

# Enthesopathy in patients with nail psoriasis – a cross-sectional evaluation of clinical, onychoscopic and ultrasonographic features

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## Abstract

**Background:** Nail involvement in psoriasis is common and may be an indicator not only of disease severity, but also of the presence of psoriatic arthritis. However, the relationship of nail psoriasis with enthesitis remains under-explored.

**Aims:** This study was conducted to evaluate the clinical, onychoscopic (nail dermatoscopic) and ultrasonographic features in patients with nail psoriasis.

**Materials and Methods:** All nails of twenty adult patients with nail psoriasis were examined clinically and onychoscopically. Patients were evaluated for psoriatic arthritis (Classification Criteria for Psoriatic Arthritis), the severity of cutaneous disease (Psoriasis Area Severity Index) and nail disease (Nail Psoriasis Severity Index). Ultrasonography of the clinically involved digits was performed for evidence of distal interphalangeal joint enthesitis.

**Results:** Out of 20 patients, 18 patients had cutaneous psoriasis and 2 had isolated nail involvement. Among the 18 patients with skin psoriasis, 4 had associated psoriatic arthritis. The most commonly observed clinical and onychoscopic features were pitting (31.2% and 42.2%), onycholysis (36% and 36.5%) and subungual hyperkeratosis (30.2% and 30.5%), respectively. Ultrasonographic evidence of distal interphalangeal joint enthesitis was seen in 57% (175/307) of the digits with clinical nail involvement. Enthesitis was more common in patients with psoriatic arthritis (77% vs 50.6%). Nail thickening, crumbling and onychorrhexis (all features of nail matrix involvement) were significantly associated with enthesitis ( $P < 0.005$ ).

**Limitations:** The major limitation was the small sample size and lack of controls. Only the clinically involved digits were evaluated for enthesitis.

**Conclusions:** Enthesitis was frequently detected on ultrasonography in patients with nail psoriasis, even in clinically asymptomatic individuals. Nail features of thickening, crumbling and onychorrhexis may predict underlying enthesitis and the potential development of arthritis. A comprehensive evaluation could help identify patients with psoriasis at risk for arthritis, helping improve long-term outcomes.

**Key words:** Enthesitis, nail psoriasis, psoriatic arthritis, nail dermoscopy.

## Plain Language Summary

Ultrasonographic evaluation of distal interphalangeal joint involvement in nail psoriasis

Nail psoriasis is more frequent as well as more severe in patients with psoriatic arthritis. Through this study we explore its association with distal interphalangeal joint (DIP) enthesitis. Ultrasonographic evidence of DIP joint enthesitis was found to be commonly present in 307 digits of 20 patients, manifesting nail psoriasis. This was present even when the patient did not have

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any clinical evidence of psoriatic arthritis. We also found that nails with thickening, crumbling, or onychorrhexis had evidence of enthesitis more commonly. This study highlights that nail psoriasis should be comprehensively evaluated and treatment options chosen with a long-term aim to prevent joint damage.

## Introduction

Isolated nail involvement may be seen in 5–10% of patients with psoriasis and the incidence of nail involvement has been estimated to be up to 90% over a lifetime.<sup>1,2</sup> Nail psoriasis significantly affects the quality of life<sup>3–5</sup> and correlates with increased disease severity, longer duration and higher frequency of joint involvement.

Clinical features of nail psoriasis are variable, determined by the site of involvement within the nail unit. The nail bed rests directly on the periosteum of the distal phalanx and the nail matrix lies in proximity to the distal interphalangeal joint and the insertion of the digital extensor tendon. This explains the frequent association of nail psoriasis with distal interphalangeal joint arthritis and enthesitis.

An early diagnosis of enthesitis and distal interphalangeal joint arthritis by radiological imaging (ultrasonography, magnetic resonance imaging) may permit choice of appropriate therapy, thus enabling optimal therapeutic outcomes, improving prognosis and preventing deformities. Ultrasonography is cheaper and more easily available than magnetic resonance imaging and is a sensitive, repeatable and real-time assessment.

The nature and characteristics of nail unit changes have not been comprehensively evaluated and data regarding the link between nail psoriasis and enthesitis of the corresponding digital extensor tendon is scant. To bridge this gap, we evaluated clinical and onychoscopic features of patients with nail psoriasis along with an ultrasonographic assessment of the DIP joints and entheses.

## Materials and Methods

A convenience sample of 20 consecutive adult patients with nail psoriasis presenting to the Skin OPD of the Department of Dermatology and STD, University College of Medical Sciences and Guru Teg Bahadur Hospital, Delhi, India, was recruited after approval by the Institutional Ethical Committee. The study protocol was explained and written informed consent obtained from each study participant.

A detailed history and complete mucocutaneous examination documenting the site(s) of cutaneous involvement and cutaneous disease severity (using the Psoriasis Area Severity Index) was performed. The nails of all fingers and toes were examined under good light, and the severity of nail involvement was recorded using the Nail Psoriasis Severity Index. Nail dermoscopy (onychoscopy) was performed with a USB dermatoscope (Dinolite edge Digital Microscope AM7515MZT, AnMo Electronics Corporation, Taipei, Taiwan) and the changes noted. A detailed musculoskeletal examination was conducted and the presence of psoriatic arthritis was

documented using the Classification criteria for Psoriatic Arthritis (CASPAR).

Ultrasonographic assessment (Samsung RS80 EVO, Samsung Electronics Co. Ltd, Seoul, South Korea) of the distal interphalangeal joint and entheses was performed on all digits with clinically involved nails using a linear probe (frequency of 3–16 Hz). We used the OMERACT 7 (Outcome Measures in Rheumatoid Arthritis Clinical Trials) definitions for ultrasonographic pathology and a loss of normal fibrillary architecture of the digital extensor tendon, the presence of enthesophytes at the point of bony insertion or bony changes, including erosions, were documented as enthesitis.<sup>6</sup>

All data were recorded in MS Excel and statistical analysis was performed using IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, N.Y., USA). Means and proportions were calculated. Appropriate statistical tests of significance including t-test (for means), Chi-square test and Fisher's exact test (for proportions) were applied to evaluate statistical significance of differences between study groups.

## Results

The ages of the study subjects ranged from 18–60 years (mean  $38.1 \pm 12.7$  years). Men outnumbered women (1.85:1) and the duration of psoriasis ranged from 1 to 13 years (mean  $5.9 \pm 3.4$  years) [Table 1]. Of the 20 patients with nail psoriasis, 4 had associated psoriatic arthritis, 2 patients had isolated nail involvement, while the rest had only cutaneous involvement. The Psoriasis Area Severity Index (PASI) of the 18 patients with cutaneous disease ranged from 1.6 to 50.8 (mean  $12.2 \pm 10.9$ ).

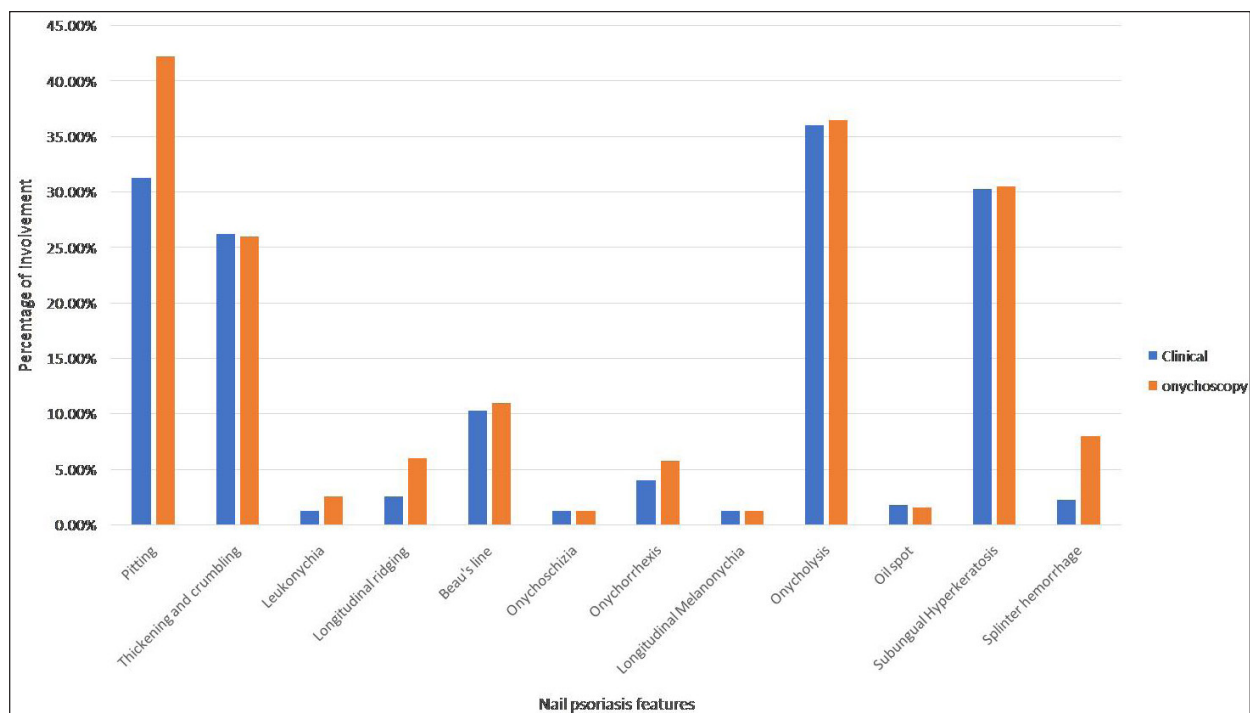
### Clinical nail involvement

All 400 nails of the 20 patients were examined and 307 of these were affected clinically. The mean number of nails involved in each patient was 15 (SD  $\pm 4$ ; range 9–20) and the mean Nail Psoriasis Severity Index (NAPSI) was 52.1 (SD  $\pm 33.4$ ; range 15–120). The mean Nail Psoriasis Severity Index was higher in patients with psoriatic arthritis in comparison with those without (92.5 vs 42). A weak correlation between nail psoriasis severity index and psoriasis area severity index was noted (Pearson's correlation coefficient ( $r$ ) = 0.208) but this was not statistically significant ( $P$  = 0.376). A total of 74/80 nails (92.5%) were involved in the 4 patients with psoriatic arthritis, while 118/320 nails (36.9%) were involved in psoriasis patients without arthritis.

The features of nail psoriasis on clinical examination are shown in Figure 1. Pitting was the commonest nail matrix change [Figure 2a] followed by thickening and crumbling [Figure 3a]. The most frequent nail bed changes were

**Table 1: Clinical profile and ultrasonography finding in patients with nail psoriasis**

	Nail psoriasis (n = 20)	Nail psoriasis without psoriatic arthritis (n = 16)	Nail psoriasis with psoriatic arthritis (n = 4)
Gender	1.85:1	1.6:1	3:1
Male:Female			
Age (years)	38.1 ± 12.65	38.18 ± 13.67	37.75 ± 7.25
Mean ± standard deviation			
Disease duration (years)	5.85 ± 3.39	5.4 ± 3.39	7.5 ± 2.87
Mean ± standard deviation			
PASI Score	12.22 ± 10.9	13.40 ± 11.67	7.5 ± 4.57
(Mean ± standard deviation)			
Nail psoriasis severity index score	52.1 ± 33.42	42 ± 24.62	92.5 ± 33.47
Mean ± standard deviation			
Number of nails involved per patient	15.35 ± 4.0	14.56 ± 4.03	18.5 ± 1.65
Ultrasonography evaluation of distal interphalangeal joint			
Total number of clinically involved nails (examined by ultrasonography)	307	233	74
Presence of radiological evidence of distal interphalangeal enthesopathy	175 (57%)	118 (50.64%)	57 (77.02%)
Ultrasonography features seen			
Enthesophyte formation	143 (46.57%)	103 (44.2%)	40 (70.17%)
Bony erosion	10 (3.25%)	3 (1.28%)	7 (9.45%)
Loss of normal fibrillary architecture	22 (7.16%)	12 (5.15%)	10 (13.5%)



**Figure 1:** Frequency distribution of nail psoriasis features on clinical examination and onychoscopy

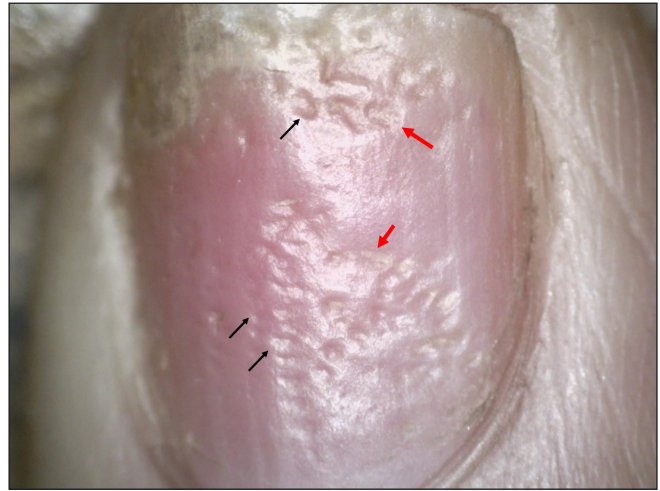
onycholysis, subungual hyperkeratosis and splinter haemorrhages, in that order [Figure 4a]. Pitting was most frequent finding in fingernails and distal onycholysis with subungual hyperkeratosis was the commonest change in toenails. A statistically significant difference was notable between the finger and toenails with respect to the incidence of some features such as pitting, thickening and crumbling, onychorrhexis, onycholysis and subungual hyperkeratosis [Table 2].

**Onychoscopy (Nail Dermatoscopy)**

Onychoscopic involvement alone (without clinical changes) was noted in 8 nails (i.e. a total of 315 nails were involved on onychoscopy) [Table 2; Figure 1]. Pitting, thickening and crumbling were the most common nail matrix features noted on onychoscopy [Figures 2b and 3b]. The most frequent nail bed changes were onycholysis, subungual hyperkeratosis and splinter haemorrhages, in that order [Figure 4b].



**Figure 2a:** Clinical evidence of pitting in nail psoriasis seen as multiple, irregularly arranged pits



**Figure 2b:** Nail dermoscopy (onychoscopy) showing psoriatic nail pitting with pits that are irregular in distribution, size, shape and depth (black arrows). Few have associated scaling (red arrow) (Dinolite AM7515MZT nonpolarised  $\times 35$ )



**Figure 3a:** Clinical finding of extensive psoriasis with thickened and crumbling nails with yellowish discoloration



**Figure 3b:** Onychoscopic image of thickened and crumbling nail plate. Yellow discoloration and opaque nail plate with the nail bed not visible (Dinolite AM7515MZT nonpolarised  $\times 35$ )

The difference in incidence of pitting, leukonychia, longitudinal ridging, onychorrhexis and subungual hyperkeratosis between finger and toenails was statistically significant ( $P < 0.05$ ) [Table 2]. Pitting, longitudinal ridging and splinter haemorrhages were significantly more frequently seen on onychoscopy as compared with the clinical examination [Table 3].

#### Ultrasonography

All 20 patients had enthesitis on ultrasonography and 57% of the clinically affected digits (175/307) demonstrated changes [Figures 5 and 6 and Table 1]. Enthesitis was documented in 77% (57 of 74) of the clinically affected nails of the 4 patients with psoriatic arthritis, but in only 51% (118/233) in those without arthritis.

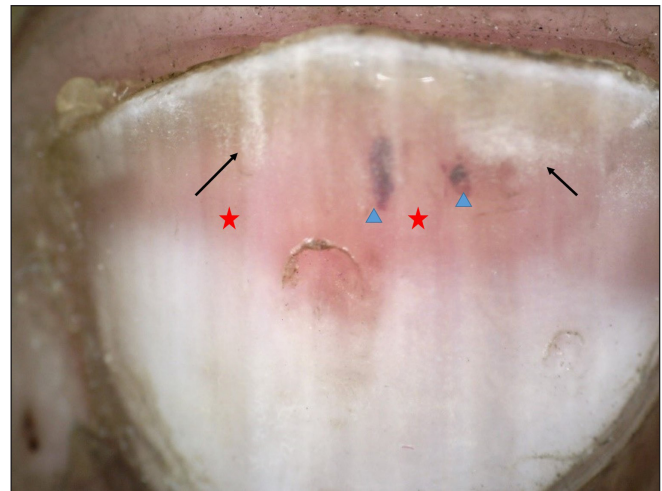
Enthesophyte formation (143 digits, 46.6%) was the commonest ultrasonography feature seen, while loss of normal fibrillary architecture (22 digits, 7.2%) and bony erosions (10 digits, 3.3%) were less commonly observed. Thickening and crumbling of the nail plate and onychorrhexis were frequently associated with enthesitis ( $P$  value of  $< 0.05$ ) [Table 4].

#### Discussion

Nail involvement in psoriasis is a common and important indicator of psoriatic arthritis and enthesitis. Ideally, nail psoriasis should influence long-term treatment choices, but in clinical practice it is often overlooked during diagnosis and management.



**Figure 4a:** Clinical evidence of nail bed psoriasis seen as distal onycholysis, salmon patch and splinter haemorrhages seen involving multiple nails



**Figure 4b:** Onychoscopic image showing distal disruption of onychodermal band (onycholysis) (black arrows) with proximal erythema (red stars) and multiple splinter haemorrhages (blue arrowheads) (Dinolite AM7515MZT polarised ×60)

**Table 2: Comparative frequency of clinical and onychoscopic features in fingernails and toenails of patients with nail psoriasis**

	Clinical examination			Onychoscopic examination		
	Fingernails n (%)	Toenails n (%)	P value	Fingernails n (%)	Toenails n (%)	P-value
Total nails examined	200	200		200	200	
Nail matrix features						
Pitting	105 (53%)	20 (10%)	<b>0.0001*</b>	127 (64%)	42 (21%)	<b>0.00001*</b>
Thickening and Crumbling	40 (20%)	65 (33%)	<b>0.004*</b>	40 (20%)	64 (32%)	0.465
Leukonychia	4 (2%)	1 (0.5%)	0.371	9 (5%)	1 (0.5%)	<b>0.02*</b>
Red spot in lunula	0	0		0	0	
Longitudinal ridging	8 (4%)	2 (1%)	0.105	18 (9%)	6 (3%)	<b>0.011*</b>
Beau's line	20 (10%)	21 (11%)	0.869	23 (12%)	21 (11%)	0.749
Onychoschizia	1 (0.5%)	4 (2%)	0.371	1 (0.5%)	4 (2%)	0.371
Onychorrhexis	2 (2%)	14 (7%)	<b>0.003*</b>	3 (1.5%)	20 (10%)	<b>0.0003*</b>
Longitudinal Melanonychia	3 (1.5%)	2 (1%)	1	3 (1.5%)	2 (1%)	1
Nail bed features						
Onycholysis	54 (27%)	90 (45%)	<b>0.001*</b>	53 (27%)	93 (47%)	0.288
Oil spot	7 (4%)	0	<b>0.014*</b>	6 (3%)	0	<b>0.03</b>
Subungual hyperkeratosis	43 (22%)	78 (39%)	<b>0.0001*</b>	43 (22%)	79 (40%)	<b>0.00009*</b>
Splinter haemorrhages	8 (4%)	1 (0.5%)	<b>0.037*</b>	27 (14%)	5 (3%)	<b>0.0001</b>

\*A P value of <0.05 was taken as significant

The mean number of nails involved per patient (18.5 vs 14.6) and the mean nail psoriasis severity index (92.5 vs 42) was higher in patients with psoriatic arthritis in our study, similar to previous reports.<sup>5,7,8</sup> This positive correlation of the frequency and severity of nail disease with psoriatic arthritis emphasizes the importance of a comprehensive nail evaluation.

The commonest clinical nail feature was onycholysis, followed by pitting and subungual hyperkeratosis [Table 3]. These have been variably reported to be onycholysis and splinter haemorrhages,<sup>9</sup> or pitting and onycholysis.<sup>10</sup> The most common onychoscopic feature was pitting, followed by onycholysis and subungual hyperkeratosis. The difference in

frequency distribution between fingernails and toenails was statistically significant for some nail features [Table 2]. In contrast, Chauhan *et al.* reported significant differences for all nail features except Beau's line and onychomadesis.<sup>11</sup> We found a statistically significant difference in the frequency of detection for pitting, splinter haemorrhages and longitudinal ridging on onychoscopic examination as compared to clinical examination [Table 3]. Thus, onychoscopy is a useful adjunct in the evaluation of nail changes that may not otherwise be visible.

Ultrasonography facilitates real-time evaluation of every component of the nail unit as well as the distal interphalangeal joint [Figure 7]. Ultrasonography nail plate changes have

**Table 3: Frequency of nail psoriasis features on clinical and onychoscopy examination**

	Clinical examination n = 200 (%)	Onychoscopic examination n = 200 (%)	P-value
Total nails involved	307 (76%)	315 (78%)	0.496
Nail matrix features			
Pitting	125 (31%)	169 (42%)	<b>0.001*</b>
Thickening and crumbling	105 (26%)	104 (26%)	0.9
Leukonychia	5 (1%)	10 (3%)	0.192
Red spot in the lunula	0	0	
Longitudinal ridging	10 (3%)	24 (6%)	<b>0.014*</b>
Beau's line	41 (10%)	44 (11%)	0.712
Onychoschizia	5 (1%)	5 (1%)	1
Onychorrhexis	16 (4%)	23 (6%)	0.25
Longitudinal Melanonychia	5 (1%)	5 (1%)	1
Nail bed features			
Onycholysis	144 (36%)	146 (37%)	0.883
Oil spot	7 (2%)	6 (2%)	0.779
Subungual HK	121 (30%)	122 (31%)	0.938
Splinter haemorrhage	9 (2%)	32 (8%)	<b>0.0002*</b>

\*A P value of <0.05 was taken as significant

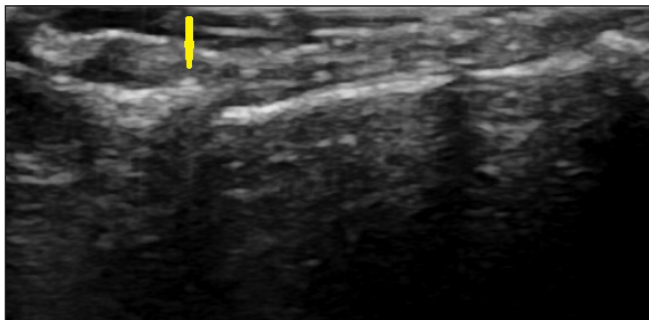
**Table 4: Statistical analysis of the nail features with regard to distal interphalangeal joint enthesitis**

Variables	Nail features		Enthesitis		P-value
	Present	Absent	Present	Absent	
Pitting	n = 125	n = 182	n = 75	n = 50	0.772
Thickening and crumbling	n = 105	n = 202	n = 68	n = 37	<b>0.04*</b>
Beau's line	n = 41	n = 266	n = 19	n = 22	0.138
Onychorrhexis	n = 16	n = 291	n = 3	n = 13	<b>0.002*</b>
Onycholysis	n = 144	n = 163	n = 82	n = 62	0.984
Oil spot	n = 7	n = 300	n = 3	n = 4	0.468
Subungual Hyperkeratosis	n = 121	n = 186	n = 76	n = 45	0.097
Splinter haemorrhages	n = 9	n = 298	n = 6	n = 3	0.736

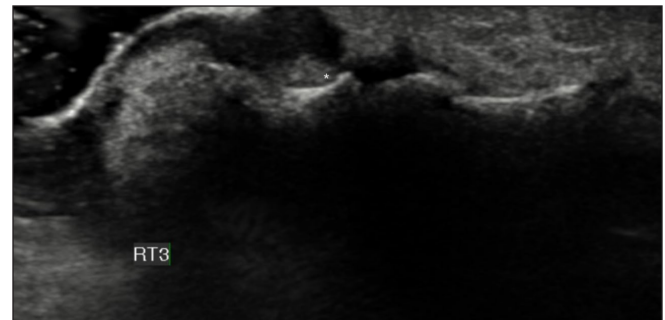
\*A P value of <0.05 was taken as significant

been classified by Wortsman *et al.*<sup>12</sup> into types I–IV, with type IV being the most severe [Figure 8]. These correlate well with psoriatic arthritis.<sup>13</sup> Though we could not do a comprehensive analysis of the nail plate structure in our patients, we did evaluate the enthesial structure in detail.

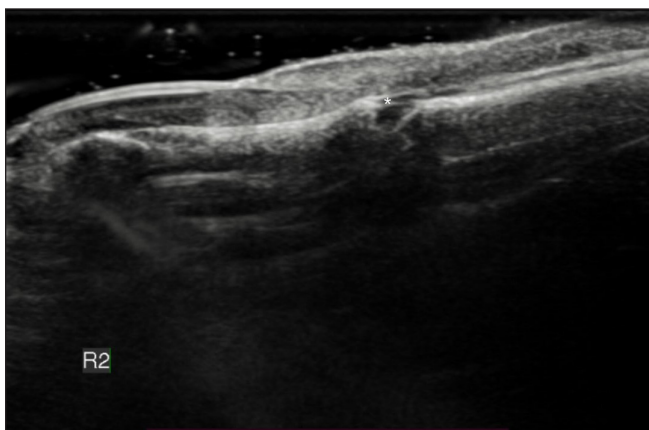
All our patients with nail psoriasis had evidence of enthesitis though most were asymptomatic. Ultrasonographic evidence



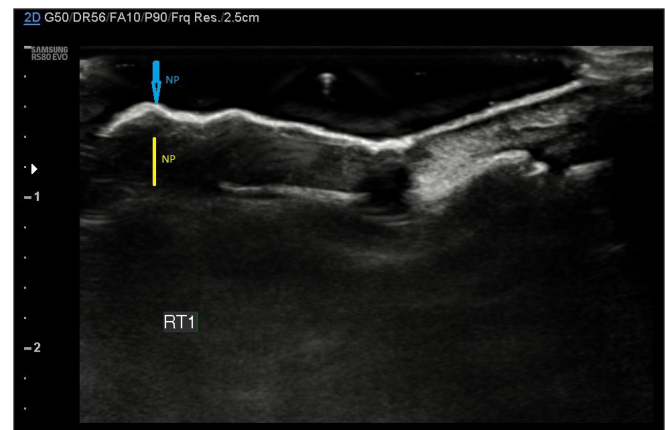
**Figure 5:** Longitudinal scan of distal interphalangeal joint showing enthesophyte (yellow arrow)



**Figure 6:** Longitudinal scan of distal interphalangeal joint showing bony erosion (white star)



**Figure 7:** Longitudinal scan of normal distal interphalangeal joint showing digital extensor tendon attachment (white star)



**Figure 8:** Longitudinal scan of psoriatic nail showing thickened, irregular and wavy nail plate (NP, blue arrow) with loss of interplate hypochoic zone and thickening of the nail bed (NB, Yellow arrow)

**Table 5: Comparative frequency of enthesitis in clinically involved digits of nail psoriasis patients in various studies**

	Acosta-Felquer et al. 2017		Krajewska-Włodarczyk et al. 2018		Krajewska-Włodarczyk et al. 2019		Present study	
	Number of nails assessed	% of enthesitis on ultrasonography	Number of nails assessed	% of enthesitis on ultrasonography	Number of nails assessed	% of enthesitis on ultrasonography	Number of nails assessed	% of enthesitis on ultrasonography
Number of nails with psoriasis	236	60.6%	416	46.3%	440	49.5%	307	57%
Number of nails with psoriasis without arthritis	93	61.2%	248	31%	272	38%	233	50.6%
Number of nails with psoriasis with psoriatic arthritis	143	60.1%	168	68%	168	68%	74	77%

of enthesitis was observed in 57% of involved digits. The higher frequency of distal interphalangeal joint enthesitis in patients with psoriatic arthritis was in concordance with previous data by Krajewska-Włodarczyk *et al.*<sup>14–16</sup> [Table 5].

Thickening, crumbling and onychorrhexis of the nail were significantly associated with distal interphalangeal joint enthesitis. These three features are reflective of nail matrix disease and should alert the clinician towards the presence of enthesitis. However, other workers have noted that onycholysis to be frequently associated with enthesitis.<sup>17–19</sup> Aydin *et al.*<sup>17</sup> and Lai<sup>19</sup> also noted pitting and crumbling, respectively in association with enthesitis.

Enthesitis is likely an early sign of arthritis and its persistence often precedes joint damage. Its frequency positively correlates with higher disease activity and poor quality of life.<sup>20</sup> The association between nail psoriasis and adjacent enthesitis has been demonstrated by previous magnetic resonance imaging and ultrasonography studies.<sup>17,21</sup> Enteseal inflammation is closely correlated with the inflammatory involvement of the nail matrix.<sup>22,23</sup> This fact was reinforced in our study, with a high frequency of enthesitis in digits with involved nails, even in the absence of joint symptoms or signs.

Our findings outline a need for improving the sensitivity of diagnostic criteria for psoriatic arthritis. Patients with nail psoriasis do not have just distal interphalangeal joint enthesitis but also enthesitis involving other joints which may be in the form of higher than normal enthesitis scores for these distant joints. This suggests that enthesitis may be a systemic rather than a solely local enteseal response.<sup>24</sup> An early diagnosis and treatment of enthesitis is critically important for ensuring a favourable outcome,<sup>25</sup> and ultrasonography can thus serve as a non-invasive, relatively cheap and rapid technique for the assessment of enteseal changes.

### Limitations

The major limitation of our study was the small sample size. No controls could be evaluated. Due to the small number of

patients with concomitant psoriatic arthritis, we could not analyse conclusive differences. As we evaluated only the clinically involved digits, we cannot rule out the presence of subclinical enthesitis in uninvolved digits.

### Conclusion

The frequency of enthesitis is very high in patients with nail psoriasis, even though clinical evidence may be lacking. The presence of nail changes like thickened and crumbling nails should alert dermatologists to plan treatment accordingly. A comprehensive clinical and onychoscopic evaluation can be a sensitive indicator in psoriasis patients at risk of psoriatic arthritis, even when the sensitivity of clinical criteria is low. Further studies with larger sample sizes involving different patient subsets can help comprehensively evaluate and validate these findings to help detect patients at risk early.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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### Conflict of interest

There are no conflicts of interest.

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