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Integration of capillary microscopy and dermoscopy into the rheumatology fellow curriculum

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ABSTRACT

Objective. *This study evaluates a novel, three-part nailfold capillaroscopy training curriculum for adult and paediatric rheumatology fellows.*

Methods. *All rheumatology fellows training at an academic medical centre took part in the three-part nailfold capillaroscopy curriculum. Tests of fellows' usage, interest, confidence, and ability in nailfold capillaroscopy were taken at multiple time-points throughout the curriculum.*

Results. *Fellows self-reported high levels of interest, increased confidence in delineating normal and abnormal nailfold capillaries (p=0.03) and increased usage of nailfold capillaroscopy (p=0.09). The ability of fellows to identify normal nailfold capillaries (p=0.03) and systemic sclerosis-specific nailfold capillary changes, such as neoangiogenesis (p<0.001), also increased.*

Conclusion. *The curriculum was feasible and led to improved ability of learners to distinguish normal from abnormal and to recognise and describe systemic sclerosis-specific nailfold capillary changes. This curriculum also led to improved confidence in examining nailfold capillaries and increased usage of this skill in rheumatologic consultation.*

Introduction

Systemic sclerosis (SSc) is an autoimmune connective tissue disease of unknown origin, characterised by the presence of skin thickening and hardening which usually begins with the fingers (1). Maricq *et al*. first reported that microvascular events in SSc could be successfully visualised using nailfold capillaroscopy (NFC) (2). NFC is therefore of interest to practicing rheumatologists and rheumatology trainees due to its usefulness in both research and the clinic.

NFC status has been included in the 2013 classification criteria for SSc, making competence in this assessment an important skill for physicians evaluating patients with Raynaud's phenomenon (RP) or suspected rheumatic disease (3). Studies have supported the use of NFC as a useful diagnostic tool for risk stratifying of SSc and other rheumatic diseases (4-8). The relevance of this approach has been supported in paediatric patients with RP as well (9). A few of the benefits of NFC include its affordability, repeatability, non-invasiveness, and portability (10). Expertise in NFC requires knowledge, access, and clinical experience.

Despite this increased clinical relevance, most American rheumatology fellowship programmes do not currently have a standardised curriculum in NFC. In Europe, where capillaroscopy is still more prevalent, the earliest capillaroscopy courses took place only just over a decade ago (11). The first American College of Rheumatology (ACR) study group dedicated to "capillaroscopy and rheumatic diseases" took place in 2010 (12).

NFC can be a highly impactful tool if utilised by properly trained rheumatologists. In order to address this need, we developed and assessed a novel educational curriculum to teach rheumatology fellows the techniques and skills required for NFC. Our aim was to teach the trainees how to use the NFC equipment, to reinforce the learned techniques during clinic and consult service visits, and to assess the accrual of knowledge through pre- and post-tests and through patient-based assessments.

Materials and methods

Adult and paediatric rheumatology fellows participated in a three-part training curriculum. Dermatoscopes were provided to all participants through a grant from the HSS Academy of Medical Educators. Fellows used the equipment to learn the normal exam and to become familiar with abnormal capillary patterns. A one-hour didactic session and workshop (led by JG) followed. This allowed the fellows to use dermoscopy and wide-field microscopy to learn the normal and abnormal exam on themselves and on a patient diagnosed with SSc. A full-day course given by 2 experts in NFC (MC and VS), which incorporated videocapillaroscopy and patient cases, completed the three-part curriculum.

All fellows were surveyed anonymously on their interest, usage, and confidence in NFC at three time points. Sur-

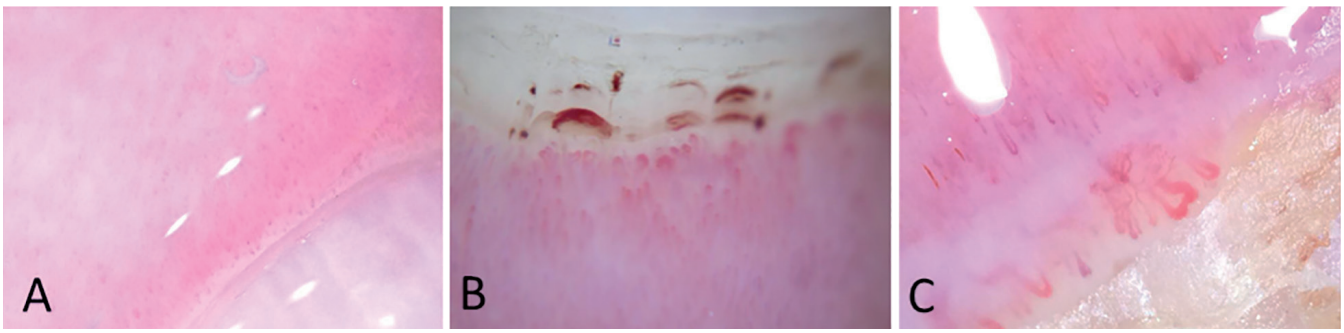

Fig. 1. Nailfold capillaroscopy images.
A: Normal nailfold capillaries; **B-C**: SSc-specific capillary abnormalities – dilation, drop-out, haemorrhage, and neoangiogenesis.
(Photo credit: Robyn Domsic, MD (**A**); Ariane Herrick, MD (**B**); Tracy Frech, MD (**C**)).

veys were conducted prior to distributing the dermatoscopes, following the one-hour didactic session, and following the full-day course. Responses were reported on a five-point Likert scale.

The fellows reported their rate of NFC usage for both general rheumatology consultations, and also for rheumatology consultations specifically on patients with a prominent complaint of Raynaud's phenomenon. They rated their confidence level in distinguishing normal from abnormal nailfold capillaries and in distinguishing specific changes occurring in the nailfold capillaries.

A second survey, testing the ability to identify normal and abnormal nailfold capillaries, was given before and after the full-day course. Fellows assessed nailfold capillaries as normal or abnormal and also utilised free text fields to describe perceived abnormalities and assign the abnormalities to a disease process.

All questions were completed anonymously, via a web-based application (Surveymonkey®). Comparisons between groups were made using Fisher's exact tests. *p*-value was set at a significance of 0.05.

Results

There were 12 paediatric and adult rheumatology fellows at our institution at the time when the three-part nailfold capillaroscopy curriculum was given. Response rates to the survey questions regarding interest, usage, and confidence were 100%, 83%, and 75% at the 1st, 2nd, and 3rd time-point, respectively (Table I). 100% of respondents noted interest or strong interest in learning NFC techniques at all time-points.

Table I. Assessment of trainee self-described interest, usage, and confidence in nailfold capillaroscopy.

	Pre-training (n=12)	Midpoint (n=10)	Post-training (n=9)	Fisher *p* (pre *vs*. post)
Confident: normal *vs*. abnormal	2 (17%)	8 (80%)	6 (67%)	0.03
Confident: specific changes	5 (42%)	7 (70%)	7 (78%)	0.18
Interest and strong interest	12 (100%)	10 (100%)	9 (100%)	1
Usage >75% RP-specific consultations	3 (25%)	5 (50%)	6 (67%)	0.09
Usage >25% of all consultations	2 (17%)	3 (30%)	0 (0%)	0.49

Fellows self-reported their confidence, interest, and usage on five point Likert scales. Possible responses for confidence and interest were: Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree. Responses of Strongly Agree and Agree comprised the positive result for each confidence and interest question and all other responses compromised the negative result. Possible responses for usage were: <10%, 10-25%, 25-50%, 50-75%, >75%. Fisher *p*-value was assessed from pre- to post-training.

The fellows reported increased confidence in their ability to discern normal from abnormal nailfold capillaries using NFC, with 2/12 pre- and 6/9 post-curriculum reporting high levels of confidence (p=0.03). A higher percentage of fellows reported increased confidence when assessing for specific nailfold capillary changes, 42% pre- and 78% post-curriculum, although this was not statistically significant (p=0.18). There was a trend towards increased usage of NFC when conducting a rheumatology consultation on a patient with a prominent complaint of RP, 3/12 pre- *versus* 6/9 post-curriculum (p=0.09).

The fellows completed surveys of trainee ability before and after the one-day course. On two distinct questions, they were significantly better able to accurately identify normal NFC images after partaking in the one-day course (p=0.03 for each question). Both before and after the one-day course, 100% of respondents correctly identified an NFC image as abnormal. The fellows more accurately described the particular abnormalities they saw on an NFC image after the one-day course (p=0.01), and were also significantly better able to identify neoangiogenesis in an abnormal NFC image after the one-day course (p<0.001).

Discussion

NFC has important clinical and diagnostic relevance in the field of rheumatology. There are a number of tools, such as dermoscopy, wide-field microscopy, and video capillaroscopy, which have been utilised to view nailfold capillary abnormalities. However, NFC is only useful as a classification and diagnostic criteria if physicians and trainees have access to the necessary tools and training (13, 14).

Multiple studies have shown that dermoscopy is comparable to other nailfold capillary imaging tools, and that dermoscopy is much less expensive, more portable, and more likely to be performed in routine clinical practice (11, 15, 16). For these reasons, we created a novel, three-part training curriculum that would sufficiently teach rheu-

matology fellows the necessary skills in order to utilise NFC, and specifically dermoscopy, as a diagnostic tool for SSc in the clinic.

An entire class of adult and paediatric rheumatology fellows from an academic medical centre (HSS) took part in our curriculum. Additionally, fellows in rheumatology, and other specialties, from nearby academic medical centres were invited to take part in certain segments of the curriculum. Not all participating rheumatology fellows responded to the mid-course and post-course surveys which may bias the results.

The fellows reported a high level of interest in learning NFC at the outset of the curriculum and maintained this high level of interest throughout. Confidence in assessing nailfold capillaries as either normal or abnormal increased throughout the curriculum. There was a trend towards increased usage of NFC for the assessment of patients with a prominent complaint of RP. This result indicates that the fellows were better able to discern how NFC can aid with diagnosis, and more confident in their own ability to assess such nailfold capillary abnormalities via NFC. These are two important skills for the practicing rheumatologist.

The assessments of trainee ability both before and after the one-day course support the efficacy of our curriculum. After taking part in the one-day course, the fellows were significantly better able to identify normal and abnormal nailfold capillary images. Even more importantly, when presented with a nailfold capillary image and a free-text field, they were significantly better able to identify the abnormalities shown. Specifically, the fellows had a much higher rate of identifying neoangiogenesis, a microvascular change often associated with SSc (17).

This study does have some inherent limitations. Firstly, the sample size of rheumatology fellows is small, all the fellows train at a single institution, and surveys require them to self-report their rates of usage of NFC. Secondly, the surveys were anonymous which limited the analyses that could be performed. Lastly, the judgment of a single investigator (JG) was defined as the imaging "gold standard". Perhaps future studies will provide this curriculum to larger numbers of fellows.

Our three-part NFC training curriculum was successful in teaching NFC to a group of rheumatology fellows. Increased confidence and sustained interest in NFC indicate that teaching NFC to rheumatology fellows is worthwhile. Our curriculum proved to be feasible and comprehensive, teaching the skills needed to correctly apply NFC in the clinical setting.

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