Optical Coherence Tomography validation: a new quantitative imaging biomarker for affected skin in scleroderma

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Title

“Optical coherence tomography validation: a new quantitative imaging biomarker for affected skin in scleroderma”

Has

• Nothing to Disclose
• No conflicts of interest
Systemic sclerosis (SSc): multisystem disease with skin/internal organ involvement

Extent of skin involvement:

• major criterion to define limited and diffuse subsets
• survival and prognosis
• primary outcome in clinical trials
• still orphan of a quantitative imaging technique

LeRoy EC, J Rheumatol 1998
Steen VD, Arthritis Rheum 2001
Clements PJ, Arthritis Rheum 2000
Background/rationale

Modified Rodnan skin score (mRSS): current gold standard used to measure skin thickness

- specific training and experience
- intra- and inter-observer variability of 12% and 25% respectively
- may be not sensitive enough to measure small but clinically meaningful changes in skin thickening
- sensitivity to change over time uncertain

Merkel PA et al, J Rheumatol 2003
Clements PJ et al, J Rheumatol 2003
Clements PJ, Arthritis Rheum 1999
Optical Coherence Tomography

“VivoSight” topical OCT probe (Michelson Diagnostics):

- laser wavelength: 1305 nm
- 100 OCT B-scans, inter-frame spacing of 4 μm
- 4 x 0.4 x 2 mm data volume (lateral x lateral x depth)
Previous studies have looked into structural details of normal skin using Optical Coherence Tomography (OCT) but no studies have been previously published with regard to the use of this technique in SSc.

Mogensen M et al, Dermatology 2008
Aim

- **concurrent validity** when compared with skin biopsy
- **construct validity** when compared with clinical assessment (mRSS)
- **intra- and inter-observer reliability** for acquiring and reading images.
Methods: subjects

37 subjects enrolled / 278 sites scanned (mRSS 0-3):

- **21 SSc patients:** 11 D/ 10 L  
  mean (se) age: 53.8 (3.5) years

- **16 healthy (H) subjects:** mean (se) age: 48 (4.8) years
OCT dorsal aspect of forearm

HEALTHY

SSc
Comparison of OCT image/mean A-scans and skin biopsy
Mean A-Scan all groups
Max OD (at 88-120 μm)
H vs mRSS 3 = 0.0031
H vs mRSS 2 = 0.0451
H vs mRSS 1 = 0.0295
H vs mRSS 0 = ns
Across 5 groups = 0.0272
Max gradient/Area

A. Maximum and mean gradients of the mean A-scan between the DE minimum and the PD peak.
B. Area bounded by the PD peak and the minimum value of the DE valley.
Max gradient/Area inversely correlate with mRSS
Results: reliability

Intra-observer reliability
(10 sites, 1 operator, different scanning session):
A. ICC = 0.91, LoA = 0.63 - 0.97
B. ICC = 0.95, LoA = 0.79 - 0.99

Inter-observer reliability
(10 sites, 2 operators, same scanning session):
A. ICC = 0.89, LoA= 0.61-0.97
B. ICC = 0.91, LoA = 0.66-0.97
We have demonstrated that OCT is:

- able to measure the increase in ECM in the basal membrane and papillary dermis affording a pathological explanation for the OCT findings.
- able to discriminate between different grades of skin involvement
- a reproducible technique

OCT appears to be a promising new imaging tool in SSc
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