Optical coherence tomography as a method for quantitative skin evaluation in systemic sclerosis

Improved, non-invasive techniques for the diagnosis, classification and monitoring of patients with systemic sclerosis (SSc) are needed. One potential technique for quantifying the extent of cutaneous sclerosis in these patients is optical coherence tomography (OCT).[1 2] Recently, Abignano *et al*[3] suggested the use of OCT as a feasible and reliable technique to evaluate skin fibrosis in SSc. Based on that initial work, the aim of this study was to evaluate OCT images and compare the findings with the modified Rodnan skin score (mRSS) in patients with SSc.

Thirty-three Brazilian patients with SSc (28 women; mean age 46.1 years; range 19–71 years) were recruited and fulfilled criteria for SSc proposed by American College of Rheumatology (ACR), 1980[4] or ACR/European League Against Rheumatism, 2013.[5] Patients were classified into limited SSc (n=18) and diffuse SSc (n=15) groups. The mean disease duration was 9.7 years (median 8 years, range 2–26 months). Thirty-five healthy control (HC) (28 women, mean age 39.2 years; range 20–68 years) were also included. The OCT scans were performed using a Swept Source-OCT at 1325 nm (Thorlabs, Newton, New Jersey, USA). All subjects had OCT scans and mRSS performed on specific sites such as proximal third finger and dorsal forearm, both sides. The tissue optical density at 300 µm depth (OD300) from OCT images was obtained using the Matlab programme. The study protocol was approved by the Ethics Committee of the Universidade Federal de Pernambuco and informed consent was obtained from all patients. Spearman's rank correlation coefficient, Mann-Whitney U-test or Kruskal-Wallis test and Dunn test were employed. Values of $p<0.05$ were considered statistically significant.

In a descriptive analysis, one can readily see that the air–skin interface in forearm between patients with SSc (figure 1A) and HC (figure 1B) shows a difference in rugosity, as well as in the visual scattering behaviour observed in both images. In the quantitative analysis of the scattering intensity as a function of depth in the skin (figure 1C), a difference is observed especially in the dermal–epidermal junction (indicated by the arrow). At 300 µm depth, the photon attenuation was higher for patients with SSc (figure 1C, dashed line).

Stratifying patients according to mRSS, there was a significant overall difference across the five groups ($p=0.0045$ for finger and $p=0.0145$ for forearm). After Tukey correction for multiple variables, the difference remained significant between HC or patients with mRSS=0 or 1 and patients with mRSS=3 in finger (figure 2A) and between HC or patients with mRSS=0 and patients with mRSS=3 in forearm (figure 2B). However, there was no difference between HC and patients with mRSS=0 or 1, indicating that this measure could not discriminate between HC and these patients and this could be a potential limitation of this technique. Besides, we also found a negative correlation between OD300 values and mRSS groups ($r=-0.66$, $p<0.0001$ in finger; $r=-0.55$, $p=0.0008$ in forearm) (figure 2C, D) and total mRSS ($r=-0.59$, $p=0.0003$ in finger; $r=-0.69$, $p<0.0001$ in forearm) (figure 2E, F). These results corroborate the findings of Abignano *et al*[3] on the usefulness of OCT in evaluating cutaneous fibrosis.

In conclusion, the skin appearance of patients with SSc in OCT images is clearly different from HC, and OCT can provide a unique perspective for objectively assessing skin thickness.

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Competing interests None declared.

Ethics approval CEP-CCS-UFPE.

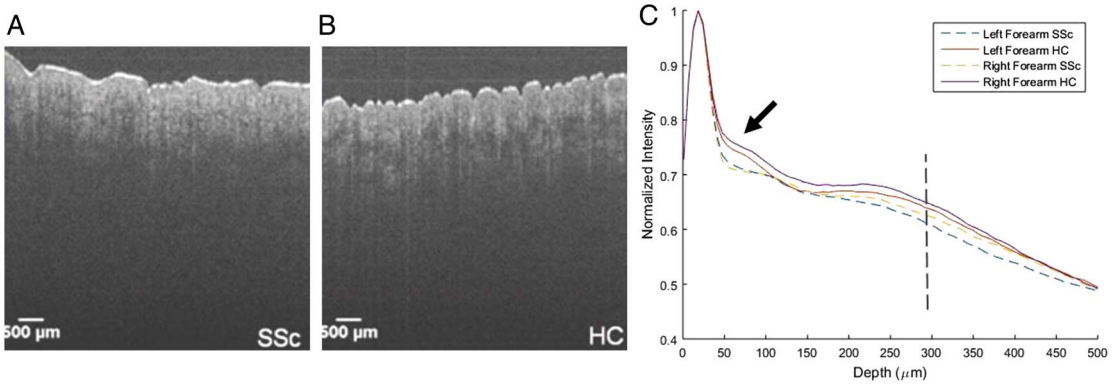

Figure 1 Qualitative analysis of the forearm by optical coherence tomography (OCT). (A) OCT image of the patient with systemic sclerosis (SSc); (B) OCT image of the healthy control (HC); (C) graphical representation of the optical density mean in HC and SSc, where the difference in the dermal–epidermal junction (arrow) and intensity of light penetration at 300 µm depth (dashed line).

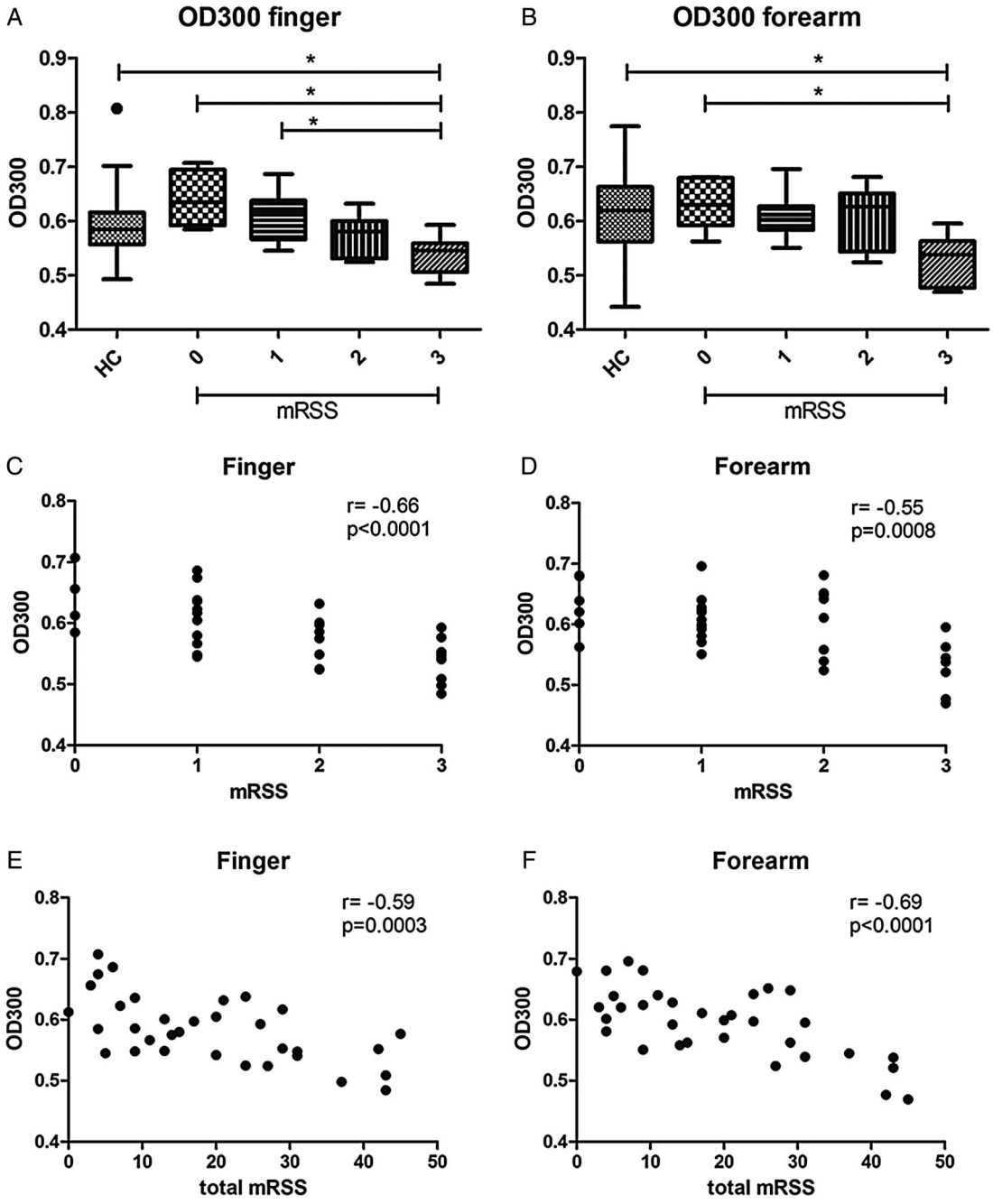

Figure 2 Graphical representation of the measurements obtained from the optical density at 300 μm depth (OD300). (A) OD300 between healthy control (HC) and the modified Rodnan skin score (mRSS) systemic sclerosis (SSc) patients on the finger and (B) on the forearm; (C) correlation of the OD300 between the mRSS groups on the finger and (D) on the forearm; (E) correlation of the OD300 between mRSS total on the finger and (F) on the forearm. *p<0.05.

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