

Case Report

Influences of Pinpoint Plantar Long-Wavelength Infrared Light Irradiation (Stress-Free Therapy) on Chorioretinal Hemodynamics, Atherosclerosis Factors, and Vascular Endothelial Growth Factor



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ABSTRACT

Background: We previously reported that pinpoint plantar long-wavelength infrared light irradiation (stress-free therapy; SFT) is useful for alleviating insulin resistance and improving intracranial blood flow in patients with type 2 diabetes mellitus. This study was undertaken to evaluate the influences of SFT on chorioretinal hemodynamics (retinal artery and vein blood flows) as well as atherosclerosis-related factors (TG, LDL-C) and VEGF in patients with dyslipidemia.

Methods: Four patients with dyslipidemia received 15-minute irradiation with a stress-free apparatus (far-infrared wavelength, 30 mW). Using laser speckle flowgraphy, associations of chorioretinal blood flow with peripheral atherosclerosis-inducing factors/VEGF levels before and after irradiation were analyzed.

Results: Chorioretinal blood flow increased, while TG/LDL-C levels decreased, after irradiation. VEGF tended to rise in cases with pre-irradiation baseline levels at the lower limit but tended to decrease in cases in which baseline levels had exceeded the normal range.

Conclusion: SFT was suggested to enhance chorioretinal circulation and to normalize VEGF, thereby possibly contributing to amelioration of atherosclerosis-inducing factors. Abnormalities in chorioretinal hemodynamics are known to be highly involved in the pathophysiology of diabetic retinopathy and age-related macular degeneration, and anti-VEGF antibody has been used for treating these conditions. The necessity of risk management, involving chorioretinal blood flow, has been pointed out when dealing with central retinal vein occlusion, diabetes mellitus, ischemic cerebral/cardiac disease, dementia and so on. SFT is therefore a potential complementary medical strategy which can be expected to contribute to normalization of chorioretinal blood flow and atherosclerosis-inducing factors/VEGF levels, and thereby to the prevention of lifestyle-related chronic diseases.

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1. Introduction

It has been reported in recent years that the risks for vascular dementia (VD) and Alzheimer disease (AD) onset are high in patients with diseases such as dyslipidemia, hypertension and diabetes mellitus (DM).^{1,2} It is also known that insulin resistance and hyperinsulinemia, which are problems associated with type 2 DM, can induce low insulin levels in the central nervous system which are closely associated with the onset of AD through reduction of cerebral blood flow, accumulation of amyloid- β , phosphorylation of tau protein and so on.³ In addition, diabetic retinopathy is known to be associated with abnormal vascular endothelial growth factor (VEGF) expression and AD.⁴

We previously reported that pinpoint plantar long-wavelength infrared light irradiation (stress-free therapy; SFT) suppresses the stress reaction mediated by cortisol and contributes to alleviation of insulin resistance and elevation of intracranial blood flow in patients with type 2 DM.^{5–8} We have additionally demonstrated that SFT activates the immunoresponsive CD19⁺ CD24hi and CD38hi B-reg cell groups and induces the expression of IL-10 on lymphocytes.⁹

The present study was undertaken to evaluate the influence of SFT on chorioretinal hemodynamics (retinal artery and vein blood flows) as well as its influences on atherosclerosis-inducing factors (triglycerides; TG, low-density lipoprotein cholesterol; LDL-C, high-density lipoprotein cholesterol; HDL-C), and VEGF in patients with dyslipidemia.

2. Methods

This study involved 4 untreated patients with dyslipidemia (3 men and 1 woman; mean age, 54.8 ± 13.5 years) and 4 healthy volunteers (2 men and 2 women; mean age, 48.8 ± 9.7 years; undergoing only placement of a probe without irradiation) serving as SFT controls.

Irradiation for SFT was applied to 4 points in total, including the point of intersection of the vertical line of the medial malleolus with the line joining the first and second metatarsal bones of the planta, the right and left orbital foramens and the depressed point one finger breadth above the center of the line joining the medial ends of the eyebrows (the latter 3 points were selected in view of increases in chorioretinal blood flow), as shown in Fig. 1.

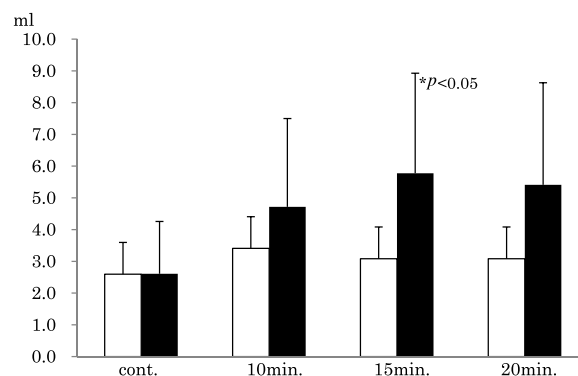


Fig. 2 – Changes in blood flow in healthy volunteers
 □: Placebo (only placement of a probe without irradiation).
 ■: SF therapy. mean \pm SD, N = 10.
 The maximal effect was obtained via 15 minutes-treatment. Changes in blood flow to the facial artery were analyzed using a laser Doppler flow meter (Advance ALF 21) in a similar manner as our previous report (Laser Therapy 24,1:27-32).

Each subject was instructed to remain still in the supine position for 15 minutes and then received 15-minute irradiation with an SFT apparatus (Controlled medical device certificate No. 224AFBZX00075000; probe diameter 20 mm, far-infrared wavelength 9000 to 12000 nm, output power 30 mW) (Fig. 1). Preliminarily, we have confirmed that maximal effect is obtained via 15 minutes-treatment (Fig. 2).

Changes in chorioretinal circulation (retinal artery and vein blood flows) after SFT from those before this therapy were analyzed on the basis of the data obtained by laser speckle flowgraphy (LSFG-NAVI) measurement conducted under identical conditions, with circadian rhythm influences, etc., taken into account. Blood, 5 cc, was collected via the cubital vein under identical conditions (time of collection, etc.) for determination of peripheral blood VEGF levels by electrochemiluminescence immunoassay (ECL) and analysis of TG, HDL-C and LDL-C by enzymatic methods (performed by Showa Medical Science Corporation). Three SFT sessions were applied to each participant at a frequency of once per week.

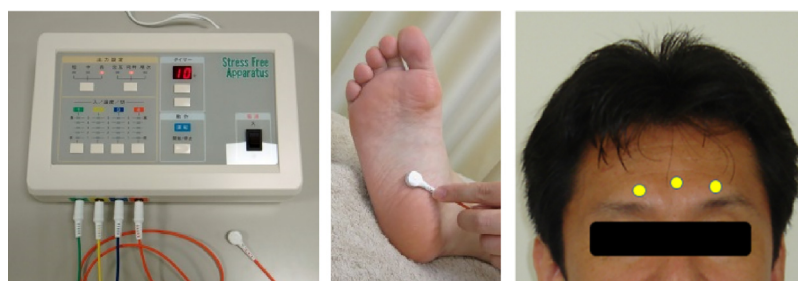


Fig. 1 – SF therapy apparatus and points of irradiation

Left: SF therapy apparatus, Middle: Point of intersection of a vertical line of the medial malleolus with the line joining the first and second metatarsal bones of the planta, Right: Right and left orbital foramens and the depressed point one finger breadth above the center of the line joining the medial ends of the eyebrows (3 points).

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