02-4 Aberrant temperature disparity in fingers, and its amelioration by warming therapies, in connective tissue diseases patients

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Introduction: Human body has systems that preserve its homeostasis, corresponding to a spectrum of stimuli. As for thermal stimuli, vasculatures would react most, and changes in blood flow could be observed as skin temperature measured by thermography. In case that vasculature gets sickened, its response may change. We have observed that temperature unevenness/disparity among fingers is the most useful finding to see disturbed peripheral circulation in connective tissue diseases (CTDs) patients, although low temperatures prior to immersion and their delayed recovery after immersion are distinguished.

Objectives: To examine whether warm stimulus ameliorates temperature disparity, and if it works, whether any differences are between warm tap water and warm water containing CO₂.

Patients and methods: CTD patients with signs or symptoms of circulatory disturbance in periphery of extremities were tested for thermo-loading test. Loading was hands immersion in 42°C tap water or water containing CO₂ (1000 ppm) for 10''. Coefficient of variation (CV, mean of right & left SD/mean of 5 nailfolds’ temperature) was calculated at each measuring point (baseline, 0, 3, 5, 10, 15, 20, 30 minutes after the immersion), its change from baseline was examined, and the CV change was compared between tap and CO₂ warm water.

Results: Twenty-one (F:20, M:1, 60.0±17.1 year-old) , and 24 (F:22, M:2 58.3±19.4 y) patients were tested for tap and CO₂ water immersion, respectively. Before warm bathing, varying levels of CV was observed from patient to patient (tap, 0.020+/-0.014; CO₂ 0.029+/-0.029, p<0.05). Just after the immersion, CV decreased in all of the patients (0.010+/-0.003, p<0.05 vs. baseline; 0.013+/-0.005, p<0.05). Then, afterward, CV gradually re-increased toward the level at baseline prior to bathing; however, until 20' after, CV was still lower than that at baseline, in both immersions (data not shown). Thirty minutes after the immersion, CV re-increased to a level not statistically different from that at baseline in tap water immersion (0.018+/−0.011, ns); however, CV was still statistically lower in CO₂ water immersion (0.016+/−0.014, p<0.05).

Conclusion: Hands immersion in warm tap water and
warm CO\textsubscript{2} water both once ameliorated varied temperature, evaluated by CV. Amelioration was dissolved 30' after the immersion in tap water, but sustained even 30' after the immersion in CO\textsubscript{2} water, in spite of higher CV in CO\textsubscript{2} group.

After hands immersion in cold water, nailfold temperatures recover delays, and keeping the evenness among fingers throughout. In normal volunteers, On the contrary, the patients of connective tissue diseases (CTDs) who have peripheral perfusion disturbance show not only, but also uneven temperatures among fingers, which is much more clearly revealed after the load (Fig). A typical example would be Raynaud phenomenon, which sometimes complicates with internal organ diseases including pseudo-ileus or pulmonary arterial hypertension.

Unevenness would be the novel finding by us. CTD patients with longstanding severely disturbed peripheral perfusion frequently show sustained very low nailfold temperatures, but rather even temperatures among fingers; this might suggest remodeling of vasculature. Drugs maybe having pharmacological effect to dissolve remodeling, including PGI\textsubscript{2}, could show a turn for the better.

When hands are immersed in warm water, the unevenness seemed to be ameliorated. The effect of warm water containing highly concentrated CO\textsubscript{2} is likely more than that of warm tap water; this is now under study.

Even internal organs, especially lungs or intestine that could touch air or foods from outside of the body, might react to thermal changes. The CTD patients having sustained low and even temperature sometimes develop pulmonary hypertension. When they have barely recovered from it by therapies, step by step favorable turn in finger thermography is observed.

As is described above, observation of vascular response to thermal stimuli is a useful tool for evaluating some diseased state. Therapies by balneologics or some drugs have sufficient potential to cure some diseases involving vasculature.

**Keywords:** Thermal stimuli, Thermography, Connective tissue diseases, Pulmonary hypertension, Raynaud phenomenon