieved better results in reducing hyperpigmentation. Furthermore, patients treated with TXA reported fewer side effects than those using azelaic acid, making this combination more advantageous. The study demonstrated that combined treatment with oral tranexamic acid and the modified Kligman formula may lead to faster and more lasting improvement in melasma, reducing not only symptom severity but also minimizing the risk of relapse. However, further studies are needed to confirm the long-term effectiveness of TXA in melasma therapy. [13]

In summary, tranexamic acid in combination with the Kligman formula may represent a promising therapeutic option in the treatment of melasma, offering patients improved aesthetic outcomes and quality of life with a lower risk of adverse effects.

The use of tranexamic acid may also yield benefits when applied concurrently with other substances, such as vitamin C. A pilot study involving ten women aged 18 to 55 years evaluated the effectiveness of topical 2% tranexamic acid combined with 2% vitamin C in patients with resistant melasma. The treatment was applied for 8 weeks, and its effectiveness was measured using the MASI index, MelasQoL, and PGA at the beginning of the study, as well as at 4 and 8 weeks. The results demonstrated significant improvement, with the MASI score decreasing from 12.76 at baseline to 3.39 after eight weeks. Additionally, the quality of life, assessed using MelasQoL, improved. No serious adverse effects were reported. The study suggests that the

combination of tranexamic acid and vitamin C may be an effective and safe option for treating melasma, providing an alternative to more risky bleaching methods. [29]

Angioedema

Angioedema is a pathological condition characterized by the sudden, spontaneous swelling of the skin, mucous membranes, and subcutaneous tissues, which can affect the face, lips, tongue, throat, limbs, and, in rare cases, internal organs. [1]

It was first described in 1882 by Quincke, later by Osler in 1888 (hereditary angioedema), and ultimately in 1963 by Donaldson and colleagues (the role of C1 inhibitor). [33]

Unlike urticaria, angioedema typically occurs without pain; however, it can lead to serious complications, particularly when the airways are involved, resulting in their narrowing and difficulty breathing, which poses a potential life-threatening risk. The pathophysiology of angioedema varies depending on its etiology, with the primary mechanism responsible for its development being increased permeability of the capillary walls, caused by the action of inflammatory mediators such as bradykinin, histamine, and other cytokines. In cases of angioedema triggered by allergic reactions (e.g., to medications, foods, insect stings), the pathological process involves mast cell degranulation and the release of histamine and other inflammatory mediators, leading to an increase in capillary wall permeability. [33, 34]

An example of drugs that can induce angioedema is ACE inhibitors (angiotensin-converting enzyme inhibitors), which increase bradykinin levels by inhibiting its breakdown via kininase II. This, in turn, increases the permeability of capillary walls and promotes the development of edema. [35]

Another form of angioedema is hereditary angioedema (HAE), which has a genetic basis and is caused by mutations in the gene responsible for producing C1 inhibitor (C1-INH). A deficiency or dysfunction of C1-INH leads to excessive activation of the kallikrein-kinin system, including kallikrein, resulting in increased production of bradykinin, a potent vasodilatory peptide, which, in turn, increases vascular permeability and promotes the formation of edema. In this case, the edema is recurrent and may occur without an obvious cause or following minor trauma or infections. [36,37]

Although the exact mechanism of action of tranexamic acid in the treatment of HAE is not yet fully understood, it is suggested that its antifibrinolytic and anti-inflammatory effects contribute to reducing the frequency and severity of HAE attacks. However, there is insufficient evidence to definitively confirm its efficacy and safety for long-term treatment of this condition, indicating the need for further, more detailed clinical studies. An example is a retrospective study conducted in France, which evaluated the efficacy of tranexamic acid as a maintenance therapy in patients with non-histaminergic angioedema, including hereditary angioedema and idiopathic angioedema (IAE). The study included 37 patients who had been using TXA for at least six months. The results showed that in 17 patients (46%), the number of attacks decreased by more than 75%, in 10 patients the improvement was moderate, and in 10 patients no changes were observed. The study focused on patients who used TXA as the sole maintenance therapy, excluding those using other treatments, such as androgen derivatives or C1 inhibitor concentrates. [38]

Although the results of this study suggest the potential efficacy of tranexamic acid in the maintenance treatment of HAE, it is important to consider certain limitations. In particular, the difficulty of conducting large prospective studies for this rare disease, where symptom severity varies among patients, may impact the overall interpretation of the results. Furthermore, the retrospective nature of the study and the lack of a control group represent significant limitations in evaluating the long-term efficacy and safety of this therapy.

Safety and Side Effects

Topical application of tranexamic acid is generally well-tolerated, with rare side effects such as dryness and transient irritation reported in some cases. [6,14]
However, intradermal injections of TXA may cause adverse effects, including pain, burning sensations, transient bleeding, erythema, and swelling at the injection site. [7,8]
Systemic use of TXA can lead to gastrointestinal discomfort and skin rashes [9], and is associated with an increased risk of severe complications, such as arterial and venous thrombosis. Thrombotic events reported in patients taking oral tranexamic acid typically involved individuals with comorbid conditions that elevated the risk of hypercoagulability. These conditions included clotting disorders, previous episodes of pulmonary embolism, prolonged immobilization, hormonal therapy, drug interactions, active bleeding, as well as cancers and surgical procedures. [30,31]

In the gynecological literature, there is positive long-term data regarding the safety of oral TXA, particularly in the treatment of heavy menstrual bleeding, where monthly doses are approximately 30% higher than those used for melasma, with studies lasting up to 25 months. [32]

However, in the dermatological context, there is insufficient data on the long-term use of TXA. Therefore, an attempt was made to assess the safety of oral TXA for more than 6 months in the treatment of melasma. This study, conducted by a dermatology center in Vancouver, included 26 female patients, with a mean age of 44.5 years, predominantly with skin type III. The patients took 250 mg of oral tranexamic acid twice daily, with the possibility of reducing the dose after 6 months. They also used standard topical treatments. The average duration of treatment was 17.42 months. The mean melasma severity scores at various time points were compared using the Wilcoxon signed-rank test. The results indicated a significant reduction in melasma severity over time: from 1.96 at baseline to 0.61 at 6 months, 0.23 at 1 year, and 0.43 at 2 years. The treatment was well-tolerated, with minimal adverse events, including some gastrointestinal disturbances. No thromboembolic events were observed in participants who received treatment for more than 6 months. [11]

A limitation of this study was the small number of participants, which highlights the need for further, larger studies to confirm the safety and efficacy of long-term oral TXA use in the treatment of melasma.

Conclusions

Tranexamic acid demonstrates promising therapeutic potential in dermatology, particularly in the context of pigmentary disorders and inflammatory skin conditions. Its action as a plasmin inhibitor, along with its anti-inflammatory properties, may contribute to effective reduction of hyperpigmentation, including melasma, and alleviation of symptoms associated with rosacea.

Clinical studies indicate that the use of TXA, both topically and through injections, yields satisfactory results in reducing pigmentation, which can significantly improve patients' quality of life. However, many of the existing studies have limitations regarding sample size and methodology, emphasizing the need for further, more detailed research to better understand the mechanisms of TXA action and its full therapeutic potential.

Moreover, TXA shows promising therapeutic properties in the treatment of angioedema, which, despite presenting with skin symptoms, is an immunologically-based disorder. TXA

reduces the frequency of hereditary angioedema attacks, particularly in maintenance therapy, through its antifibrinolytic and anti-inflammatory effects.

The safety of tranexamic acid appears to be at an acceptable level, with minimal side effects, making it an attractive option in dermatological therapy. However, the risks associated with systemic use of TXA, such as thrombosis, require ongoing monitoring and caution in patient selection.

In summary, tranexamic acid may be a valuable tool in the treatment of dermatological disorders, but continued research is necessary to establish therapeutic standards and to better understand the long-term effects of its use in clinical practice.

Disclosure

Authors contribution:

Conceptualisation: Aleksandra Górska, Natalia Gniaź, Wiktor Grela

Methodology: Natalia Marko, Alicja Dziedzic, Dawid Tulej

Formal analysis: Dominika Marciniuk, Daria Furtak

Investigation: Dominika Marciniuk, Paulina Głogowska, Jagoda Niewiadomska

Writing - Rough Preparation: Aleksandra Górska, Natalia Gniaź, Wiktor Grela

Writing - Review and Editing: Aleksandra Górska, Dawid Tulej, Jagoda Niewiadomska, Alicja Dziedzic, Natalia Marko

Visualisation: Natalia Marko, Daria Furtak, Paulina Głogowska

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

Conflicts of Interest: The authors declare no conflicts of interest.

Funding Statement: No external funding was received to perform this review.

Board Statement: Not applicable – this review included an analysis of the available literature.

Statement of Informed Consent: Not applicable

References

1. **Gaćina K, Krstanović Ćosić A. THE USE OF TRANEXAMIC ACID IN DERMATOLOGY. Acta Clin Croat. 2023 Aug ;62(2):368-372. doi: 10.20471/acc.2023.62.02.16. PMID: 38549597; PMCID: PMC10969640.**
2. **Chauncey JM, Wieters JS. Tranexamic Acid. 2023 Jul 24. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan–. PMID: 30422504.**
3. **Wang X, Wang X, Liang F, Yu Y, Han R. Safety and efficacy of intravenous or topical tranexamic acid administration in surgery: a protocol for a systematic review and network meta-analysis. BMJ Open. 2022 May 9;12(5):e058093. doi: 10.1136/bmjopen-2021-058093. PMID: 35534082; PMCID: PMC9086642.**
4. **Mota S, Rosa GP, Barreto MC, Garrido J, Sousa E, Cruz MT, Almeida IF, Quintas C. Comparative Studies on the Photoreactivity, Efficacy, and Safety of Depigmenting Agents. Pharmaceuticals (Basel). 2023 Dec 28;17(1):55. doi: 10.3390/ph17010055. PMID: 38256889; PMCID: PMC10820089.**
5. **Das A, Sil A, Ghosh S, Panda S. Unconventional uses of common conventional drugs: A review. Indian J Dermatol Venereol Leprol. 2021 Jul-Aug;87(4):592-598. doi: 10.25259/IJDVL_389_20. PMID: 33871199.**
6. **Pazyar N, Raeispour M, Yaghoobi R, Seyedtabib M. Evaluation of the effectiveness of microneedling with tranexamic acid in comparison with microneedling with vitamin C in the treatment of melasma: A prospective and single-blind clinical trial. Health Sci Rep. 2023 Oct 20;6(10):e1636. doi: 10.1002/hsr2.1636. PMID: 37867785; PMCID: PMC10588557.**
7. **Kashikar Y, Madke B, Singh A, Meghe S, Rusia K. Mesotherapy for Melasma - An Updated Review. J Pharm Bioallied Sci. 2024 Apr;16(Suppl 2):S1055-S1056. doi: 10.4103/jpbs.jpbs_1192_23. Epub 2024 Apr 16. PMID: 38882767; PMCID: PMC11174183.**

8. **Pazyar N, Dezfuly MB, Hadibarhaghtalab M, Parvar SY, Molavi SN, Mapar MA, Zeinali M. Intradermal Injection of 100mg Tranexamic Acid Versus Topical 4% Hydroquinone for the Treatment of Melasma: A Randomized, Controlled Trial. J Clin Aesthet Dermatol. 2023 Jan;16(1):35-40. PMID: 36743976; PMCID: PMC9891212.**
9. **Yan C, Xing M, Zhang S, Gao Y. Clinical Development and Evaluation of a Multi-Component Dissolving Microneedle Patch for Skin Pigmentation Disorders. Polymers (Basel). 2023 Aug 4;15(15):3296. doi: 10.3390/polym15153296. PMID: 37571190; PMCID: PMC10422440.**
10. **Zhang J, Gu D, Yan Y, Pan R, Zhong H, Zhang C, Xu Y. Potential Role of Tranexamic Acid in Rosacea Treatment: conquering Flushing Beyond Melasma. Clin Cosmet Investig Dermatol. 2024 Jun 14;17:1405-1412. doi: 10.2147/CCID.S473598. Erratum in: Clin Cosmet Investig Dermatol. 2024 Jun 26;17:1551-1552. doi: 10.2147/CCID.S484236. PMID: 38895607; PMCID: PMC11185165.**
11. **Lam K, Mansour D, Sutton A. Oral tranexamic acid treatment beyond 6 months for melasma patients - A retrospective case series. JAAD Int. 2024 Mar 25;15:195-196. doi: 10.1016/j.jdin.2024.03.006. PMID: 38707929; PMCID: PMC11066674.**
12. **Godse K, Sarkar R, Mysore V, Shenoy MM, Chatterjee M, Damisetty R, Shah S, Vedamurthy M, Aurangabadkar S, Srinivas C, Ganjoo A, Das S, Patil A. Oral Tranexamic Acid for the Treatment of Melasma: Evidence and Experience-Based Consensus Statement from Indian Experts. Indian J Dermatol. 2023 Mar-Apr;68(2):178-185. doi: 10.4103/ijd.ijd_266_22. PMID: 37275826; PMCID: PMC10238972.**
13. **Singh R, Maheshwari P, Madke B, Singh A, Jawade S. Comparative Study of Combination of Oral Tranexamic Acid With Modified Kligman's Formula Versus Oral Tranexamic Acid With Azelaic Acid 15% in the Treatment of Melasma. Cureus. 2023 Jun 24;15(6):e40908. doi: 10.7759/cureus.40908. PMID: 37496546; PMCID: PMC10366003.**
14. **Mamdouh Kamal Dawaud S, Hegab DS, Mohamed El Maghraby G, Ahmad El-Ashmawy A. Efficacy and Safety of Topical Tranexamic Acid Alone or in Combination with Either Fractional Carbon Dioxide Laser or Microneedling for the Treatment of Melasma. Dermatol Pract Concept. 2023 Jul 1;13(3):e2023195. doi: 10.5826/dpc.1303a195. PMID: 37557109; PMCID: PMC10412040.**

15. **Lawrence E, Al Aboud KM. Postinflammatory Hyperpigmentation. 2022 Oct 3. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan–. PMID: 32644576.**
16. **Oh SM, Lee YE, Ko MJ, Baek JH, Shin MK. Proposal of facial pigmentary unit and facial hyperpigmentation type for Fitzpatrick skin types II-IV. Skin Res Technol. 2023 Jan;29(1):e13251. doi: 10.1111/srt.13251. Epub 2022 Dec 7. PMID: 36478452; PMCID: PMC9838779.**
17. **Dhungel O, Amatya IP, Sharma P. An Unusual Presentation with Facial Hyperpigmentation on Escalation of the Dose of Sertraline. Case Rep Psychiatry. 2024 Aug 7;2024:7416277. doi: 10.1155/2024/741lase77. PMID: 39148763; PMCID: PMC11325013.**
18. **Rachadi H, Hali F, Elfatoiki FZ, Chiheb S. Successful Management of Post-Laser Hyperpigmented Scar with Intralesional Tranexamic Acid Injections. Dermatol Pract Concept. 2024 Jul 1;14(3):e2024182. doi: 10.5826/dpc.1403a182. PMID: 39122525; PMCID: PMC11313627.**
19. **Mohamed RR, Mahmoud Mohamed LG, Mansour M, Rageh MA. Topical 10% Tranexamic Acid with and without Microneedling in the Treatment of Erythematotelangiectatic Rosacea: A Split-face Comparative Study. J Clin Aesthet Dermatol. 2024 Feb;17(2):47-51. PMID: 38444423; PMCID: PMC10911261.**
20. **Bageorgou F, Vasalou V, Tzanetakou V, Kontochristopoulos G. The new therapeutic choice of tranexamic acid solution in treatment of erythematotelangiectatic rosacea. J Cosmet Dermatol. 2019 Apr;18(2):563-567. doi: 10.1111/jocd.12724. Epub 2018 Aug 11. PMID: 30099833.**
21. **Mrowietz U, Lauffer F, Sondermann W, Gerdes S, Sewerin P. Psoriasis as a Systemic Disease. Dtsch Arztebl Int. 2024 Jul 12;121(14):467-472. doi: 10.3238/arztebl.m2024.0064. PMID: 38657176.**
22. **Hseu JH, Chan CI, Vadivalagan C, Chen SJ, Yen HR, Hseu YC, Yang HL, Wu PY. Tranexamic acid improves psoriasis-like skin inflammation: Evidence from in vivo and in vitro studies. Biomed Pharmacother. 2023 Oct;166:115307. doi: 10.1016/j.biopha.2023.115307. Epub 2023 Aug 11. PMID: 37573659.**
23. **Philipp-Dormston WG. Melasma: A Step-by-Step Approach Towards a Multimodal Combination Therapy. Clin Cosmet Investig Dermatol. 2024 May 22;17:1203-1216. doi: 10.2147/CCID.S372456. PMID: 38800358; PMCID: PMC11128260.**

24. **Abd Elraouf IG, Obaid ZM, Fouda I. Intradermal injection of tranexamic acid versus platelet-rich plasma in the treatment of melasma: a split-face comparative study. Arch Dermatol Res. 2023 Aug;315(6):1763-1770. doi: 10.1007/s00403-023-02580-y. Epub 2023 Mar 1. PMID: 36856856; PMCID: PMC10338558.**
25. **Galache TR, Galache M, Sena MM, Pavani C. Amber photobiomodulation versus tranexamic acid for the treatment of melasma: protocol for a double-blind, randomised controlled trial. BMJ Open. 2023 Jul 21;13(7):e073568. doi: 10.1136/bmjopen-2023-073568. PMID: 37479524; PMCID: PMC10364183.**
26. **González-Molina V, Martí-Pineda A, González N. Topical Treatments for Melasma and Their Mechanism of Action. J Clin Aesthet Dermatol. 2022 May;15(5):19-28. PMID: 35642229; PMCID: PMC9122278.**
27. **Sarkar R, Handog EB, Das A, Bansal A, Macarayo MJ, Keshavmurthy V, Narayan V, Jagadeesan S, Pipo E 3rd, Ibaviosa GM, Podder I, Bansal S. Topical and Systemic Therapies in Melasma: A Systematic Review. Indian Dermatol Online J. 2023 Oct 27;14(6):769-781. doi: 10.4103/idoj.idoj_490_22. PMID: 38099013; PMCID: PMC10718129.**
28. **Yasnova N, Sirait SP, Rahmayunita G. The effectiveness and safety of 3% tranexamic acid cream vs. 4% hydroquinone cream for mixed-type melasma in skin of color: a double-blind, split-face, randomized controlled trial. Acta Dermatovenerol Alp Pannonica Adriat. 2024 Jun;33(2):83-88. PMID: 38918942.**
29. **Kaikati J, El Bcherawi N, Khater JA, Dib SM, Kechichian E, Helou J. Combination Topical Tranexamic Acid and Vitamin C for the Treatment of Refractory Melasma. J Clin Aesthet Dermatol. 2023 Jul;16(7):63-65. PMID: 37560507; PMCID: PMC10409511.**
30. **Bala HR, Lee S, Wong C, Pandya AG, Rodrigues M. Oral Tranexamic Acid for the Treatment of Melasma: A Review. Dermatol Surg. 2018 Jun;44(6):814-825. doi: 10.1097/DSS.0000000000001518. PMID: 29677015.**
31. **Tian N, Sun Y, Liu Y, Jin J, Chen S, Han H, Zhang Y, Li Z. Safety assessment of tranexamic acid: real-world adverse event analysis from the FAERS database. Front Pharmacol. 2024 May 28;15:1388138. doi: 10.3389/fphar.2024.1388138. PMID: 38863974; PMCID: PMC11165083.**

32. Meaidi A, Mørch L, Torp-Pedersen C, Lidegaard O. Oral tranexamic acid and thrombosis risk in women. EClinicalMedicine. 2021 May 6;35:100882. doi: 10.1016/j.eclinm.2021.100882. PMID: 34124632; PMCID: PMC8176123.
33. Memon RJ, Tiwari V. Angioedema. 2023 Aug 8. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan–. PMID: 30860724.
34. Hébert J, Boursiquot JN, Chapdelaine H, Laramée B, Desjardins M, Gagnon R, Payette N, Lepeshkina O, Vincent M. Bradykinin-induced angioedema in the emergency department. Int J Emerg Med. 2022 Mar 26;15(1):15. doi: 10.1186/s12245-022-00408-6. PMID: 35350995; PMCID: PMC8966254.
35. Hasara S, Wilson K, Amatea J, Anderson J. Tranexamic Acid for the Emergency Treatment of Angiotensin-Converting Enzyme Inhibitor-Induced Angioedema. Cureus. 2021 Sep 20;13(9):e18116. doi: 10.7759/cureus.18116. PMID: 34692327; PMCID: PMC8525683.
36. Abdulkarim A, Craig TJ. Hereditary Angioedema. 2023 May 1. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan–. PMID: 29489144.
37. Caballero T. Treatment of Hereditary Angioedema. J Investig Allergol Clin Immunol. 2021 Feb;31(1):1-16. doi: 10.18176/jiaci.0653. PMID: 33602658.
38. Wintenberger C, Boccon-Gibod I, Launay D, Fain O, Kanny G, Jeandel PY, Martin L, Gompel A, Bouillet L. Tranexamic acid as maintenance treatment for non-histaminergic angioedema: analysis of efficacy and safety in 37 patients. Clin Exp Immunol. 2014