



Concise report

Nailfold capillaroscopy: a survey of current UK practice and ‘next steps’ to increase uptake among rheumatologists

Martin Eden ¹, Sarah Wilkinson², Andrea Murray³, Praveen Gurunath Bharathi⁴, Andy Vail⁵, Chris J. Taylor⁴, Katherine Payne¹ and Ariane L. Herrick ³

Abstract

Objectives. To identify barriers to the use of nailfold capillaroscopy as a diagnostic tool for patients presenting with Raynaud’s phenomenon in UK rheumatology centres and to obtain rheumatologists’ views on a proposed internet-based standardized system for clinical reporting of nailfold capillaroscopy images.

Methods. An online survey was developed using expert opinion from clinicians, scientists and health service researchers. The survey was piloted and sent to UK-based rheumatologists using established electronic mailing lists between October 2020 and March 2021. Survey data were analysed using descriptive statistics.

Results. A total of 104 rheumatologists representing rheumatology centres across the UK responded to the survey. Wide variations in terms of workloads and practices were described. Thirty-four (33%) respondents reported using nailfold capillaroscopy only at their own centre, 33 (32%) referred to other centres, 9 (9%) did both and 28 (27%) did not use capillaroscopy at all. Of the 43 respondents using capillaroscopy on site, 25 (58%) used either a dermatoscope or universal serial bus microscope and 9 (21%) used videocapillaroscopy. Among the 61 respondents not undertaking capillaroscopy on site, barriers included lack of equipment (85%), lack of experience in acquiring images (69%) and lack of expertise in interpreting images (67%). Sixty-six respondents (63%) expressed interest in an internet-based, standardized automated system for reporting images.

Conclusion. Most UK rheumatologists currently do not perform nailfold capillaroscopy on site. An internet-based nailfold capillaroscopy system for use with low-cost microscopes as well as with videocapillaroscopy could help increase uptake of capillaroscopy and thereby facilitate early diagnosis of SSc across the UK.

Key words: nailfold capillaroscopy, SSc, Raynaud’s phenomenon, service evaluation

Rheumatology key messages

- The benefits of nailfold capillaroscopy for diagnosing systemic sclerosis are not being fully realized.
- A centralized system could provide high-quality diagnostic information resulting in improved patient outcomes.

Introduction

RP is the most common presenting feature of SSc and therefore provides a window of opportunity for early diagnosis [1, 2]. The National Institute for Health and Care Excellence (NICE) recommends referral to a

rheumatologist of all patients in whom RP is suspected as possibly being secondary, including secondary to connective disease such as SSc [3]. As well as being assessed for symptoms and signs of an underlying CTD, patients presenting with RP should have their ANA checked and their nailfold capillaries examined: patients with normal capillaries can often be reassured, whereas if capillaries are abnormal, then a diagnosis of SSc must be considered. Abnormal nailfold capillaries are included

¹Manchester Centre for Health Economics, ²Division of Musculoskeletal and Dermatological Sciences, The University of Manchester, ³Division of Musculoskeletal and Dermatological Sciences, The University of Manchester, Northern Care Alliance NHS Foundation Trust, Manchester Academic Health Science Centre, ⁴Division of Informatics, Imaging and Data Sciences and ⁵Centre for Biostatistics, The University of Manchester, Manchester, UK
Submitted 17 March 2022; accepted 20 May 2022

Correspondence to: Martin Eden, Manchester Centre for Health Economics, 4th Floor Jean McFarlane Building, University of Manchester, Oxford Road, Manchester M13 9PL, UK.
E-mail: martin.eden@manchester.ac.uk

in the 2013 ACR/EULAR classification criteria for SSc [4, 5]. Therefore all rheumatologists involved in the diagnosis of CTDs should be familiar with and have access to nailfold capillaroscopy.

Yet despite the increasing interest in nailfold capillaroscopy over the last 20 years, evidenced by biennial EULAR courses being oversubscribed, the popularity of the BSR capillaroscopy courses and the increasing number of nailfold capillaroscopy-related publications [6], there is anecdotal evidence that many rheumatologists do not examine nailfold capillaries. This omission may be because of a lack of equipment combined with a lack of expertise in acquiring images and/or a lack of confidence in image interpretation.

The objectives of this study were to understand the RP caseloads and practices in the diagnosis of SSc across the UK, identify barriers to the use of nailfold capillaroscopy and canvas opinion of UK rheumatologists on an internet-based standardized system for reporting of images from nailfold capillaroscopy.

Methods

An online survey (see [Supplementary Data S1](#), available at *Rheumatology* online) comprising mainly closed and some free-text questions was developed by a multidisciplinary research team comprising two health economists, a health services researcher, a statistician, a rheumatologist, an imaging scientist and a physicist. Sawtooth software (Sawtooth Software, Provo, UT, USA; <https://sawtoothsoftware.com/>) was used to create the online version of the survey. All responses were housed on a protected university server. The survey was piloted with a sample of rheumatologists ($n = 4$).

The study population was rheumatologists working in the National Health Service (NHS) across the UK. The study sample frame was formed using four sources: the BSR, including via its trainee network; National Institute for Health and Care Research (NIHR) Clinical Research Networks; the UK Scleroderma Study Group (UKSSG) and a Manchester-based rheumatology mailing list. The survey was promoted via the BSR news bulletin and social media platforms. Potential respondents were e-mailed in October 2020 and the survey link was active between 2 October 2020 and 8 March 2021. Reminders were sent out midway through the survey activation period.

Data were analysed using Stata version 14 (Timberlake Software, Richmond upon Thames, UK) [7]. Descriptive statistics were used to summarize data from the closed questions. Responses from free-text questions were collated and summarized using key themes.

This study was a service evaluation, so ethical approval was not required.

Results

Of the 113 respondents, responses from 104 rheumatologists were included in the main analysis ([Table 1](#)). The

nine other respondents exited the survey after answering the first two questions on page 1, five of whom expressed an interest in a new standardized system. At least 41 rheumatology departments were represented in the analysis.

Of the 104 rheumatologists completing the survey, 47 (45%) were working in teaching hospitals and 47 (45%) in district general hospitals across the UK. One respondent (1%) worked in both a teaching hospital and a district general hospital. Nine rheumatologists (9%) did not state their hospital type. The majority [90 (87%)] were based in England, with high representation [45 (43%)] from the northwest ([Supplementary Table S1](#), available at *Rheumatology* online).

Referrals and caseload

The number of patients referred with RP was estimated for the year 2019 (i.e. before the coronavirus pandemic). Most respondents [79/104 (76%)] received referrals from both general practitioners and hospital-based colleagues and most referrals were of adult patients (six respondents were not referred adults, suggesting that they were based within paediatric departments). Eleven (23%) respondents from teaching hospitals reported seeing >30 patients with RP over 12 months compared with 3 (6%) from district general hospitals ([Supplementary Table S2](#), available at *Rheumatology* online).

Current uptake and utilization of nailfold capillaroscopy

Thirty-four respondents (33%) undertook nailfold capillaroscopy in their own centres, 9 (9%) referred to other centres alongside use of capillaroscopy within their own centre, 33 (32%) only accessed nailfold capillaroscopy via referral to other centres and 28 (27%) did not use nailfold capillaroscopy at all ([Fig. 1A](#)). Of those who referred to other centres, 37 (88%) referred ≤ 10 cases per year. Twenty-one (45%) teaching hospital respondents undertook nailfold capillaroscopy compared with 16 (34%) district general hospital respondents. Of the 43 respondents reporting on-site capillaroscopy, 22 (51%) stated that this was performed in the context of a general clinic appointment and 16 (37%) at a separate visit, and 18 (42%) reported having a dedicated room for capillaroscopy ([Table 1](#)).

Equipment and personnel

Of the 43 respondents using capillaroscopy on site, 13 (30%) used a dermatoscope, 12 (28%) a universal serial bus (USB) microscope, 9 (21%) videocapillaroscopy, 1 (2%) a stereomicroscope, 1 (2%) an ophthalmoscope and 1 (2%) used both a stereomicroscope and dermatoscope ([Fig. 1B](#)). Six (14%) were unsure what equipment was being used. Twenty (47%) did the imaging themselves ([Table 1](#)), 17 of whom were consultants, and 25 (58%) interpreted the images themselves, 22 of whom were consultants. Imaging and interpretation was also

TABLE 1 Summary of responses from 104 rheumatologists: their characteristics, workplaces and RP workload and use of nailfold capillaroscopy^a

All respondents n = 114	n	%
Job role		
Consultant	81	77.9
Specialist registrar	11	10.6
Other	4	3.8
Not stated	8	7.7
Hospital type		
Teaching hospital	47	45.2
District general hospital	47	45.2
Teaching hospital/district general hospital	1	1
Not stated	9	8.7
Where referrals come from		
General practitioner	23	22.1
Hospital	2	1.9
Both	79	76
How many patients with RP referred in 2019		
1–5	5	4.8
6–10	6	5.8
11–20	28	26.9
21–30	12	11.5
≥30	15	14.4
Not sure	38	36.5
Do you use nailfold capillaroscopy at your site?		
No	61	58.7
Yes	43	41.3
Total	104	100
Respondents who do nailfold capillaroscopy at their site (n = 43)	n	%
In what context are nailfold capillaroscopy images taken?		
At the general clinic appointment	22	51.2
At a separate hospital appointment	16	37.2
Other	1	2.3
Either general clinic or separate hospital appointment	2	4.7
Missing/unclear	2	4.7
Is there a dedicated room where imaging is done?		
No	23	53.5
Yes	18	41.9
Unclear/missing	2	4.7
What type of equipment do you use?		
Video microscope	9	20.9
Stereomicroscope	1	2.3
USB microscope	12	27.9
Dermatoscope	13	30.2
Ophthalmoscope	1	2.3
Stereomicroscope and dermatoscope	1	2.3
Don't know	6	14
Who usually does imaging in your centre?		
I do it myself	20	46.5
Another consultant or specialist registrar	9	20.9
Nurse/allied health professional	3	7
Technician/medical physics	6	14
Medical photography	4	9.3
Clinical scientist	1	2.3
Who usually interprets the imaging in your centre?		
I do it myself	25	58.1
Another consultant or specialist registrar	8	18.6
Nurse/allied health professional	2	4.7
Technician/medical physics	5	11.6
Other	1	2.3
Clinical scientist	1	2.3

(continued)

TABLE 1 Continued

Respondents who do nailfold capillaroscopy at their site (n = 43)	n	%
Technician and consultant/specialist registrar	1	2.3
From how many RP patients do you obtain images?		
0	3	7.0
1–5	3	7.0
6–10	9	20.9
11–20	6	14.0
21–30	4	9.3
>30	9	20.9
Not sure/no answer	9	20.9
How many of those patients imaged were diagnosed with SSs?		
0	4	9.3
1–5	16	37.2
6–10	8	18.6
11–20	3	7.0
21–30	2	4.7
>30	2	4.7
Not sure/no answer	8	18.6

^aParticipants were asked to base answers on the situation in 2019 before the coronavirus disease pandemic.

done by those in other roles, including allied health professionals and technicians (Table 1).

Numbers of patients imaged and reporting results

The 43 respondents with on-site imaging reported substantial variation in the numbers of patients imaged (Table 1), with an estimated mean of 18 patients imaged per centre per year (s.d. 13) and an estimated mean of 8 resultant diagnoses of SSs (s.d. 9). The estimated number of patients imaged was similar in teaching hospitals [mean 18 (s.d. 15)] and district general hospitals [mean 16 (s.d. 9)], but the estimated number of patients diagnosed with SSs was higher in teaching hospitals [mean 11 (s.d. 12)] than in district general hospitals [mean 5 (s.d. 4)]. There was a range of approaches to informing patients of their capillaroscopy findings: 14 respondents (33%) did this at a clinic appointment, 11 (26%) at the time of imaging and 13 (30%) by letter/part of a treatment plan.

Barriers to the use of nailfold capillaroscopy

Among the 61 respondents not undertaking capillaroscopy on site, 52 (85%) reported that this was because of a lack of equipment, 42 (69%) because of a lack of expertise in acquiring images and 41 (67%) because of a lack of expertise in analysing images. Other reasons reported (each by one respondent) were a lack of space, a lack of training and time constraints.

Fifty-four of the 104 respondents (52%) reported that they found it difficult to interpret images. Among these 54 respondents, 40 (74%) reported seeing insufficient numbers of nailfold capillaroscopy images to gain expertise, 33 (61%) reported a lack of training in using equipment, 22 (41%) reported that the heterogeneity of images made it difficult to reach a diagnosis and 11

(20%) reported that poor-quality images hindered diagnosis.

Interest in a centralized system

The majority of respondents [66/104 (63%)] expressed an interest in the development of an internet-based centralized system to provide clinical reporting for images, 15 (14%) were unsure and 23 (22%) were not interested in a new system. Ninety-one respondents (88%) reported Wi-Fi availability in clinics to facilitate a centralized system.

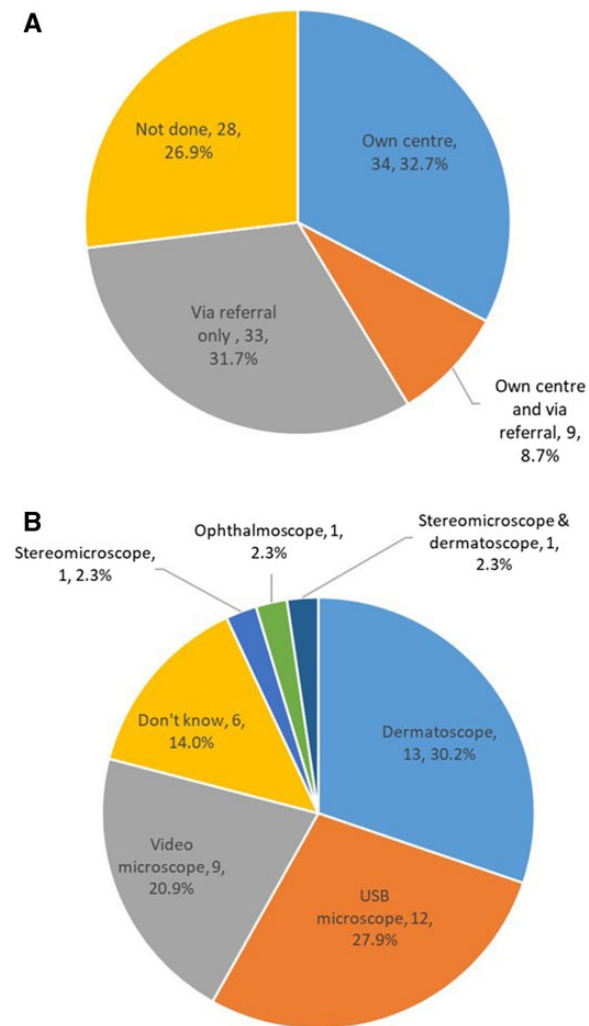
Free-text responses for interest in a centralized system were received from 52 respondents and grouped under five themes (see Table S3 of Supplementary Data S2, available at *Rheumatology* online). The most common theme, from 14 respondents, related to 'Reassurance from an additional opinion providing validation'. Additional themes describing interest related to 'Additional diagnostic information', 'Timeliness of diagnostic information', 'Potential to improve patient outcomes' and an 'Acceptable/efficient system'.

Of the 23 respondents providing a reason for a lack of interest in a standardized system, 8 described a lack of demand for external expertise and 3 cited small case-loads (see Table S4 of Supplementary Data S2, available at *Rheumatology* online). The most common theme for lack of interest (14 respondents) related to a 'Perceived barrier due to the current situation'.

Discussion

This survey has provided insights into current nailfold capillaroscopy practice in UK rheumatology departments and demonstrated wide disparities across centres. A key finding is that only 41% of rheumatologists report access to nailfold capillaroscopy on site and 27% do not

Fig. 1 How nailfold capillaroscopy is accessed and equipment used



(A) How nailfold capillaroscopy is accessed by 104 survey respondents and **(B)** equipment used by the 43 survey respondents performing capillaroscopy on site.

use capillaroscopy at all (i.e. they neither undertake capillaroscopy themselves nor refer elsewhere). Those centres that undertake nailfold capillaroscopy use mainly low-cost techniques (dermoscopy, USB microscopy), mirroring findings in the USA [8], but in contrast with findings of a survey of mainly European centres that suggested videocapillaroscopy as the preferred technique [9]. Many centres—even some of those with the capability of imaging nailfold capillaries on site—routinely refer their patients with RP to other centres for imaging, most likely because the referring centres have access to low-cost techniques but not to videocapillaroscopy, which is more sensitive to abnormalities [10, 11]. Difficulties in both acquiring and interpreting images were widely reported across centres. These difficulties represent the two main challenges to increasing uptake of

capillaroscopy: first, image acquisition (which depends on having the necessary equipment in addition to expertise in acquiring images) and second, image interpretation (which is related in part to the number of patients imaged each year, with increased numbers allowing clinicians to gain confidence). The results of our survey suggest that an internet-based centralized system to facilitate clinical reporting of nailfold capillaroscopy images would be welcomed. Anticipated barriers to such a system include a current lack of equipment and small centre-based caseloads, factors that could be addressed through the introduction of a nationwide system that could be applied to either videocapillaroscopy or lower-cost capillaroscopy systems.

Our survey provides an up-to-date, comprehensive view of current practice. Key strengths include a multidisciplinary approach to the development and pilot testing of the survey. Participants were invited from rheumatology centres from across the UK and a broadly representative sample of >100 participants took part, with an even split between respondents working in teaching and district general hospitals. However, there are limitations to acknowledge. Quantitative survey data are limited in their ability to reveal nuances and reasons behind current practices. While this survey did elicit open-ended responses to some questions, it would be useful to employ additional qualitative work to triangulate these findings and to identify any other issues that may not have been detected.

Our findings have a number of implications. First, effort has to be invested in increasing the availability of nailfold capillaroscopy across UK rheumatology centres. Increasing awareness of the different types of equipment available, including low-cost systems [6, 12], should facilitate this and could be done through training courses and inclusion of nailfold capillaroscopy into training curricula. Second, the potential benefits from a new standardized system have been highlighted from the clinician's perspective and would facilitate early diagnosis of SSc by facilitating image interpretation. Increased uptake of nailfold capillaroscopy across the UK would realize patient benefits in terms of health gains through early detection (through appropriate monitoring) and treatment of internal organ involvement and could also improve the overall patient experience beyond these anticipated health gains. For example, a widely available standardized system would reduce the need for patients to travel to different centres. Importantly, a new system could minimize variations in practices, consequently reducing health inequalities.

In summary, nailfold capillaroscopy is now recognized to be an essential clinical tool to optimize the early diagnosis of SSc. The results of our survey have confirmed the need and appetite for a new approach to nailfold capillaroscopy in the context of the UK NHS, incorporating internet-based image analysis. They also provide a rationale for future studies to determine the feasibility, acceptability, effectiveness and cost-effectiveness of a new system.

Funding: This work was supported by the NIHR under its Invention for Innovation (i4i) Programme (grant II-LB-1117-20006) and by the NIHR Manchester Biomedical Research Centre.

Disclosure statement: The authors have declared no conflicts of interest.

Data availability statement

The data underlying this article will be shared upon reasonable request to the corresponding author.

Supplementary data

[Supplementary data](#) are available at *Rheumatology* online.

References

- 1 Matucci-Cerinic M, Allanore Y, Czirják L *et al.* The challenge of early systemic sclerosis for the EULAR Scleroderma Trial and Research group (EUSTAR) community. It is time to cut the Gordian knot and develop a prevention or rescue strategy. *Ann Rheum Dis* 2009;68:1377–80.
- 2 Bellando-Randone S, Galdo FD, Lepri G *et al.* Progression of patients with Raynaud's phenomenon to systemic sclerosis: a five-year analysis of the European Scleroderma Trial and Research group multicentre, longitudinal registry study for Very Early Diagnosis of Systemic Sclerosis (VEDOSS). *Lancet Rheumatol* 2021;3:e834–43.
- 3 National Institute for Health and Care Excellence. Clinical knowledge summaries. Raynaud's phenomenon. <https://cks.nice.org.uk/topics/raynauds-phenomenon/management/management/> (22 March 2021, date last accessed).
- 4 van den Hoogen F, Khanna D, Fransen J *et al.* 2013 classification criteria for systemic sclerosis: an American College of Rheumatology/European League Against Rheumatism collaborative initiative. *Ann Rheum Dis* 2013;72:1747–55.
- 5 van den Hoogen F, Khanna D, Fransen J *et al.* 2013 classification criteria for systemic sclerosis: an American College of Rheumatology/European League Against Rheumatism collaborative initiative. *Arthritis Rheum* 2013;65:2737–47.
- 6 Smith V, Herrick AL, Ingegnoli F *et al.* Standardisation of nailfold capillaroscopy for the assessment of patients with Raynaud's phenomenon and systemic sclerosis. *Autoimmun Rev* 2020;19:102458.
- 7 Timberlake Software. Stata: Software for Statistics and Data Science. https://www.stata-uk.com/software/stata.html/?creative=395124764558&keyword=stata&matchtype=p&network=g&device=c&utm_medium=adwords&utm_campaign=&utm_source=&gclid=EAlaQobChMI7tPC4rvl8gIVDOztCh2dPA8ZEAAYA SAAEgJlhvD_BwE (18 February 2022, date last accessed).
- 8 Snow MH, Saketkoo L-A, Frech TM *et al.* Results from an American pilot survey among Scleroderma Clinical Trials Consortium members on capillaroscopy use and how to best implement nailfold capillaroscopy training. *Clin Exp Rheumatol* 2019;37(Suppl 119):151.
- 9 Ingegnoli F, Ughi N, Dinsdale G *et al.* An international SURvey on non-iNvaSive tecHniques to assess the mIcrocirculation in patients with RayNaud's phENomenon (SUNSHINE survey). *Rheumatol Int* 2017;37:1879–90.
- 10 Dinsdale G, Peytrignet S, Moore T *et al.* The assessment of nailfold capillaries: comparison of dermoscopy and nailfold videocapillaroscopy. *Rheumatology (Oxford)* 2018;57:1115–6.
- 11 Hughes M, Moore T, O'Leary N *et al.* A study comparing videocapillaroscopy and dermoscopy in the assessment of nailfold capillaries in patients with systemic sclerosis-spectrum disorders. *Rheumatology (Oxford)* 2015;54:1435–42.
- 12 Berks M, Dinsdale G, Marjanovic E *et al.* Comparison between low cost USB nailfold capillaroscopy and videocapillaroscopy: a pilot study. *Rheumatology (Oxford)* 2021;60:3862–7.