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Quantitative and qualitative assessment of one rheumatology trainee's experience with a self-teaching programme in videocapillaroscopy

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ABSTRACT

Objective. *We have developed a self-taught course by which rheumatologists in training can learn how to conduct capillaroscopy examinations using a computerized videomicroscopy system. We assessed the effectiveness of this course by following the learning curve of one specialist trainee with no experience in capillaroscopy.*

Methods. *The student's training consisted of 10 practical sessions held on three consecutive days. The perceived difficulty in completing each session was graded from 0 (least difficult) to 10 (most difficult). All the images obtained were stored and the time spent by both the trainee and the tutor during the sessions was recorded. Each image was blindly judged by both the novice and the tutor for quality, assigning a score from 0 (lowest quality) to 10 (highest quality). The minimum acceptable score for standard clinical practice was considered to be ≥5.*

Results. *The student spent a total of approximately 5 non-consecutive hours engaged in 'direct' capillaroscopy and recorded a total of 172 images. The mean time required to produce each image varied from approximately 1.0 to 2.0 minutes. The perceived difficulty in completing a session decreased from the first to the last session. A quality score ≥ 5 was assigned by the novice and tutor, respectively, to 16/49 images for the first group of sessions, 26/45 for the second group of sessions, and 56/78 for the third group of sessions. The overall agreement between the novice and tutor was good (K=0.617, SE=0.021).*

Conclusion. *The monitoring of one rheumatologist in training indicates that novices can quickly learn, through an intensive self-teaching programme under the supervision of an expert, how to use computerized videomicroscopy to conduct capillaroscopy studies.*

Introduction

Capillaroscopy is a useful non-invasive imaging technique for the *in vivo* assessment of the microcirculation and is known to be particularly helpful in the diagnosis of systemic sclerosis (SSc) and related diseases (1). It has been proposed as a first-line examination in the early differential diagnosis of Raynaud's phenomenon (RP) and is currently receiving considerable attention as a potential tool for determining the prognosis (2- 4).

Capillaroscopy can be performed using different means, including the ophthalmoscope, photomacrography, and the stereomicroscope (5). However, the quality of the study of the microcirculation has improved significantly with the development of videomicroscopy with optical contact probes (6).

The demand for appropriate training in this technique is increasing worldwide. Since 2004 the three 'full immersion' capillaroscopy courses held in Genoa with the sponsorship of the European League Against Rheumatism (EULAR) have been well attended by rheumatologists. The requirement for demonstrated 'competence in performing and interpreting capillaroscopy' forms part of the core curriculum for specialist training in rheumatology in Europe (7), although the most appropriate tool for achieving this competence is not indicated. In Italy capillaroscopy is considered to be an essential part of the training of rheumatologists, who must show at the end of their postgraduate course that they have attended at least 200 procedures and have personally carried out a total of 50 capillaroscopic examinations.

At present there are no recommendations on how to reach basic technical competence in this field, nor are there any guidelines regarding equipment specifications and image acquisition. The time required to learn the basic technical skills is also not defined. In order to obtain much needed information on the untrained student's learning curve, we tested an intensive self-teaching program on the use of a videocapillaroscopy system carried out under the supervision of a qualified expert.

Methods

After a one-hour introductory session focusing mainly on the correct procedure for the use of the videocapillaroscope (VideoCap Dietosystem, Milan, Italy), the rheumatologist in training (JPR) was asked to obtain nailfold capillaroscopic images for all fingers, as

similar as possible to the 'gold standard' images contained in the *Atlas of Capillaroscopy* (8) and the online version of the EULAR Database on Imaging in Rheumatology (9), in a series of subjects. The criteria for the images were: focus, lighting and orientation angle of the probe, contrast setting, and the quality of the focused image on the monitor before it was saved to the database.

The student's training consisted of 10 practical sessions, divided into three teaching blocks and held on three consecutive days, during which he examined 7 healthy subjects and 7 consecutive in-patients with SSc. The healthy subjects were examined first.

All of the images obtained during each session were saved, and the time required to obtain these images was recorded. The perceived difficulty of each session was graded from 0 (least difficult) to 10 (most difficult). The quality of the images was graded, according to pre-defined criteria, in a blinded assessment at the end of each session and again at the end of the training period by both the novice and the tutor, who assigned scores ranging from 0 (lowest quality) to 10 (highest quality). The minimum acceptable score for standard clinical use was considered to be ≥5.

Statistical analysis

Inter-observer and intra-observer agreement for each block of sessions held over the 3 consecutive days was estimated using weighted k statistics (the quadratic method) and an exact agreement percentage. A k value <0.20 was considered to be poor, 0.21–0.40 was fair, 0.41–0.60 was moderate, 0.61 – 0.80 was good, and 1.0 almost perfect (10). Significance testing was performed using the Wilcoxon signed rank test. A p-value ≤0.05 was considered to be significant. Statistical analysis was performed using the MedCalc software package (Version 9.5.1 for Windows XP).

Table I. Details of the capillaroscopic training programme.

Session	Time spent (min.) in performing the capillaroscopy	Number of images taken	Mean time (min.) to obtain each image	Novice's difficulty score
1	30	15	2.00	7
2	33	16	2.06	7
3	35	18	1.94	8
4	30	16	1.87	7
5	30	13	2.30	5
6	30	16	1.87	3
7	20	12	1.66	7
8	30	22	1.36	2
9	20	15	1.33	2
10	30	29	1.03	2
	288	**172**		

Table II. Intra- and inter-observer agreement (by k statistics) for the trainee and tutor in the quality of the images.

	Group I 3 sessions	Group II 3 sessions	Group III 4 sessions
Intra-observer (tutor) K (SE)	0.782 (0.042)	0.755 (0.052)	0.815 (0.050)
Intra-observer (novice) K (SE)	0.446 (0.069)	0.532 (0.090)	0.617 (0.074)
Inter-observer K (SE)	0.429 (0.067)	0.545 (0.081)	0.570 (0.079)

SE: standard error of the mean.

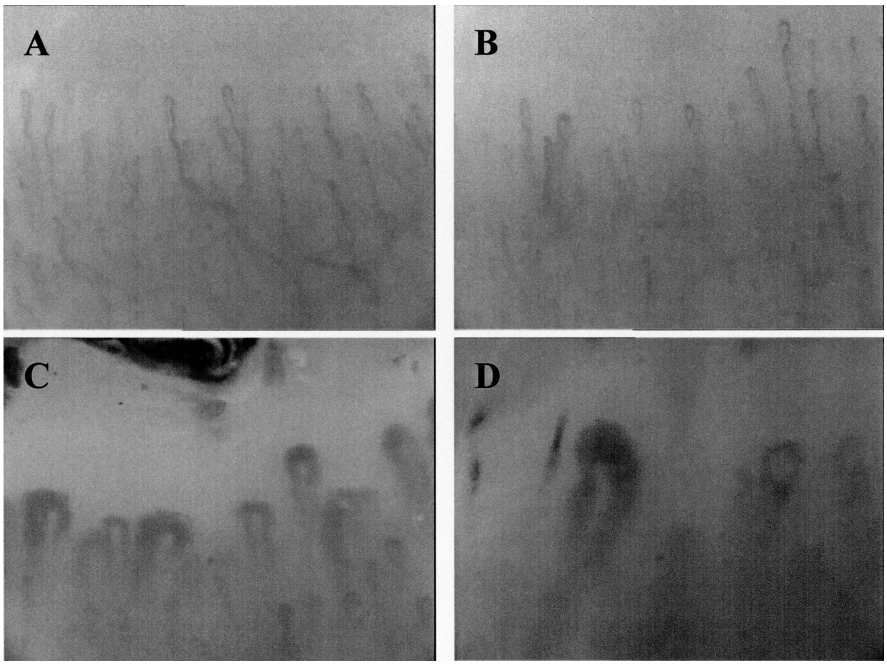

Fig. 1. (**A, B**). Healthy subject (x 200 magnification). (**C, D**) Systemic sclerosis (x 200 magnification); features of microvascular involvement.

Results

Table I presents the quantitative results of the self-teaching program. The student spent a total of approximately five, fully committed, non-consecutive hours carrying out capillaroscopic examinations. The overall time required for the entire course was 7 hours and 50 minutes.

A total of 172 capillaroscopic images (78 from healthy subjects) were recorded and assessed. The mean time required to produce each image varied from about 1.0 to 2.3 minutes (Table I). The novice's perception of the difficulty of completing each session gradually decreased from the first to the last session (Table I). No difference in the difficulty

of obtaining images between healthy subjects and patients was reported.

A quality score ≥5 was assigned to 16/49 (32.6%) images by the novice and 6/49 (12.2%) by the tutor in the first group of sessions, 26/45 (57.7%) by the novice and 14/45 (31.1%) by the tutor in the second group of sessions, and 56/78 (71.7%) by the novice and 59/78 (75.6%) by the tutor in the third group of sessions.

Table II shows the intra- and inter-observer agreement between the novice and the tutor in terms of the quality scores for all the images. As would be expected, the results show consistent intra-observer agreement between sessions for the tutor without significant variance (p=0.819), and a significantly increasing agreement for the novice (p=0.0002). The inter-observer agreement for quality gradually became comparable (p=0.008), reaching a moderate level of agreement in the third group of sessions. The overall agreement between the novice and the tutor was good (K=0.617, SE=0.021).

Figure 1 shows representative examples of the images taken.

Discussion

This preliminary experience indicates that the technical knowledge and skill required to carry out capillaroscopy using a videomicroscopy system can be attained in a very short time (approximately 5 non-consecutive hours) by a previously inexperienced rheumatology trainee by means of a self-teaching programme under expert supervision.

Our example shows that performance and skill improve with practical experience following a gentle learning curve, as indicated by the gradual reduction in perceived difficulty and the gradual decrease from one session to the next in the time spent obtaining each image. The image quality also improved, reaching an acceptable score in up to 70% of the images from the third group of sessions. Further studies involving a large number of trainees that could provide more information on the reliability and reproducibility of this teaching programme are needed, as different students may progress at different rates (11).

Like other imaging methods, expertise in capillaroscopy requires a combination of knowledge, skill and practical clinical experience, qualities that can also vary between tutors (12). Learning how to perform capillaroscopy should constitute one of the first steps in a rheumatology student's comprehensive training since, in addition to the basic technical skills, a thorough knowledge of the wide range of 'normal' capillaroscopic patterns, as well as the pathological findings typical of the 'scleroderma pattern' and other rheumatic diseases with secondary RP, demands careful standardization and training in qualified teaching centres (13-17).

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