CASE REPORT

Non-Invasive Imaging in Pediatric Psoriasis: Combined Use of Reflectance Confocal Microscopy and Optical Coherence Tomography

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Abstract: Psoriasis is a chronic, immune-mediated inflammatory disease that may present unique clinical and diagnostic challenges in pediatric patients. In children, invasive diagnostic procedures such as skin biopsy are often avoided because of pain, anxiety, and cosmetic concerns, prompting interest in non-invasive imaging modalities. We report the case of a 9-year-old boy presenting with erythematous, scaly plaques on the scalp and knees, clinically and dermoscopically suggestive of psoriasis. Reflectance confocal microscopy (RCM) revealed parakeratosis with bright polygonal keratinocytes, preserved honeycomb pattern of the epidermis, and dilated dermal capillaries with visible leukocyte flow. Optical coherence tomography (OCT) demonstrated hyperkeratosis, papillomatosis, and vertically oriented dilated capillaries. These findings supported the clinical diagnosis of psoriasis without the need for histopathological confirmation. This case highlights the diagnostic value of multimodal non-invasive imaging, particularly RCM and OCT, in pediatric psoriasis. Such approaches improve diagnostic confidence, reduce patient discomfort, and may represent viable alternatives to skin biopsy in children.

Keywords: *pediatric psoriasis, reflectance confocal microscopy (RCM), optical coherence tomography (OCT), non-invasive imaging.*

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INTRODUCTION

Psoriasis is a chronic, immune-mediated inflammatory disease characterized by keratinocyte hyperproliferation and immune dysregulation that extends beyond the skin, being increasingly regarded as a systemic condition associated with significant cardiometabolic comorbidity [1,2]. This disease affects approximately 2–3% of adults worldwide, accounting for more than 125 million people globally, with the highest prevalence reported in Northern Europe and North America [3].

Pediatric psoriasis, although less prevalent, represents a significant and growing clinical concern. The estimated global prevalence among children and adolescents ranges from 0.1% to 1.0%, with higher rates up to 2.1% reported in some European cohorts [4,5]. According to the Global Psoriasis Atlas, the estimated prevalence of psoriasis in Romanian children is approximately 0.25% [6]. Pediatric psoriasis accounts for 4–8% of all psoriasis cases and often presents distinct morphologic features compared to adult disease, such as smaller and thinner plaques, more frequent scalp and facial involvement, and higher overlap with eczema or seborrheic dermatitis [7,8]. Diagnosis in children is further complicated by limited biopsy tolerance, parental reluctance, and the psychological distress associated with invasive procedures [9]. Early-onset psoriasis has been correlated with greater disease persistence and a higher risk of developing psoriatic arthritis and cardiometabolic comorbidities later in life, emphasizing the importance of early recognition and non-invasive diagnostic tools [10].

In recent years, non-invasive imaging has become an important adjunct in dermatologic diagnostics [11]. Reflectance confocal microscopy (RCM) enables in vivo, real-time visualization of the skin with near-histologic resolution, allowing assessment of both epidermal and superficial dermal structures [12]. RCM findings in psoriasis typically include parakeratosis with bright polygonal keratinocytes, acanthosis reflected by an irregular “honeycomb” pattern, loss of the bright rim around dermal papillae (non-edged papillae), and dilated capillary loops with visible leukocyte flow [13,14]. These microscopic characteristics correlate closely with histopathologic features and provide a valuable diagnostic alternative in equivocal cases [15]. The technique is painless, repeatable, and suitable for pediatric patients, thus improving both diagnostic confidence and patient compliance [16].

Optical coherence tomography (OCT) complements RCM by offering cross-sectional imaging of skin architecture at greater depth [17]. High-definition OCT (HD-OCT) visualizes epidermal thickening, hyperkeratosis, papillomatosis, and the orientation of dilated dermal capillaries typical of psoriatic lesions [18]. The ability of OCT to quantify epidermal thickness and vascular patterns has proven useful not only for diagnosis but also for monitoring therapeutic response and disease progression [19]. When used in combination, RCM and OCT provide complementary information—RCM captures cellular-level morphology, while OCT delineates tissue structure—thus enabling a comprehensive non-invasive evaluation of psoriatic skin [20]. Their integration represents an evolving diagnostic approach that may reduce the need for biopsy, with an important impact in pediatric dermatology, where minimal invasiveness and patient comfort are essential [21].

CASE PRESENTATION

We present the case of a 9-year-old boy that was referred to the Department of Dermatology, “Sf. Parascheva” Clinical Hospital of Infectious Diseases, Galati, Romania, for non-invasive imaging evaluation due to the presence of erythematous, scaly lesions on the scalp and knees and parental reluctance to skin biopsy. The child had no significant past medical history and denied any family history of psoriasis or other inflammatory dermatoses.

The first lesions appeared on the scalp approximately two years earlier, consisting of

erythematous plaques covered by adherent silvery-white scales. Over the following months, the lesions persisted with minimal variation in intensity and were mildly pruritic. Two months prior to presentation in our department, small papules and thin plaques developed on both knees, progressively enlarging and showing fine scaling. No nail changes or arthralgia were reported.

Clinical examination revealed several erythematous-scaly plaques and patches on the scalp and retroauricular areas, as well as smaller, faintly scaly plaques on both knees. The lesions were well-demarcated, dry, and covered by adherent, micaceous scales, without signs of secondary infection.

Dermoscopic examination demonstrated a regular pattern of dotted vessels on a light-red background and diffuse white scales — a vascular and surface pattern characteristic of psoriasis vulgaris.

Because of the patient's anxiety and the parents' refusal of biopsy, non-invasive imaging was performed. Reflectance confocal microscopy (RCM) (VivaScope 3000) was used to obtain high-resolution in vivo images from lesional skin on the scalp.

At the level of the stratum corneum, RCM revealed parakeratosis characterized by large, hyper-reflective keratinocytes. The typical "honeycomb" epidermal pattern was largely preserved, although slightly irregular in some areas due to acanthosis (thickening of the spinous layer). In the superficial epidermis, early dermal papillae lacking a bright peripheral rim (non-edged papillae) were observed. Within these papillae, round capillary lumina with visible leukocyte movement were noted, indicating increased vascular activity (Fig. 1).

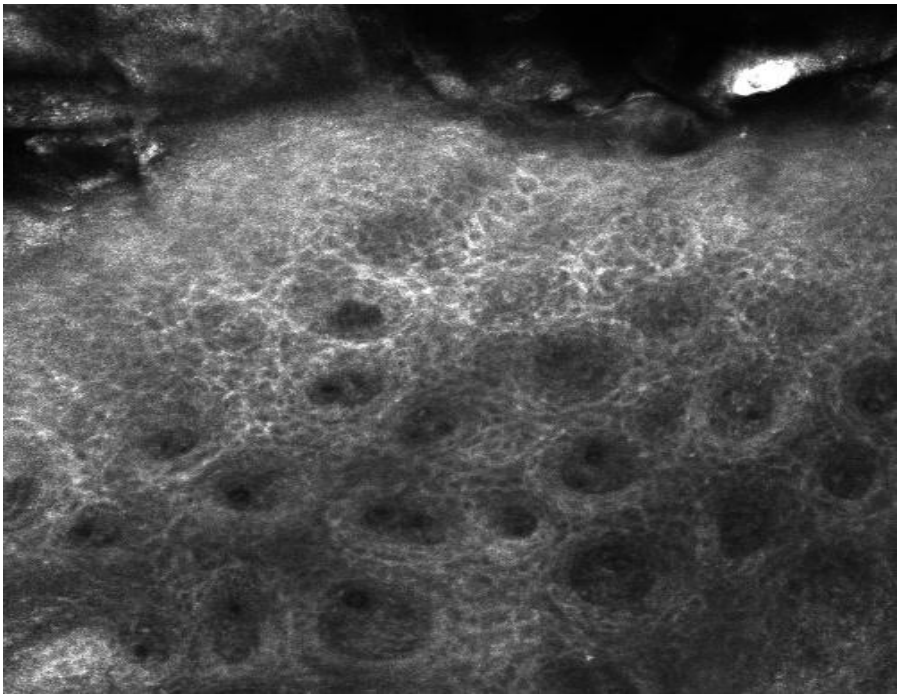

Figure 1. Reflectance Confocal Microscopy (RCM) findings in pediatric psoriasis.

In addition, optical coherence tomography (OCT) was performed to assess skin architecture at greater depth. The OCT examination demonstrated hyperkeratosis and papillomatosis, with dilated capillary loops oriented perpendicularly to the skin surface. Epidermal thickening was clearly visualized, in agreement with the RCM findings (Fig. 2).

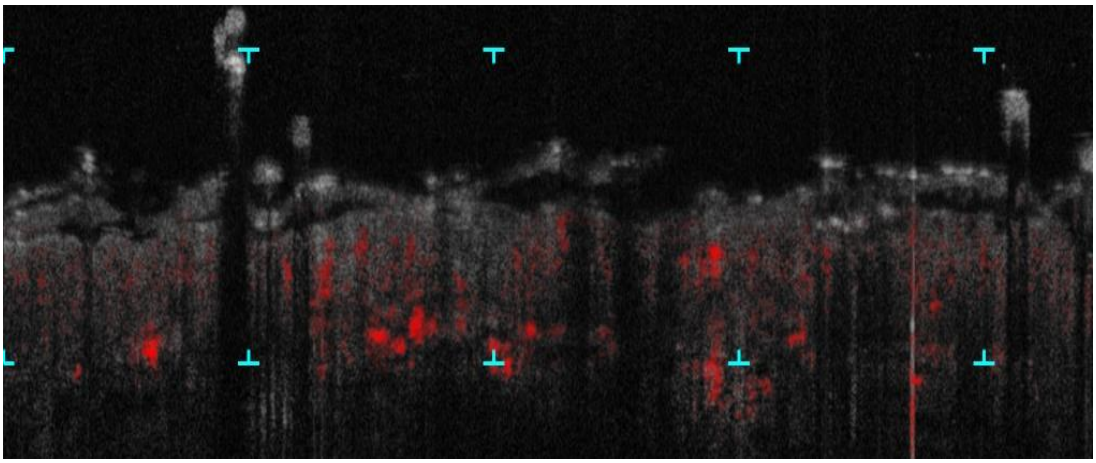

Figure 2. Optical Coherence Tomography (OCT) features of pediatric psoriasis.

Based on the clinical, dermoscopic, and multimodal imaging features (RCM and OCT), a diagnosis of psoriasis vulgaris was established. No histopathologic or laboratory investigations were conducted, as the imaging results were considered sufficient for diagnosis.

The patient was managed with topical emollients and low-potency corticosteroids, with clinical improvement at two-month follow-up.

DISCUSSION

Psoriasis in pediatric patients often presents with atypical morphology and distribution, frequently leading to diagnostic uncertainty and potential delay in treatment initiation. [7,8] The reluctance to perform skin biopsies in children due to anxiety and potential scarring has encouraged the usage of non-invasive diagnostic alternatives. In this context, reflectance confocal microscopy (RCM) and optical coherence tomography (OCT) have emerged as reliable adjunct tools, bridging the gap between clinical and histopathologic evaluation [11,12,22].

RCM allows in vivo visualization of cellular and microvascular alterations characteristic of psoriasis. In the present case, the presence of parakeratosis, preserved honeycomb epidermal pattern, and dilated dermal papillae containing bright capillary loops with leukocyte flow mirrored the classic RCM findings reported in adult and pediatric cohorts [13,14,25]. These features reflect histopathologic hallmarks such as hyperkeratosis, acanthosis, and capillary dilatation [15]. Importantly, the identification of non-edged papillae, a well-described RCM marker, is crucial in distinguishing psoriasis from eczema, in which spongiosis and vesiculation dominate [14,28]. The ability to visualize dynamic leukocyte flow within dermal capillaries is another strong diagnostic indicator, correlating with inflammatory activity [25,26].

OCT provides complementary structural information with greater imaging depth, allowing evaluation of the dermo-epidermal junction and vascular orientation. In our patient, OCT revealed epidermal thickening, papillomatosis, and vertically oriented dilated vessels—findings in line with prior studies using high-definition and line-field confocal OCT [17,18,23,24]. These features correspond histologically to elongation of rete ridges and dermal vascular proliferation. The quantitative potential of OCT, including measurement of epidermal thickness and vessel diameter, can be particularly useful for longitudinal monitoring of disease activity and treatment response [19,23,27].

Recent investigations further highlight the complementary diagnostic value of RCM and OCT in inflammatory dermatoses. These modalities provide correlated morphological and vascular data, enabling differentiation of

psoriasis from other papulosquamous diseases with overlapping clinical features [22,23]. RCM offers near-histologic visualization of epidermal and vascular alterations, while OCT contributes depth-resolved structural assessment, improving diagnostic confidence [24,25,27]. The usage of these non-invasive techniques reduces the need for confirmatory biopsies, a particularly relevant advantage in pediatric dermatology [26,28].

Our case underlines the feasibility of integrating multimodal imaging into pediatric dermatologic evaluation. The combined use of RCM and OCT provides both cellular-level and architectural information, increasing diagnostic accuracy and patient comfort [20,21,26]. The congruence between clinical, dermoscopic, and imaging findings allowed a confident diagnosis without histology. Future research should focus on establishing standardized diagnostic criteria for pediatric dermatological diseases by using non-invasive imaging and exploring their role in treatment monitoring [24,29].

CONCLUSIONS

Reflectance confocal microscopy and optical coherence tomography offer complementary, non-invasive visualization of psoriatic skin, reproducing histopathologic hallmarks *in vivo* and minimizing procedural discomfort. Non-invasive imaging modalities such as RCM and OCT provide reliable, high-resolution diagnostic information, enabling accurate evaluation of epidermal and dermal morphology while avoiding biopsy. Their combined use enhances diagnostic precision and facilitates monitoring of disease evolution across different age groups. Incorporating these techniques into routine dermatologic assessment may significantly improve patient comfort and diagnostic confidence, representing a meaningful step toward a fully non-invasive approach to cutaneous diagnosis.

Author contributions:
M.I.M. conceived the original draft preparation. M.I.M., E.G., L.G.G., A.L.T and C.C.D. were responsible for conception and design of the review. M.I.M. was responsible for the data acquisition and for the collection and assembly of the articles/published data, and their inclusion and interpretation in this review. All authors contributed to the critical revision of the manuscript for valuable intellectual content. All authors have read and agreed with the final version of the manuscript.

Compliance with Ethics Requirements:
The authors declare no conflict of interest regarding this article.

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REFERENCES

[1]. Immunology of psoriasis. Annu Rev Immunol. 2014;32:227–55.
[2]. Takeshita J, Grewal S, Langan SM, et al. Psoriasis and comorbid diseases: epidemiology. J Am Acad Dermatol. 2017;76(3):377–90.
[3]. Parisi R, Symmons DPM, Griffiths CEM, Ashcroft DM. Global epidemiology of psoriasis: a systematic review of incidence and prevalence. J Invest Dermatol. 2013;133(2):377–85.
[4]. Bronckers IMGJ, van Geel MJ, Seyger MMB. The epidemiology of childhood psoriasis: a scoping review. Br J Dermatol. 2016;174(6):1242–51.
[5]. Dairov A, Kimball AB, Menter A, et al. Prevalence, incidence, gender and age distribution, and economic burden of psoriasis worldwide and in selected countries. Dermatol Ther (Heidelb). 2024;14:1051–68.
[6]. Global Psoriasis Atlas. Prevalence Data, Romania. 2024. Available from: https://www.globalpsoriasisatlas.org/prevalence-data-pdf?country=ROU
[7]. Paller AS, Mancini AJ. Psoriasis in children: clinical aspects and management. Pediatr Dermatol. 2015;32(5):593–605.
[8]. Stănescu AMA, Sendrea AM, Popa LG. Essential clinical and diagnostic aspects in pediatric psoriasis. Rom J Med Pract. 2021;16(4):214–8.

[9]. Kimball AB, Wu EQ, Guérin A, et al. Risks of developing comorbidities in patients with psoriasis. J Am Acad Dermatol. 2008;58(6):1039–48.
[10]. Kumar B, Jain R, Sandhu K, Kaur I, Handa S. Epidemiology of childhood psoriasis: a study of 419 patients. Pediatr Dermatol. 2014;31(1):59–64.
[11]. Białek-Galas K, Reich A, Adamski Z, Szepietowski JC. The use of reflectance confocal microscopy in selected inflammatory skin diseases. Adv Dermatol Allergol. 2019;36(2):140–6.
[12]. Ardigò M, Agozzino M, Longo C, et al. Reflectance confocal microscopy in psoriasis and other inflammatory skin diseases. Dermatology. 2010;221(2):133–7.
[13]. Agozzino M, Longo C, Ardigò M. Reflectance confocal microscopy for inflammatory skin diseases: an update. Clin Exp Dermatol. 2016;41(8):826–34.
[14]. Wang ZY, Liu X, Zhang LF, et al. Accuracy of dermoscopic and reflectance confocal microscopy features in psoriasis. Chin Med J. 2020;133(12):1420–7.
[15]. Boone M, Norrenberg S, Jemec GBE, et al. High-definition optical coherence tomography imaging of psoriasis. Br J Dermatol. 2016;174(2):353–6.
[16]. Boone M, Norrenberg S, Jemec GBE, et al. Non-invasive imaging of psoriasis vulgaris using optical coherence tomography and reflectance confocal microscopy. Skin Res Technol. 2013;19(1):e14–9.
[17]. Ulrich M, Lange-Asschenfeldt B. In vivo confocal microscopy and optical coherence tomography in dermatology: recent advances. Curr Opin Oncol. 2022;34(2):126–34.
[18]. Negruțiu M, Nedelea I, Dumitrașcu D, et al. Imaging approach in the diagnostics and evaluation of psoriasis vulgaris. Diagnostics (Basel). 2024;14(10):969.
[19]. Ardigo M, Soyer HP. Integration of RCM and OCT for non-invasive assessment of inflammatory skin diseases. J Eur Acad Dermatol Venereol. 2022;36(5):669–77.
[20]. Boone M, Jemec GBE. High-definition optical coherence tomography and reflectance confocal microscopy for non-invasive skin imaging. Dermatol Clin. 2023;41(2):213–24.
[21]. Reiter O, Mimouni D, Gdalevich M, et al. Pediatric psoriasis: comorbidities, treatments and challenges. Dermatol Ther (Heidelb). 2023;13(5):1305–19.
[22]. Jiang Q, Zhang L-F, Liu X, et al. Reflectance confocal microscopy for plaque psoriasis: monitoring epidermal and dermal changes under secukinumab therapy. Sci Rep. 2024;14:65902.
[23]. Wirsching HB, Mayer OJ, Schlingmann S, et al. Line-field confocal optical coherence tomography of plaque psoriasis under IL-17 inhibitor therapy: AI-supported analysis. Appl Sci. 2025;15(2):535.
[24]. Truong TM, Pathak GN, Rao BK, et al. Line-field confocal optical coherence tomography imaging of psoriasis: in vivo high-resolution assessment. Skin Res Technol. 2023;29(4):e132-41.
[25]. Micali G, Raskovic D, et al. Noninvasive evaluation of diameter and density of dermal capillaries in plaque psoriasis using RCM. J Invest Dermatol. 2023;143(6):1764–72.
[26]. Negruțiu M, Nedelea I, Dumitrașcu D, et al. Imaging approach in the diagnostics and evaluation of psoriasis vulgaris. Diagnostics (Basel). 2024;14(10):969.
[27]. Orsini C, Trovato E, Cortonesi G, et al. Line-field confocal optical coherence tomography: new insights for psoriasis diagnosis and monitoring. J Eur Acad Dermatol Venereol. 2024;38(3):325–31.
[28]. Wang ZY, Liu X, Zhang LF, et al. Comparison of dermoscopy and reflectance confocal microscopy in psoriasis diagnosis and monitoring. Skin Res Technol. 2022;28(2):e13158.
[29]. Wan B, Ganier C, Du-Harpur X, et al. Applications and future directions for optical coherence tomography in dermatology: focus on psoriasis. Br J Dermatol. 2021;184(6):1014.