Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Periocular Steroid-Induced Skin Changes in a Pediatric Patient: Highlighting the Need for Improved Eye Drop Delivery Systems — A Case Report and Literature Review

Horia Alansi

alansiha23@gmail.com

Sana'a University

Ibrahim Alwazeer

Sana'a University

Case Report

Keywords: Topical corticosteroids, Pediatric dermatology, Periocular atrophy, Allergic conjunctivitis, Medication adherence, Eye drop delivery systems

Posted Date: March 2nd, 2026

DOI: https://doi.org/10.21203/rs.3.rs-8713814/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background: Cutaneous atrophy with hypopigmentation is well documented following dermal or injectable corticosteroid use in adults; however, similar presentations in pediatric patients, particularly those related to ophthalmic preparations, are rarely reported.

Case Presentation: A 4.5-year-old child with allergic conjunctivitis developed localized cheek skin atrophy with a hypopigmented patch while using topical glucocorticoid eye drops without medical supervision. The child exhibited poor cooperation during administration, leading to repeated attempts and spillage from the bottle. Ophthalmic examination revealed no intraocular abnormalities, and discontinuation of the glucocorticoid was advised. Fear-related behavior during pediatric eye drop administration increases local exposure, medication spillage, and reduces effective dosing. A review of the literature also indicates a risk of systemic absorption associated with ophthalmic agents in pediatric eye care. Contributing factors include thin periocular skin, enhanced percutaneous absorption, persistent contact, and drug potency and formulation.

Conclusion: Caregiver education and medical supervision are essential for the safe use of pediatric eye drops. Furthermore, this report highlights the need for improved eye drop delivery systems that ensure accurate dosing, reduce medication wastage, improve treatment adherence, and minimize the risk of local or systemic adverse effects.

Introduction

The steroid eye drops are widely used in ophthalmic practice for the management of inflammatory and allergic ocular conditions because of their ability to suppress inflammatory pathways and alleviate symptoms such as redness, itching and discomfort. [1–6] Despite their therapeutic value, inappropriate or prolonged use may lead to local and systemic adverse effects, particularly when medical supervision and proper dosing regimens are not strictly followed.[3–5] Clinical recommendations emphasize limited treatment duration, gradual dose tapering and careful monitoring, especially in pediatric patients, whose tissues, body size and behavior increased susceptibility to adverse effects. [3, 4, 7] Cutaneous atrophy represents one of the most frequently encountered complications associated with potent topical corticosteroids applied to the skin, an adverse effect involves all skin layers and documented in dermatological practice. [2, 3, 5, 7, 8] In pediatric eye care, noncooperation during drop installation can inadvertently, shift drug from eye surface to skin. The peri-ocular skin involvement secondary to ophthalmic steroid exposure remains under-recognized in routine ophthalmic care, particularly among children. The majority of reported pediatric cases of steroid-induced skin changes are associated with dermatological preparations or injectable formulations rather than ophthalmic medications [5, 4, 7, 8]. Furthermore, no consistent genetic or systemic predisposition has been identified to explain individual variability in the development of steroid-related cutaneous lesions. [5, 7, 9]. Transferring the vulnerability to systemic bioavailability of eye drops even with the normal dosing quantity. The ocular dose among children in literature still not weight adjusted with quite different physiological clearance from these of

adults. In addition. this dependent age group also might get abuse in drop installation by unfit caregiver. This report studied the cause and effect factors in this skin atrophy and its phase. The unsupervised eye steroid use upon this child alarmed full eye examinations to evaluate his illness nature and the other adverse effects of the persistent use of steroids on the child eye

Case report

A Yemeni male child of 4.5 years old, was brought from a remote village by his father to Al-Thawra General Hospital, Eye Clinic, Sana'a, Yemen, with a complaint of a newly appearing furrow on the right cheek ending in a pale pigmented patch for about one week. According to his present history, the child had been using eye drops containing dexamethasone 0.1% combined with polymyxin and neomycin in a benzalkonium-containing vehicle among past 5 weeks to relieved redness and itching. There was negative history about the presence of any systemic disease such as scleroderma, previous trauma, or the use of traditional remedies. On examination, the child was slim with light brownish skin. A skin furrow extended from the lateral angle of the right eye, encircled the right cheek, and ended in a flat hypo-pigmented patch just lateral to the right angle of the mouth. The skin furrow was regular, about 0,3 cm depth, 0,6 cm width and 4 cm with no change in texture and consistency. The father gave positive history about difficulty in drop installation for child by refuse. The advice was conservative for possible skin resolution and always to adhere medical recommendations. A full ophthalmic examination showed normal eyes and vision. The eye drops used contained dexamethasone 0.1%, polymexin and neomycin. He advised to be away from dust exposure and mobile watch as possible. mobile watch decreases blinking and then the dryness leads to itching that elicit rubbing the eyes continuously. The management were preventive measures to lessen environmental factors that trigger symptoms of the allergy, use steroid–sparing agents as antihistamines, mast cell stabilizers, and artificial tears also and least potent eye steroid drops in severe symptoms with dose tapering or ciclosporien A if severe symptoms. An advice for Allegist consultation for any systemic atopia and possible desensitization therapy. He needed regular follow-up to his teenage, when allergy may lessens and keratoconus progresses by check visual acuity, refraction to guard from keratoconus, which is related to his chronic atopic inflammation and apply cold compress to lessen itching sense.

Discussion

The clinical presentation of skin deepening is esthetic concerning with history of the site contact to a potent topical or several steroid injections, for example triamcinolone used for treatment of chronic joint pain and autoimmune illnesses. [1, 5-7] The youngest age group have much less chance for persistent use of steroids treatment, this explains the minimally reported skin thinning among children. [1-7] The furrow in this report, followed the path of tear overflow from the right eye down. The child's behavior of fear, resistance and blepharospasm keeping closed eyes, spill out drops in trials to get any of them inside the eye. [10] The right check get the atrophy as it contacted tears containing steroids more than left. The left eye might be elicit immediate rubbing, as it received the drop at first by the relative's right hand, eliciting blepharospasm then most of tears spread more over child's right check. The drop volume

exceeding that of the conjunctival sac volume of the child from the current convenan tal bottles, and find way to the nasal mucosa and skin.[11]

Excessive ocular dosing upon thin skin in periocular area enhance systemic absorption through skin added to absorption through conjunctiva and nasolacrimal pathway, The systemic adverse effect is proportionally greater in children due to smaller body size and lower circulatory blood volume, [12-19]

Frequent and uncontrolled administration of topical steroid eye drops in resistant pediatric patients may result in inefficient drug delivery to the ocular tissues while increasing periocular exposure, contributing to both local and systemic

adverse effects. Infants and young children, ages from days to 4 years, are particularly susceptible due to thin ocular membranes and skin, which can facilitate systemic absorption and manifestations such as Cushingoid features and intraocular pressure elevation in steroid eye drops, [12,13] A reported respiratory depression and bradycardia from eye drops containing Apraclonidine eye drops in childs aged less than 6 months. Atropine eye drop might lead to urinary retention, dry mouth or even anaphylactic shock. [13,14]

The measures to prevent absorption, choose the least potent medication and care giver education as keeping head up, apply digital press at the medical canthus to occlude the lacrimal passage and raise the in the lower cul-de sac of the conjunctiva for a while during installation, [10] The esthetic complain of this report was translated and transferred to generalized as a visual indicator of excessive drop volume and repeated spillage during instillation, reflecting general challenges of eye drop installation in young children. This challenge involves these dependent group in their eye care around 20% of population show struggle fear, tremors, or these who are bed ridden or suffering from paralysis. The children add non-cooperation and even resist taking the topical eye by behavioral blinking reflexes, and inability or refusal to maintain upward gaze or eyelid retraction leading to missing both medication and aim of use [10, 18] Furthermore third of caregiver are not competent in application of eye drop installation, for this point teaching videos showing common mistakes in the drop installation may help address this issue. [18] An ophthalmic bottles, designed to deliver a dose quantity efficiently in single drop per actuation through the medial side of closed eye lids and spread inside the eye by blink in the right therapeutic dose. An example of a mechanism for delivery of the drop is by mechanism of one way capillary attraction to prevent bacterial contamination from eye lashes to the bottle. [19] Despite these needs, there are commercial shortage. Future research should focus on the development of standardized design criteria to pediatric ophthalmic care.

The clinical skin atrophy evolution due to topical steroids begins 3-14 days after treatment and run into subtle pre-atrophy, followed by overt thinning or atrophy and ultimately tissue tolerance or tachphylaxis. [5,21] Early discontinuation of the offending agent may allow partial or complete reversal of the skin changes, particularly in pre-atrophic or in younger individuals with higher regenerative capacity. [2,5,8,21] In contrast persistent exposure may result in irreversible alterations, including striae formation, fibrotic remodeling and long term pigmentary changes, The tachphylaxis phase results in tissue tolerance to

steroid and loss of capillary vasoconstriction then the capillaries within 4 days become able to constrict for that, a pulse therapy is preferred to decrease the exposure time, in which topical steroids discontinued for 4 days over 2-4 weeks. [1,3,4,5]

Another less common adverse effect is the melanin cells pigment alteration toward either hypo or hyperpigmentation that might persist months post recovery of skin thinning. [2,5,7] The factors enhancing skin atrophy by topical steroids are the strength (potency), vehicle constituent and either or both duration and frequency of the dose.[1,2,5-6,8] According to the US potency classification of corticosteroids, The Dexamethasone is a Class I or supra-potent corticosteroids and the Hydrocortisone 0.5-1.0% is the least potent and it is the only steroid recommended for face lesions as an ointment once a day and it is among Class VII with cautiously tapering dose and limited treatment period to 2 weeks as in chronic eczema activity. [6] The potency of topical steroid is its amount producing a desired therapeutic effect. [1-4] Local cutaneous vasoconstriction assay based on steroid effect is the measure of steroid potency. [1-6]

The adverse effects of steroids by any rout on the eye, occur at any age and they are irreversible sight threatening as cataract and/or glaucoma and the eye steroids are contraindicated or cautiously used when there is infected corneal ulcer, as they lead to delay ulcer healing with rapid perforation. [7,21] Finally, while steroids are well recognized role in inducing cutaneous thinning, there is no conclusive evidence linking early steroid exposure to with the development of corneal thinning disorders as keratokonus. [16, 22, 23] However, keratoconus has genetic predisposition and it is a stromal ectasia due to intrinsic biomechanical disruption of collagen links in the stroma as inflammatory corneal ectasia in nature with high matrix metalloprotease enzyme (MMP) that might be linked to connective tissue diseases – atopia and exacerbated by eye rubbing.[22,23] The steroid, as an anti-inflammatory, could decrease these leading risks in keratoconus. However, the Benzalkonium chloride, a vehicle constituent in most of eye drop, might has potential epithelial toxicity that decreases cell viability and corneal ectasia, in addition to atopic chronic conjunctivitis, as a connective tissue disease and the continuous mechanical rubbing behavior, these considerations highlights the impotence of long term follow up in pediatric patients with chronic ocular allergy. [15, 22, 23]

Conclusion

Although the skin atrophy in this report was from malpractice use of eye drops, it transferred the illustration to the challenge in eye drop installation among children. The education of parents and dispensing of a more controlled pediatric drug delivery system might improve pediatric eye care..

Lesson from this report: Close monitoring is advocated for children using topical steroids. Care giver education about the need for one drop and use the steroid sparing alternatives to control symptoms of the chronic allergy. A wide distribution of cheap eye drop-control bottles to avoid drop spillages, medication loss, possible systemic absorption and to adhere treatment aim.

Limits in the study: This report was observational and further studies are needed to identify the period limits and dose frequency for cutaneous toxicity from eye drops in children as well as resolution period as the follow up missed.

Declarations

Consent for image Publication: A written informed consent was obtained from the father of the patient for publication of rare complaint as a case report with any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Author Consideration: H.A conducted the patient, conceived and provided the professional writing. I A, revised the report

Ethics Approval and consent to participate: not applicable

Acknowledgements: Non Applicable

Availability of supporting data and Materials: Data sharing is not applicable to this article, as no generated or analyzed datasets during the current study.

Competing interests: The Authors declare that having no competing interests.

Funding: No funding received for the publication of this case report.

References

1. Gabros S, Nessel TA, Zito PM. Topical Corticosteroids. In: Stat Pearls [Internet]. Treasure Island (FL): Stat Pearls Publishing; Jan-2024. Available from "https://www.ncbi.nlm.nih.gov/books/NBK532940/"532940
2. Niculet E, Bobeica C, Tatu A L. Glaucocorticoid-Induced Skin Atrophy: The Old and New. Clinical Cosmetic and investigational Dermatology, 2020 Dec. 30: Vol. 13:1041-1050. Doi: 10.2147/CCID.S224211. PMID: 33408495; PMC 7779293.
3. Lax SJ, Harvey J, Axon E, Howells L, Santer M, Ridd MJ, Lawton S, Langan S, Roberts A, Ahmed A, Muller I, Ming LC, Panda S, Chernyshov P, Carter B, Williams HC, Thomas KS, Chalmers JR, et al. (Cochrane Skin Group): Mar. 2022. "Strategies for using topical corticosteroids in children and adults with eczema". The Cochrane Database of Systematic Reviews: 2022 (3): CD 013356. doi:10.1002/14651858. CD013356.pub2. PMC 8916090. PMID 35275399.
4. Camisa, Charles; Garofola, Craig. Topical corticosteroids". Comprehensive Dermatologic Drug Therapy:2021:511–527.e6. doi: 10.1016/B978-0-323- 61211-1.00045-0. ISBN 9780323612111.
5. Babu TS, Ramesh V, Harish K, et al. Topical steroid-damaged face: clinical features and stages of skin atrophy (pre-atrophy, atrophy and tachyphylaxis). J Dermatol Case Rep. 2023;17(3)45–49.

6. Zvidzayi M, Rath S, Bon C, Abboo S, Kanfer I. A Novel Approach to Assess the Potency of Topical Corticosteroids. Pharmaceutics. 2021 Sep 13;13(9):1456. doi: 10.3390/pharmaceutics13091456. Erratum in: Pharmaceutics. 2022 Sep 22;14(10):2006. doi: 10.3390/pharmaceutics14102006. PMID: 34575532; PMCID: PMC8466269.
7. Coondoo A, Phiske M, Verma S, Lahiri K. Side-effects of topical steroids: A long overdose revisit. Indian Dermatol Online j. 2014 Oct;5(4):416-25.doi:10.4103/2229-5178.142483. PMID:25396122.
8. Abtahi-Naeini B. et al. “Nicolau syndrome in a pediatric patient after corticosteroid injection: a case report and review of the literature.” Journal of Medical Case Reports 2025;19:370, DOI: https://doi.org/10.1186/s13256-025-05437-2, link.springer.com
9. Masood, H., Abdul-Mughni, G. T., Othman, A. M., Al-Sonboli, N. N. A., & Ghlab, F. A. (2025). Risk Factors Associated with Atopic Asthma among Yemeni Children in Sana’a city: A Case-Control Study. Faculty of Medicine and Health Sciences Journal - Sana'a University, 19(1), 157–163. https://doi.org/10.59628/jchm.v19i1.1523
10. Dadak, Rohan1; Hatamnejad, Amin1; Patil, Nikhil S.1; Qiu, Hongbo1; Chan, Toby Y.B.2; Rayat, Jaspreet2. Eye drop Instillation Techniques, Difficulties, and Currently Available Solutions: A Literature Review. Journal of Current Ophthalmology 35(3):p 226-230, Jul–Sep 2023. | DOI: 10.4103/joco.joco_308_22
11. Mishima S, Gasset A, Klyce SD, Baum Jl. Determination of tear volume and tear flow. Invest Ophthamol. 1966; 5(3):264-276.
12. 12-Jinagal J, Gupta PC, Pilania RK, Ram J. Systemic toxicity of topical corticosteroids. Indian J Ophthalmol. 2019 Apr;67(4):559-561. doi: 10.4103/ijo.IJO_1091_18. PMID: 30900600; PMCID: PMC6446646.
13. Mundkur S, Kumar S, Aroor S, Kumar M. Iatrogenic Cushing’s syndrome in a child following topical ocular steroid therapy. Pediatr Oncall J. (Year/Volume/Pages).
14. Gish P, Kim I, Kapoor R, Jones SC. Systemic Toxicity With Use of Apraclonidine Ophthalmic Drops in Pediatric Patients. JAMA Ophthalmol. 2025 Dec 1;143(12):1061-1065. doi: 10.1001/jamaophthalmol.2025.4243. PMID: 41196580; PMCID: PMC12593656.
15. Princelle A, Hue V, Pruvost I, Potey C, Dubos F, Martinot A. Effets systémiques des collyres mydriatiques atropiniques chez deux enfants [Systemic adverse effects of topical ocular instillation of atropine in two children]. Arch Pediatr. 2013 Apr;20(4):391-4. French. doi: 10.1016/j.arcped.2013.01.012. Epub 2013 Feb 22. PMID: 23433845.
16. Choudhary S, Singh AK, Gupta K, Pandav SS, Kaushik S. Topical Steroid-Induced Cushing's Syndrome in a Newborn Following Goniotomy for Glaucoma. J Glaucoma. 2023 Jan 1;32(1):65-67. doi: 10.1097/IJG.0000000000002116. Epub 2022 Aug 22. PMID: 36001506.
17. Haga C, Waller T, Ahuja A S, et al. (January 04, 2022) There’s Danger in the Drops: Systemic Effects of Ophthalmic Drops Used to Treat Glaucoma. Cureus 14(1): e20945. doi:10.7759/
18. Mo Y, Xu Z, Xiao H, Yu X, Zhang H, Huang W, Geo L, Wang Y. Caregaver competence in pediatric eye drop administration: An observational study. J Pediatr Nurs. 2025 sep-Oct;84:261-267.

Doi10.1016/j.pedn.2025.06.023. Epub 2025 jun 20. PMID:40543350.

19. Daul P, Roy P, Accurate Delivary and Precise Dosing of Eye Drops: What if We Change the installation Procedures? ONdrugDelivery, Issue 157 (Mar2024),pp 4-9
20. Oikarinen A, Haapasaari KM, Sutinen M, Tasanen K. The molecular basis of glucocorticoid-induced skin atrophy: topical glucocorticoid apparently decreases both collagen synthesis and the corresponding collagen mRNA level in human skin in vivo. Br J Dermatol. 1998 Dec;139(6):1106-10. doi: 10.1046/j.1365-2133.1998.02646.x. PMID: 9990383.
21. Mehta JS, Chen WL, Cheng AC, Cung LX, Dualan IJ,Kekunnaya R, Khaliddin N, Kim TI, Lam DK, Leo SW, Manurung F, Tesavibul N and Bremond-Gignac D (2022) Diagnosis, 14-Management, and Treatment of Vernal Keratoconjunctivitis in Asia: Recommendations From the Management of Vernal Keratoconjunctivitis in Asia Expert Working Group. Front. Med. 9:882240 doi: 10.3389 /fmed.2022.882240
22. Paterson T, Azizoglu S, Gokhale M, Cambers M, Suphioglu C. Preserved Ophthalmic Anti-Allergy Medication in Cumulatively increasing Risk Factors of Corneal ectasia. Biology (basel):2023 Jul;12(7):1036.doi:10.3390/biology12071036, PMC10376818.
23. Vought R, Greenstein SA, Gelles J, Hersh PS. The Pathophysiology of Keratoconus. Cornea. 2025 Feb 1;44(2):137-143. doi: 10.1097/ICO.0000000000003585. Epub 2024 May 30. PMID: 38830186.ite

Figures

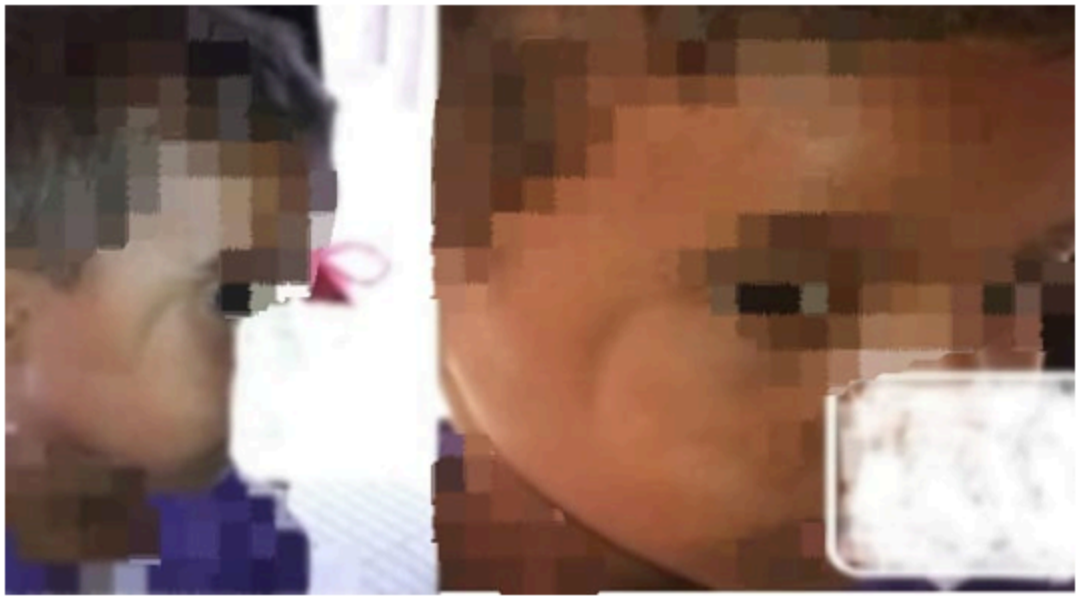


Figure 1

Figure shows two images of a child with allergic conjunctivitis. Prolonged use of potent topical steroi4d eye drops resulted in skin thinning and hypopigmentation over the right cheek. The curved linear pattern represents the path of tear flow containing steroid medication, leading to localized esthetic cutaneous side effects.