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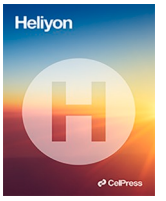

Research article

Matching between ctlinical examination and dermoscopy in patients with nail psoriasis: Should dermoscopy be used instead of clinical examination?

Kaveh Gharaei Nejad [a,*], Hojat Eftekhari [a], Rana Rafiei [a], Abbas Darjani [a], Narges Alizadeh [a], Reyhaneh Ghadarjani [b], Katayoun Dadgostar [a]

[a] Department of Dermatology, Skin Research Center, Razi Hospital, Guilan University of Medical Sciences, Rasht, Iran
[b] Department of Pathology, Razi Hospital, Guilan University of Medical Sciences, Rasht, Iran

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ABSTRACT

Background: Dermoscopy has emerged as a useful diagnostic tool to evaluate skin lesions, including psoriasis. We aimed to compare the clinical examination and digital dermoscopy findings of nail involvement in patients with psoriatic nails.
Methods: This study included 60 patients with clinically diagnosed psoriasis. The nail findings and NAPSI were evaluated clinically and via dermoscopy, and then the severity of the disease was calculated using PASI criteria.
Results: About 32 patients were males, with a median PASI score of 4.4, and pitting and subungual hyperkeratosis were the most common findings. The clinical and dermoscopic examination had a moderate diagnostic resemblance regarding onycholysis, subungual hyperkeratosis, and leukonychia. The resemblance between the two methods for the diagnosis of leukonychia in patients with a duration of disease <2 years (Kappa = 0.59) and 2–6 years was moderate (Kappa = 0.48), and for 6 years< was perfect (Kappa = 0.62). The resemblance for the diagnosis of subungual hyperkeratosis and onycholysis in subjects with a duration of disease <2 years was slight, and for 2–6 years and 6 years< were moderate. The resemblance between the NAPSI score by the two methods was also moderate (95%CI -0.89-0.81, $P < 0.001$).
Conclusion: Dermoscopy is an efficient, supportive, and non-invasive method providing a better diagnosis of nail psoriasis.

1. Introduction

Psoriasis is a complex autoimmune/inflammatory skin disorder affecting 2–4% of the general population [1,2]. Psoriasis is characterized by abnormal keratinocyte proliferation, dysregulation of human leukocyte antigens, and T-cell-driven epidermal hyperplasia [3–5]. The prevalence of psoriasis in different regions of the world has a bimodal pattern, with the first peak around 30–39 years of age and the second peak around 60–69 years of age [6]. Multiple factors contribute to the etiology of nail psoriasis, including genetic, immunological, and environmental factors [3]. Although nails only cover a small portion of the body's surface area, psoriasis in these regions can significantly impact a patient's life's physical and psychosocial aspects [7]. About 80–90 % of patients with

* Corresponding author. Department of Dermatology, Skin Research Center, Razi Hospital, Guilan University of Medical Sciences, Rasht, Iran.
E-mail address: gharaeek36@gmail.com (K. Gharaei Nejad).

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psoriasis complain from nail affection [8]. The clinical manifestations of nail psoriasis vary according to the compartment of the nail units involved, including nail discoloration, subungual hyperkeratosis, pitting, and onycholysis [9]. Nail psoriasis severely impacts the individual's quality of life and can interfere with professional and other activities [9,10]

The gold standard in diagnosing nail psoriasis is histopathologic evaluation of the nail biopsy; however, a biopsy of the nail apparatus is an invasive procedure and results in permanent deformity and disfigurement of the nail plate. Nail area psoriasis severity index (NAPSI) criteria are used clinically to evaluate and monitor nail involvement in psoriasis. While symptoms of nail psoriasis are usually easy to evaluate, some symptoms are subtle and may challenge or delay the diagnosis and interfere with accurate NAPSI scores [11]. For uncommon and challenging features, dermoscopy can help make the clinical signs more obvious for better and earlier diagnosis, prompt management, and prevent long-term sequelae [11–13]. Dermoscopy is a non-invasive and inexpensive method that can serve as a helpful tool for early diagnosis, in which the practitioner can better evaluate nail apparatus components by attaching a camera to a magnifying set of lenses [14–16]. Dermoscopic indicators of onychomycosis demonstrate strong specificity and prove valuable in distinguishing between nail psoriasis, trauma, and onychomycosis [17].

Considering The emerging role of dermoscopy in the diagnosis of nail disorders and the limited studies on dermoscopic evaluation of nail change)s in psoriasis, we aimed to conduct this study to investigate the resemblance between clinical findings and dermoscopic features which may suggest implementing dermoscopy instead/along physical examination for earlier and more accurate diagnosis of nail psoriasis among patients.

2. Methods

2.1. Study design and variables

This cross-sectional study included 60 patients with psoriasis referred to Besat and Razi Dermatology Clinics affiliated with Guilan University of Medical Sciences, Rasht, Iran, in 2017. The patients' demographical data and clinical characteristics were recorded via a questionnaire. The patients with incomplete data, previous significant nail traumas (occupational or non-occupational), suspected fungal infections, rheumatoid disorders, and patients undergoing chemotherapy or immunosuppressive medications were excluded from the study. This study design was approved by the ethical committee of Guilan University of Medical Sciences, Rasht, Iran (IR.GUMS.REC.1396.263), and all patients consented to participate in the current study.

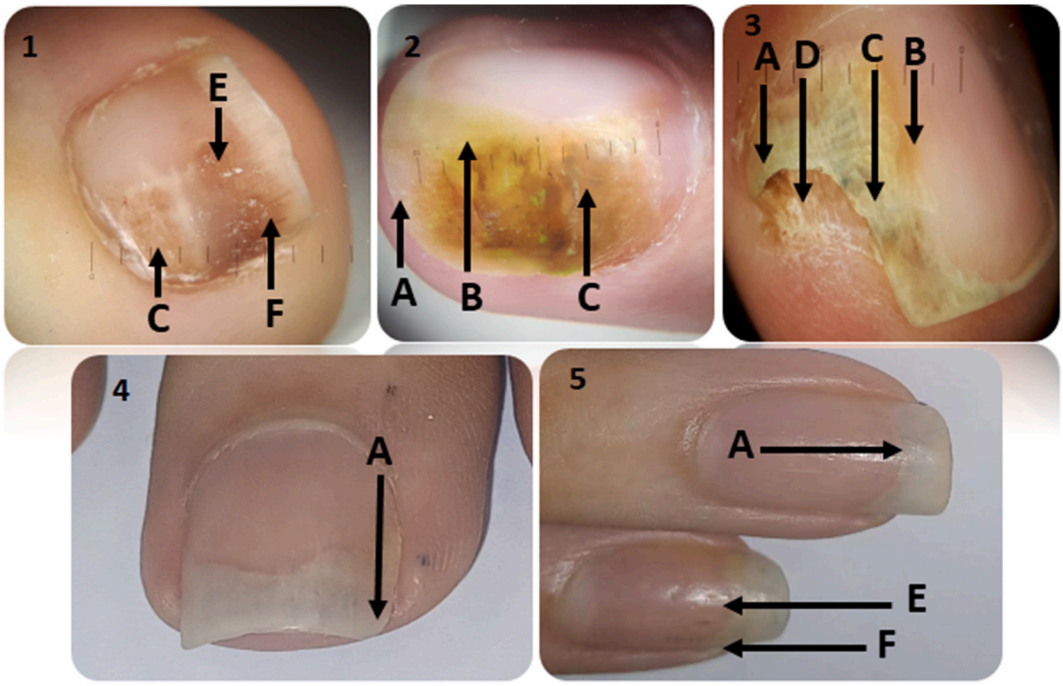

Fig. 1. Nai1 involvement psoriasis via a video dermoscopy (microDERM ®, version 3.5.0.16, © Visiomed AG, Bielefeld, GERMANY) with 10 × magnification (1, 2, and 3) and clinical examination (4 and 5).
A. Onycholysis
B. Oil spot
C. Fragility
D. Subungual hyperkeratosis
E. Pitting
F. Splinter hemorrhages.

2.2. Diagnosis of psoriasis

A dermatologist diagnosed psoriasis and the severity of the disease was calculated by the psoriasis area severity index (PASI), which includes four parameters: extent, erythema, crusting, and plaque thickness rating 0 = None, 1 = Slight, 2 = Moderate, 3 = Severe, and 4 = Very severe. Degree of involvement as % for each body region affected (score each region with a score between 0 and 6); 0 = None, 1 = 1–9%, 2 = 10–29 %, 3 = 30–49 %, 4 = 50–69 %, 5 = 70–89 %, and 6 = 90–100 %. Features evaluated for nail involvement by clinical examination or dermoscopy included pitting, subungual hyperkeratosis, onycholysis, salmon patch or oil spots, splinter hemorrhage, nail thickening, nail fragility (lamellar onycholysis, onychorrhexis, and keratin degranulation) (Fig. 1). The NAPSI scoring system was calculated both clinically and by dermoscopy for finger psoriasis. NAPSI scoring is as follows: score for matrix psoriasis: 0 = none, 1 = present in 1/4 nail, 2 = present in 2/4 nail, 3 = present in 3/4 nail, 4 = present in 4/4 nail score for nail bed psoriasis: 0 = none, 1 = present in 1/4 nail, 2 = present in 2/4 nail, 3 = present in 3/4 nail, 4 = present in 4/4 nail. Patients with no abovementioned nail findings but other findings of nail involvement in dermoscopy are considered patients without apparent nail involvement (subclinical nail involvement). Dermoscopy was done using a video dermoscopy (microDERM ®, version 3.5.0.16, © Visiomed AG, Bielefeld, GERMANY) with 10 × magnification and performed by two experienced dermatologists, Fig.1[(A-F)].

2.3. Statistical analysis

Mean and standard deviation (SD) were used to describe quantitative variables with normal distribution, and median and interquartile range were used for quantitative variables with non-normal distribution. Qualitative variables were described based on number and percentage. First, the normal distribution of the study's quantitative data was measured using the Shapiro-Wilk test, skewness and skewness values, and Q-Q plot. Then, the resemblance between the findings of nail involvement in clinical and dermoscopic examination in psoriasis patients was measured using Cohen's kappa coefficient Kappa (κ) can be defined as a coefficient of resemblance ($\kappa < 0$: Less than chance resemblance; $0.01 \leq \kappa \leq 0.20$: Slight resemblance; $0.21 \leq \kappa \leq 0.40$: Fair resemblance; $0.41 \leq \kappa \leq 0.60$: Moderate resemblance; $0.61 \leq \kappa \leq 0.80$: Substantial resemblance; $0.81 \leq \kappa \leq 0.99$: Almost perfect resemblance). The resemblance between the measured values of the NAPSI score by the clinical and dermoscopic method using the Altman-Bland plot and intraclass correlation coefficients and 95 % confidence limits using SPSS software version 21 (Single-Rating, absolute-resemblance, two-way mixed-effects model) was measured. A significant level was considered <0.05.

3. Results

The mean age of the patients was 41.78 ± 16.17 years, ranging from 11 to 73 years, and 53.3 % were men. The median duration of the disease (MDD) was four years, and the disease duration in more than half of the people (n = 32; 61.7 %) was less than six years. The disease duration in 21 patients (35.0 %) was less than two years. The median PASI score of the patients was 4.4, with a range of 0.4–37.50. The severity of nail involvement in 39 people (69 %) was mild (PASI ≤7). In the clinical examination, the frequency distribution of three common complications in fingers were pitting (60.0 %), onycholysis (38.3 %), and subungual hyperkeratosis (25.0 %), respectively, and in toes, subungual hyperkeratosis (48.3 %), onycholysis (40.0 %) and pitting (28.3 %), respectively. Moreover, according to the dermoscopic method, the three frequent complications in fingers were 83.3 % pitting, 73.3 % splinter hemorrhage, and 60 % onycholysis; and in toes, 78.3 % subungual hyperkeratosis, 76.7 % onycholysis, and 70.0 % splinter

Table 1
The prevalence of nail involvement based on clinical examination and dermoscopy.

Nail involvement	Remarks	Clinical		Dermoscopy	
		Hands n(%)	Feet n(%)	Hands n(%)	Feet n(%)
Pitting	Yes	36(60.0 %)	17(28.3 %)	50(83.3 %)	34(56.7 %)
	No	24(40.0 %)	43(71.7 %)	10(16.7 %)	26(43.3 %)
Leukonychia	Yes	7(11.7 %)	0 (0.0)	15(25.0 %)	1(1.7 %)
	No	53(83.3 %)	60(100.0 %)	45(75.0 %)	59(98.3 %)
Fragility	Yes	12(20.0 %)	8(13.3 %)	32(53.3 %)	35(58.3 %)
	No	48(80.0 %)	52(86.7 %)	28(46.7 %)	25(41.7 %)
Oil spot	Yes	8(13.3 %)	2(3.3 %)	23(38.3 %)	15(25.0 %)
	No	52(86.7 %)	58(96.7 %)	37(61.7 %)	45(75.0 %)
Subungual hyperkeratosis	Yes	15(25.0 %)	29(48.3 %)	29(48.3 %)	47(78.3 %)
	No	45(75.0 %)	31(51.7 %)	31(51.7 %)	13(21.7 %)
Onycholysis	Yes	23(38.3 %)	24(40.0 %)	36(60.0 %)	46(76.7 %)
	No	37(61.7 %)	36(60.0 %)	24(40.0 %)	14(23.3 %)
Splinter hemorrhage	Yes	14(23.3 %)	8(13.3 %)	44(73.3 %)	42(70.0 %)
	No	46(76.7 %)	52(86.7 %)	16(26.7 %)	18(30.0 %)

In clinical examination, the three most common nail involvement in fingers were pitting (0.60 %), onycholysis (38.3 %), and subungual hyperkeratosis (25.0 %), and in toes were subungual hyperkeratosis (48.3 %), onycholysis (40.0 %) and pitting (28.3 %). By the dermatoscopic method, the three most common nail involvement in fingers were pitting (83.3 %), splinter hemorrhage (73.3 %) and onycholysis (60.0 %), and in toes, were subungual hyperkeratosis (78.3 %), onycholysis (76.7 %) and splinter hemorrhage (70.0 %); The frequency distribution of nail involvement is based on the number (percentage).

hemorrhage (Table 1).

The highest resemblance between clinical examinations and dermoscopy for the diagnosis of leukonychia was with a coefficient of $\kappa = 0.59$, with a moderate resemblance that out of 15 patients with leukonychia, both methods diagnosed seven patients, and the dermoscopy diagnosed eight patients, also based on both methods of 45 people were negative for leukonychia. Moreover, in total, the lowest resemblance between clinical and dermoscopic examinations for the diagnosis of splinter hemorrhage was with a coefficient of $\kappa = 0.06$, with a slight resemblance that out of 52 patients with splinter hemorrhage, only 16 patients were diagnosed by both methods and 36 patients were diagnosed by dermoscopy method. Also, based on both methods, 7 people were negative for leukonychia. Furthermore, a substantial resemblance between clinical and dermatoscopic examinations was observed for patients with pitting for <2 years ($\kappa = 0.64$) and leukonychia ≥ 6 years ($\kappa = 0.62$); so, 21 patients from the 60 psoriatic patients complained of pitting of less than two years; 14 of them were diagnosed clinically and dermoscopically, while the dermoscopic diagnosed three only and were normal clinically, whereas the remaining four patients were clinically and dermoscopically free. Of the four patients with leukonychia ≥ 6 years, two were diagnosed by both methods, while two were diagnosed by dermatoscopy (Table 2).

There was a substantial resemblance between the two methods based on PASI score for patients with onycholysis in the category of $7<\text{PASI} \leq 12$ ($\kappa = 0.67$), so among 13 patients, 11 were diagnosed by each method. In contrast, only 2 of them were diagnosed by dermatoscopy. Also, there was a moderate resemblance between the two methods for patients with leukonychia in the category of PASI ≤ 7 ($\kappa = 0.58$) and $7<\text{PASI} \leq 12$ ($\kappa = 0.45$), pitting, and subungual hyperkeratosis in the category of PASI ≤ 7 ($\kappa = 0.45$ and, $\kappa = 0.44$),

Table 2
The resemblance between clinical examination and digital dermoscopy in diagnosing various nail involvement (finger and toe) is based on the disease duration.

Nail findings	Observation	Clinical	Dermoscopy		Total	kappa	Total Kappa
			Yes	No			
Pitting	**<2years**	Yes	14	0	14	0.64	0.38
		No	3	4	7		
	2-6years	Yes	8	0	8	0.12	
		No	7	1	8		
	≥6years	Yes	17	1	18	0.40	
		No	3	2	5		
Leukonychia	**<2years**	Yes	3	0	3	0.59	0.59
		No	3	15	18		
	2-6years	Yes	2	0	2	0.48	
		No	3	11	14		
	≥6years	Yes	2	0	2	0.62	
		No	2	19	21		
Fragility	**<2years**	Yes	4	0	4	0.07	0.18
		No	14	3	17		
	2-6years	Yes	4	0	4	0.20	
		No	8	4	12		
	≥6years	Yes	7	0	7	0.32	
		No	9	7	16		
Oil spot	**<2years**	Yes	1	0	1	0.12	0.28
		No	8	12	20		
	2-6years	Yes	2	0	2	0.25	
		No	6	8	14		
	≥6years	Yes	5	0	5	0.35	
		No	8	10	18		
Subungual hyperkeratosis	**<2years**	Yes	10	0	10	0.26	0.41
		No	8	3	11		
	2-6years	Yes	9	0	9	0.60	
		No	3	4	7		
	≥6years	Yes	15	0	15	0.44	
		No	5	3	8		
Onycholysis	**<2years**	Yes	8	0	8	0.25	0.41
		No	9	4	13		
	2-6years	Yes	10	0	10	0.56	
		No	3	3	6		
	≥6years	Yes	16	0	16	0.51	
		No	4	3	7		
Splinter hemorrhage	**<2years**	Yes	4	0	4	0.02	0.06
		No	16	1	17		
	2-6years	Yes	4	0	4	0.26	
		No	7	5	12		
	≥6years	Yes	8	1	9	−0.03	
		No	13	1	14		

The resemblance between the two methods of clinical observations and dermoscopy is interpreted based on the Cohen's kappa coefficient. The κ coefficient can be defined as a coefficient of resemblance ($\kappa < 0$: Less than chance resemblance; $0.01 \leq \kappa \leq 0.20$: Slight resemblance; $0.21 \leq \kappa \leq 0.40$: Fair resemblance; $0.41 \leq \kappa \leq 0.60$: Moderate resemblance; $0.61 \leq \kappa \leq 0.80$: Substantial resemblance; $0.81 \leq \kappa \leq 0.99$: Almost perfect resemblance).

respectively (Table 3). Moreover, among individuals with PASI ≥12, there is a slight resemblance only for oil spots κ = 0.12, Table 3. According to the Altman-Bland plot (Diagram1), there was a moderate resemblance between the two methods based on the NAPSI score (95 % CI 0.089–0.81, $P < 0.001$).

4. Discussion

Dermoscopy is an objective and non-invasive innovation used in dermatological examinations in recent years. Most of the patients were males and middle-aged, with an average duration of psoriasis disease of four years. In the current study, among the diagnosed clinical and dermoscopic features of nail psoriasis, pitting, onycholysis, and subungual hyperkeratosis were the most frequent findings among patients, respectively. Moreover, pitting was the most common complication in the fingers, and subungual hyperkeratosis was the most common complication in the toes by clinical and dermoscopic examinations. One of the remarkable aspects of this study is that the findings of clinical and dermoscopic examinations were reported separately for the upper and lower limbs. Similar to our findings, studies reported that pitting was the most common finding of nail psoriasis among patients [18–21]. Furthermore, Plot et al. illustrated a statistically significant difference in the frequency of pitting diagnosis in clinical and dermoscopic examinations, in which the number of findings by dermoscopic examination was higher than in clinical examinations ($P = 0.03$). In addition, they reported

Table 3
The resemblance between clinical examination and digital dermoscopy in diagnosing various nail involvement (finger and toe) is based on the PASI score.

Nail findings	Observation	Clinical	Dermoscopy		Total	kappa
			YES	No		
Pitting	**PASI ≤7**	Yes	24	0	24	0.45
		No	9	6	15	
	7<PASI ≤12	Yes	10	1	11	0.13
		No	4	1	5	
	PASI>12	Yes	5	0	5	NA
		No	0	0	0	
Leukonychia	**PASI ≤7**	Yes	6	0	6	0.58
		No	6	27	33	
	7<PASI ≤12	Yes	1	0	1	0.45
		No	2	13	15	
	PASI>12	Yes	0	0	0	NA
		No	0	5	5	
Fragility	**PASI ≤7**	Yes	10	0	10	0.21
		No	19	10	29	
	7<PASI ≤12	Yes	5	0	5	0.26
		No	7	4	11	
	PASI>12	Yes	0	0	0	NA
		No	5	0	5	
Oil spot	**PASI ≤7**	Yes	3	0	3	0.23
		No	12	24	36	
	7<PASI ≤12	Yes	4	0	4	0.26
		No	7	5	12	
	PASI>12	Yes	1	0	1	0.12
		No	3	1	4	
Subungual hyperkeratosis	**PASI ≤7**	Yes	19	0	19	0.44
		No	11	9	20	
	7<PASI ≤12	Yes	11	0	11	0.26
		No	4	1	5	
	PASI>12	Yes	4	0	4	NA
		No	1	0	1	
Onycholysis	**PASI ≤7**	Yes	20	0	20	0.37
		No	12	7	19	
	7<PASI ≤12	Yes	11	0	11	0.67
		No	2	3	5	
	PASI>12	Yes	3	0	3	NA
		No	2	0	2	
Splinter hemorrhage	**PASI ≤7**	Yes	11	1	12	0.12
		No	20	7	27	
	7<PASI ≤12	Yes	3	0	3	NA
		No	13	0	13	
	PASI>12	Yes	2	0	2	NA
		Yes	3	0	3	

The resemblance between the two methods of clinical observations and dermoscopy is interpreted based on Cohen's kappa coefficient. The κ coefficient can be defined as a coefficient of resemblance (κ < 0: Less than chance resemblance; 0.01 ≤ κ ≤ 0.20: Slight resemblance; 0.21 ≤ κ ≤ 0.40: Fair resemblance; 0.41 ≤ κ ≤ 0.60: Moderate resemblance; 0.61 ≤ κ ≤ 0.80: Substantial resemblance; 0.81 ≤ κ ≤ 0.99: Almost perfect resemblance); NA: Not applicable.

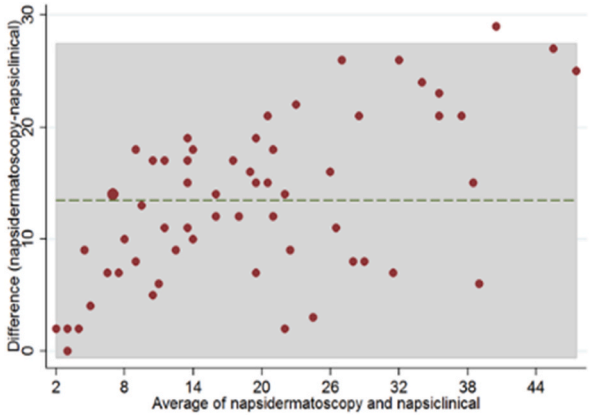

Diagram 1. Altman-Bland Plot: Resemblance between clinical and dermoscopic methods based on NAPSI score for finger nail psoriasis. The diagram shows the there was a moderate resemblance between the two methods based on the NAPSI score (95 % CI 0.089–0.81, $P < 0.001$.

that the most common complications of nail psoriasis in patients were pitting, leukonychia, and splinter hemorrhage, respectively [18].

In the present study, the comparison between clinical examination and dermoscopic findings demonstrated a moderate resemblance in visualizing onycholysis, leukonychia, and subungual hyperkeratosis in nail psoriasis, but a significant disagreement was observed in the diagnosis of pitting, fragility, oil spots, and especially splinter hemorrhage; therefore, it should be considered that dermoscopy may allow for better detection of these nail findings. Furthermore, since these features are among the criteria for NAPSI index calculation and routine nail examination, this tool can help evaluate nail involvement by psoriasis and NAPSI index calculations due to the higher diagnostic accuracy of digital dermoscopy. Furthermore, the resemblance between clinical examination and digital dermoscopy in diagnosing nail psoriasis complications, according to NAPSI, considerably implies the role of dermoscopy in assessing NAPSI compared to the clinical assessment due to its sensitivity for more accurate findings of nail psoriasis complications [22]. Therefore, except for histopathology, dermoscopy may be the future gold-standard diagnostic tool for nail psoriasis [14,23–25]. In addition, positive associations between several dermoscopic manifestations and disease severity were reported [22,26].

On the other hand, the diagnostic resemblance of clinical examinations and dermoscopy according to the duration of psoriasis was generally a moderate resemblance between clinical examination and dermoscopy regarding onycholysis, subungual hyperkeratosis, and leukonychia. Furthermore, our results indicated that as the duration of psoriasis increases, the resemblance strength of the two diagnostic methods increases; one reason is that when the duration of psoriasis increases, it is expected that the nail lesions will become more visualized to be detected by the naked eye, which represented that dermoscopy is especially helpful for detecting subtle nail involvements by psoriasis early.

The obtained findings of onycholysis indicated that the poor diagnostic resemblance between clinical examinations and dermoscopy becomes more robust with increasing severity of the disease. Also, dermoscopy can detect nail changes during psoriasis treatment and should be used to evaluate treatment success [27]. In subungual hyperkeratosis and pitting lesions, the average diagnostic resemblance between clinical examinations and dermoscopy weakens with increasing severity of the disease. On the other hand, in the leukonychia lesion, the average diagnostic resemblance between clinical examinations and digital dermoscopy was maintained steady with an increase in the severity of the disease. In this study, due to the small number of patients with PASI above 12, the study's accuracy has decreased in this period, so maybe the decrease in resemblance in high PASI is due to the small number of patients with severe psoriasis in this study. Dermoscopy offers a non-invasive and efficient method for monitoring the evolution of therapeutic interventions and assessing their efficacy over time.

5. Conclusion

Therefore, dermoscopy seems more appropriate and accurate for early diagnosis of most nail psoriasis findings. On the other hand, the nail biopsy method is invasive, expensive, and has permanent complications, so dermoscopy can be considered a suitable alternative method for nail biopsy for early diagnosis of psoriasis.

Consent to participate

We informed all participants and they provided verbal consent to participate in the study and signed the consent form. Written consent was obtained from literate individuals. In cases where the participants were unable to sign a form, because of a language barrier or cognitive decline, their legal guardian/family or an appropriate representative gave informed consent to participate on their behalf and signed a form in a written format.

Ethical approval

This study design was approved by the ethical committee of Guilan University of Medical Sciences, Rasht, Iran (IR.GUMS.REC.1396.263).

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None.

Data availability

The current study's data are available from the corresponding author upon reasonable request.

CRediT authorship contribution statement

Kaveh Gharaei Nejad: Writing – review & editing, Validation, Supervision, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Hojat Eftekhari:** Writing – review & editing, Validation, Methodology, Investigation, Data curation. **Rana Rafiei:** Visualization, Validation, Supervision, Methodology, Formal analysis, Data curation. **Abbas Darjani:** Writing – review & editing, Validation, Methodology, Investigation, Data curation, Conceptualization. **Narges Alizadeh:** Writing – review & editing, Validation, Data curation. **Reyhaneh Ghadarjani:** Writing – original draft, Software, Investigation. **Katayoun Dadgostar:** Writing – original draft, Software, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Not applicable.

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