

Pedal osteolysis after acute neuropathic (Charcot) arthropathy with persistent local and systemic markers of inflammation.

David R. Sinacore¹, Mary K. Hastings¹, Kathryn L. Bohnert¹, Paul K. Commean², Kirk E. Smith², Charles F. Hildebolt², Fred W. Prior², Jeffrey E. Johnson³. Applied Kinesiology Laboratory, Program in Physical Therapy¹, Electronic Radiology Laboratory, Mallinckrodt Institute of Radiology², Dept of Orthopedic Surgery³, Washington University School of Medicine, St. Louis, MO. Funded by NIDDK R21 DK 079457 & NICHD 1K12 HD 055931-03.

BACKGROUND

The acute stage of neuropathic Charcot arthropathy (NCA) is characterized by gradual onset of a red, hot & swollen foot with a dulled sensation to pain and a loss of function impairing mobility and walking. This inflammatory stage may be associated with a profound loss of bone mineral density (BMD) in the tarsal and metatarsal bones. The goal of orthopedic management during the acute stage of NCA is immobilization & off-loading the foot until inflammation has subsided and the foot is stable for weight bearing. The magnitude of pedal bone loss (osteolysis) resulting from immobilization & following resolution of the acute stage of NCA is not known and has not previously been reported.

OBJECTIVE

The purpose of this study is to determine the magnitude of bone loss in the tarsal and metatarsal bones & the local and systemic markers of inflammation in participants with diabetes mellitus (DM), peripheral neuropathy (PN) and neuropathic Charcot arthropathy (NCA) one year after acute-onset.

SUBJECTS

We studied 37 participants:

- 18 with DMPN with NCA

Age: 56 ± 10 yrs

Sex: 9M & 9F

BMI: 34 ± 8

Eichenholtz Stage 1, onset ≤ 7 wks

Off-loaded for avg of 16 weeks (total contact casting or removable cast walker boot, figures at right)

- 19 with DMPN without NCA

Age: 57 ± 10 yrs

Sex: 8M & 11F

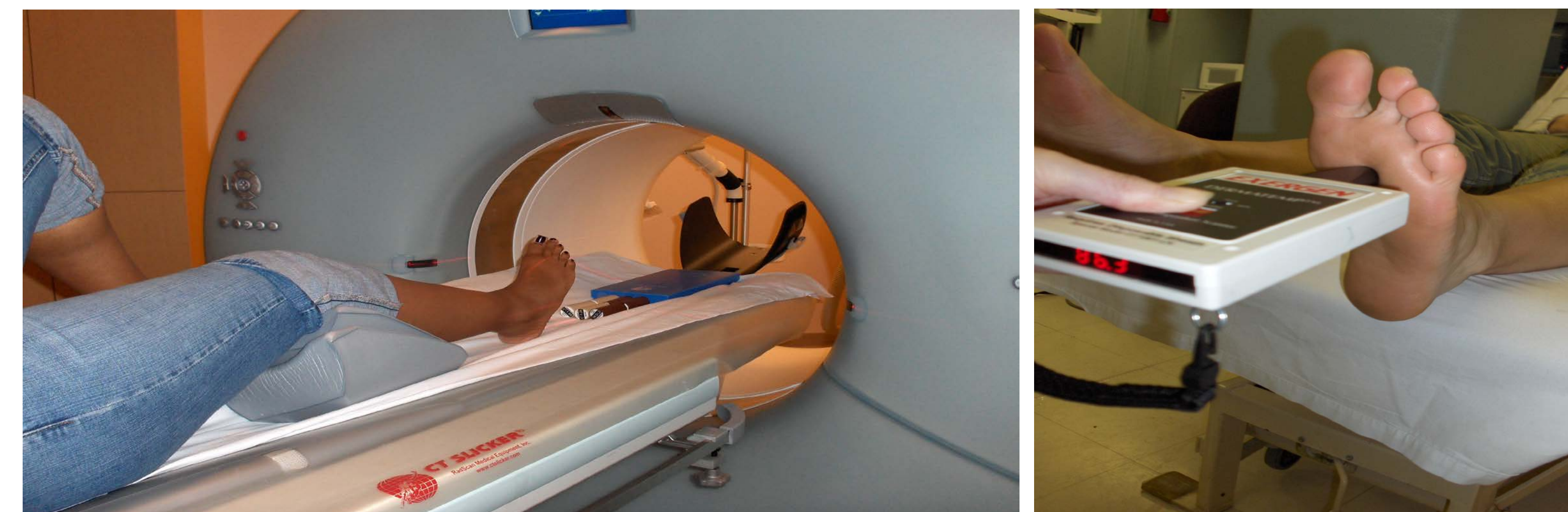
BMI: 32 ± 8



METHODS

All participants completed tests at baseline and 1 year:

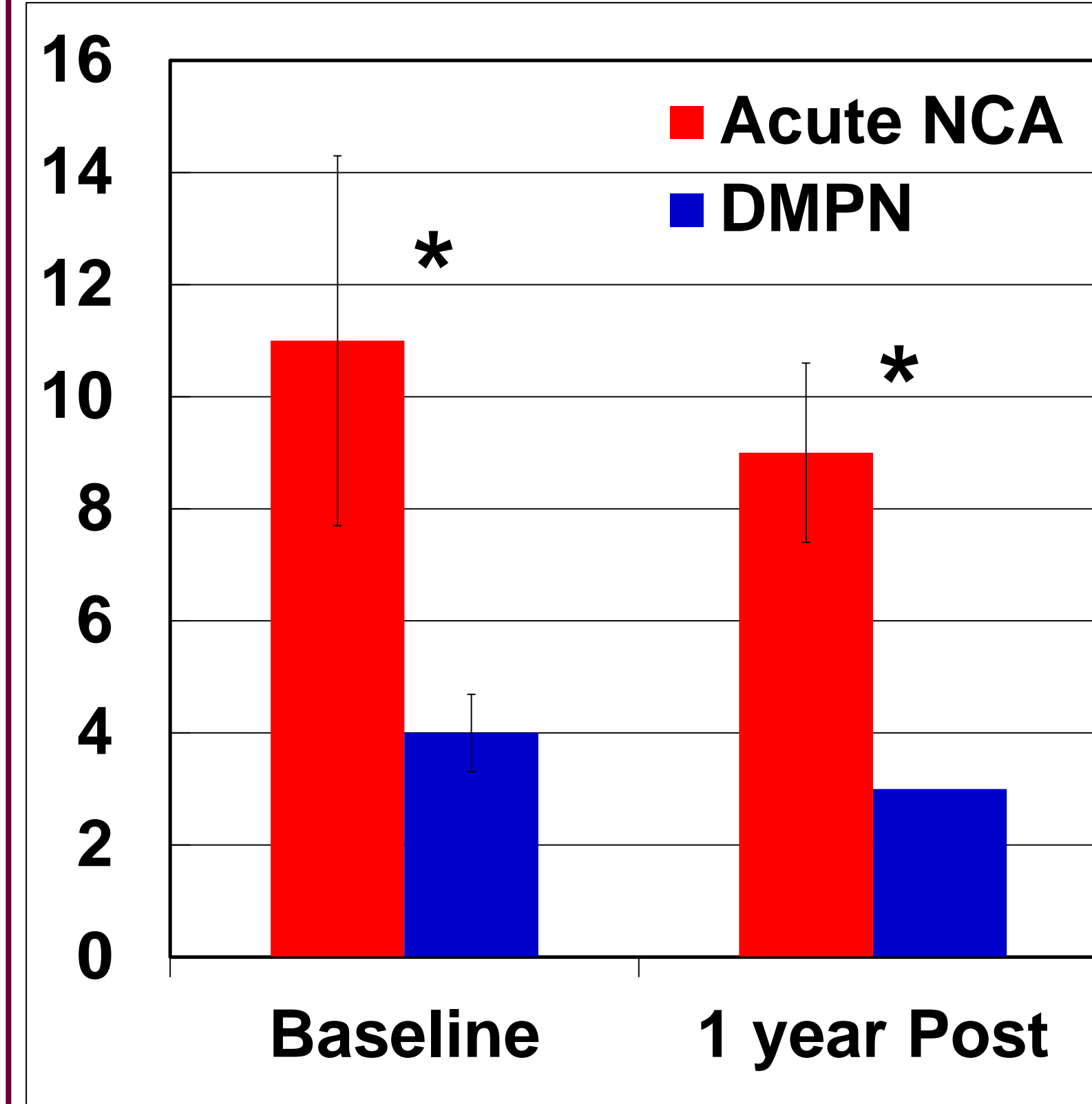
- Quantitative computed tomography (QCT) of both feet (Siemens Somatom Definition CT Scanner)
- Foot skin temperatures (Exergen Dermatemp DT1001-LN)
- Blood drawn for inflammation markers: C-reactive protein (CRP) & erythrocyte sedimentation rate (ESR)



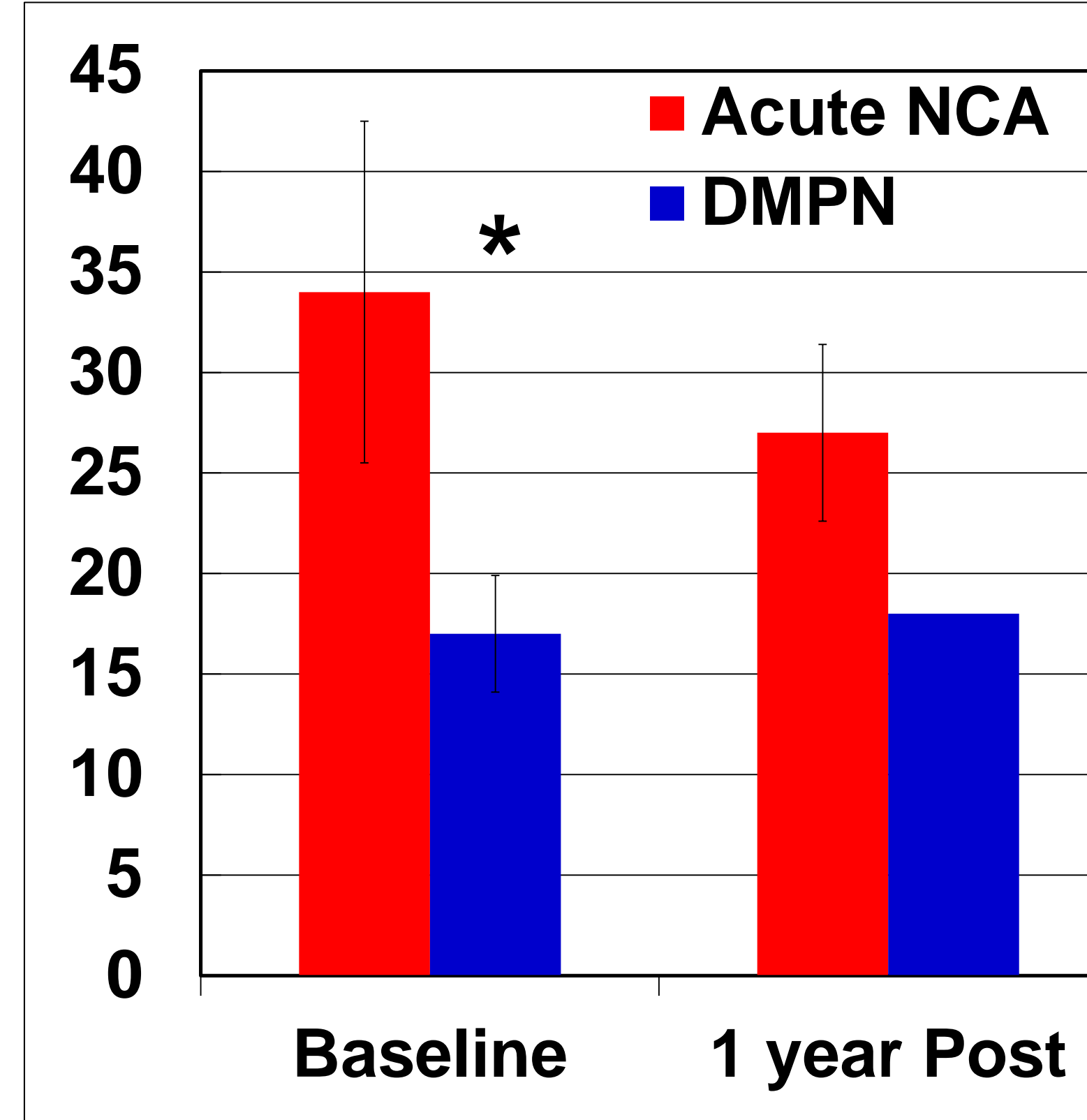
Data Analysis: Tarsal & metatarsal BMD, skin temperature differences between feet and serum markers of CRP & ESR were compared using a Group X Time repeated measures ANOVA.

RESULTS

CRP (mg/L)



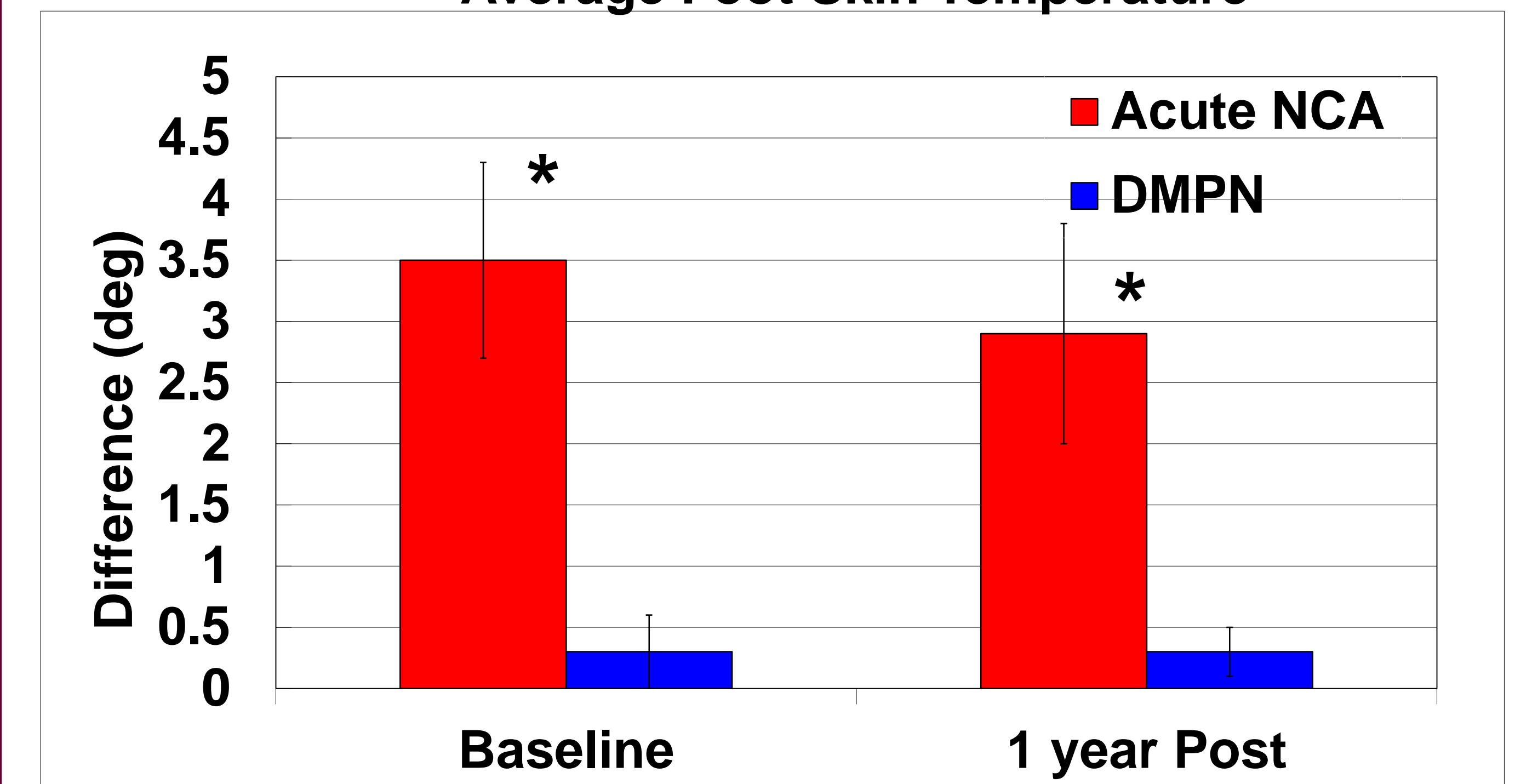
ESR (mm/hr)



*p < 0.01 between Acute NCA group & DMPN group ; p > 0.05 between Baseline & 1 year Post in both groups.

RESULTS, cont.

Average Foot Skin Temperature



*p < 0.01 between Acute NCA & DMPN group ; p > 0.05 between Baseline & 1 year Post in both groups.

Bone	NCA % Different (T1-T4)	DMPN % Different (T1-T4)	P Value	Bone	NCA % Different (T1-T4)	DMPN % Different (T1-T4)	P Value
1 st Met	-8.2*	0.2	0.00	Talus	-2.7	-0.7	0.09
2 nd Met	-3.4*	0.4	0.00	Navic.	-6.9*	-0.2	0.01
3 rd Met	-1.5	0.9	0.07	Cuboid	6.7	0.0	0.50
4 th Met	-7.2*	0.6	0.00	1 st Cune.	-3.6	-0.5	0.09
5 th Met	-7.6*	-0.2	0.00	2 nd Cune.	4.3	-0.5	0.06
Calc.	-5.5*	-0.9	0.00	3 rd Cune.	1.1	0.0	0.38

*p < 0.01 between Acute NCA & DMPN group

CONCLUSIONS

Local and systemic markers of inflammation persist for a year in some participants after treatment resulting in a net loss of BMD. The persistent inflammation may be the contributing cause for pedal bone osteolysis resulting in foot deformities characteristic of the chronic Charcot foot.

CLINICAL RELEVANCE

Patients with NCA may require: 1) longer immobilization time & offloading to reduce inflammation; 2) a slower return to weight bearing activities; 3) therapeutic agents to limit pedal osteolysis following acute NCA.