

[Articles and Studies on Far Infrared Therapy](#)

Chronic Pain

Intern Med. 2008;47(16):1473-6. Epub 2008 Aug 15.

Efficacy of Waon therapy for fibromyalgia.

Matsushita K, Masuda A, Tei C.

The First Department of Internal Medicine, Kagoshima University Hospital.

Abstract

OBJECTIVE: Fibromyalgia syndrome (FMS) is a chronic syndrome characterized by widespread pain with tenderness in specific areas. We examined the applicability of Waon therapy (soothing warmth therapy) as a new method of pain treatment in patients with FMS.

METHODS: Thirteen female FMS patients (mean age, 45.2±15.5 years old; range, 25-75) who fulfilled the criteria of the American College of Rheumatology participated in this study. Patients received Waon therapy once per day for 2 or 5 days/week. The patients were placed in the supine or sitting position in a far infrared-ray dry sauna maintained at an even temperature of 60 degrees C for 15 minutes, and then transferred to a room maintained at 26-27 degrees C where they were covered with a blanket from the neck down to keep them warm for 30 minutes. Reductions in subjective pain and symptoms were determined using the pain visual analog scale (VAS) and fibromyalgia impact questionnaire (FIQ).

RESULTS: All patients experienced a significant reduction in pain by about half after the first session of Waon therapy (11-70%), and the effect of Waon therapy became stable (20-78%) after 10 treatments. Pain VAS and FIQ symptom scores were significantly ($p < 0.01$) decreased after Waon therapy and remained low throughout the observation period.

CONCLUSION: Waon therapy is effective for the treatment of fibromyalgia syndrome.

Psychother Psychosom. 2005;74(5):288-94.

The effects of repeated thermal therapy for patients with chronic pain.

Masuda A, Koga Y, Hattanmaru M, Minagoe S, Tei C.

Nishi Kyusyu University, Saga, Japan.

Abstract

BACKGROUND: It has been reported that local thermal therapy with a hot pack or paraffin relieves pain. We hypothesized that systemic warming may decrease pain and improve the outcomes in patients with chronic pain. The purpose of this study was to clarify the effects of systemic thermal therapy in patients with chronic pain.

METHODS: Group A ($n = 24$) patients with chronic pain were treated by a multidisciplinary treatment including cognitive behavioral therapy, rehabilitation, and exercise therapy, whereas group B ($n = 22$) patients were treated by a combination of multidisciplinary treatment and repeated thermal therapy. A far-infrared ray dry sauna therapy and post-sauna warming were performed once a day for 4 weeks during hospitalization. We investigated the improvements in subjective symptoms, the number of pain behavior after treatment and outcomes 2 years after discharge.

RESULTS: The visual analog pain score, number of pain behavior, self-rating depression scale, and anger score significantly decreased after treatment in both groups. After treatment, the number of pain behavior was slightly smaller ($p = 0.07$) and anger score was significantly lower in group B than those in group A ($p = 0.05$). Two years after treatment, 17 patients (77%) in group B returned to work compared with 12 patients (50%) in group A ($p < 0.05$).

CONCLUSION: These results suggest that a combination of multidisciplinary treatment and repeated thermal therapy may be a promising method for treatment of chronic pain. Copyright 2005 S. Karger AG, Basel.

Conf Proc IEEE Eng Med Biol Soc. 2009;2009:1589-91.

Phantom limb pain treated by far infrared ray.

Huang CY, Yang RS, Kuo TS, Hsu KH.

Department of Electrical Engineering, Biomedical Group, National Taiwan University, Taipei, 10617 Taiwan. chiyuhuang@ntu.edu.tw

Abstract

We have treated a patient with severe phantom limb pain by a novel far infrared ray (FIR) therapy. The patient has suffered persistent and progressively worsening phantom limb pain after amputation ten years ago. He also experienced severe muscle spasm and twitch of stump during the attacks. His phantom limb pain was excruciating and was rated up to 9 by the Visual Analog Pain Scale. Various pain treatment modalities have been used but in vain, including medications and rehabilitation. He also underwent two episodes of sympathectomy, only achieving short-term effects for three months. Then he underwent our new treatment method. We applied FIR to the amputated limb site instead of the stump of the patient for 40 minutes for each treatment session twice a week. One month after the FIR treatment, he felt much improved and rated his phantom pain at 4, and down to 2-3 after two months of treatment. The duration of each phantom limb pain attack has significantly reduced from over 24 hours to only a few minutes or seconds after five months of FIR treatment. During a six-month post-treatment follow-up, his phantom limb pain occurred seldom for only a few seconds at a low 1-2 rating on the pain scale. The analgesic effect of FIR treatment has prevented him from the scheduled third sympathectomy and the risk of heart attack followed by severe twitch of stump. The results of this study demonstrate an easy, non-invasive and effective treatment modality for phantom limb pain.

Chronic Fatigue, Stress, and Depression

Nippon Rinsho. 2007 Jun;65(6):1093-8.

A new treatment: thermal therapy for chronic fatigue syndrome.

[Article in Japanese]

Masuda A, Munemoto T, Tei C.

Masuda Clinic.

Abstract

Thermal therapy using far-infrared ray dry sauna was performed for patients with chronic fatigue syndrome (CFS). Symptoms such as fatigue, pain, and low-grade fever were dramatically improved on two patients. And prednisolone administration was discontinued and became socially rehabilitated 6 months after discharge. On other 11 patients with CFS, physical symptoms such as fatigue and pain improved, too. Furthermore, we reported that repeated thermal therapy had relaxation effect and diminishes appetite loss and subjective complaints in mildly depressed patients. These results suggest that repeated thermal therapy may be a promising method for the treatment of CFS.

J Psychosom Res. 2005 Apr;58(4):383-7.

The effects of repeated thermal therapy for two patients with chronic fatigue syndrome.

Masuda A, Kihara T, Fukudome T, Shinsato T, Minagoe S, Tei C.

Respiratory and Stress Care Center, Kagoshima University Hospital, 8-35-1 Sakuragaoka, Kagoshima 890-8520, Japan.

Abstract

OBJECTIVE: This paper describes the successful treatment of two patients with chronic fatigue syndrome (CFS) using repeated thermal therapy.

METHODS: Two patients with CFS underwent treatment with prednisolone (PSL), with no satisfactory effect. They were subjected to thermal therapy that consisted of a far-infrared ray dry sauna at 60 degrees C and postsauna warming. The therapy was performed once a day, for a total of 35 sessions. After discharge, these subjects continued the therapy once or twice a week on an outpatient basis for 1 year.

RESULTS: Symptoms such as fatigue, pain, sleep disturbance, and low-grade fever were dramatically improved after 15 to 25 sessions of thermal therapy. Although PSL administration was discontinued, the subjects showed no relapse or exacerbation of symptoms during the first year after discharge. The patients became socially rehabilitated 6 months after discharge.

CONCLUSIONS: These results suggest that repeated thermal therapy might be a promising method for the treatment of CFS.

Measuring Stress Reduction Using Far Infrared Ray Medical Device Biomat for 12 Subjects.

AUTHOR: DR. GEORGE GRANT, Ph.D, I.M.D., M.Sc., M.Ed., C.CHEM., R.M.

Affiliation: Currently in private practice at Champion Integrative Clinic, Toronto, ON Canada. Former Consultant for Health Canada, Ottawa, ON, Professor at Seneca College, North York, ON and Scientist at the faculty of Pharmacy, Saskatoon, Sask., Canada.

March 2nd 2011

Abstract:

12 subjects were tested before and after using the Biomat for one hour daily over 3 months period using 3 different biofeedback devices and blood cortisol levels to measure stress reduction.

Far Infra Red/Negative Ions Amethyst Biomat reduces Stress by 78% as validated by Pre and Post Biofeedback Brain Scans as well as fasting blood test to measure the stress hormone cortisol.

The core of Biomat technology is a combination of far infrared ray, negative ion effects and the conductive properties of amethyst channels. These three powerful health stimulators are combined in a single, easy-to-use product with remarkable healing properties.

The Biomat delivers soothing, deep-penetrating heat while stimulating the regeneration of damaged cells in your body. It's a safe and natural way to achieve optimal health now and maintain a stronger, more resilient body in the future. This highly effective therapy is now available to medical professionals and home consumers who want to improve health and wellbeing with products based on Nobel prize-winning scientific research pioneered by NASA and developed using pure, natural materials. The Biomat is an approved medical device by FDA.

Benefits of the Infra red ray and Negative Ions emits by Amethyst Biomat:

Reduces stress and fatigue, relieves anxiety and promotes relaxation, improves sleep patterns, reduces inflammation, eases joint pain and stiffness, provides warm, soothing pain relief, eliminates toxins in the body, increases blood circulation, alleviates migraines and tension headaches, reduces allergy symptoms, improves immune system function, improves

cardiovascular health, burns calories and controls weight and improves muscle tone and skin quality.

12 subjects were tested before and after using the Biomat for an hour daily over 2 months using ICAP Brain Scan, HRV Heart scan and Bio resonance Magnetic analyzer.

The results were reduction in stress by 78% among subjects tested and an increased sense of well being. All 12 subjects were tested in Toronto, ON Canada.

Am J Chin Med. 2009;37(5):837-42.

The effect on serotonin and MDA levels in depressed patients with insomnia when far-infrared rays are applied to acupoints.

Chang Y, Liu YP, Liu CF.

Jenteh Junior College of Medicine and Nursing Management, Miaoli, Taiwan.

Abstract

Little is known about the effect of far-infrared rays (FIR) on serotonin and malondialdehyde levels in depressed patients with insomnia. The purpose of this study is to assess the effect of far-infrared rays on depressed people with insomnia. A randomized design was used to determine this effect. A total of 70 inpatients were recruited with the clinical diagnosis of depression with sleep disturbance. In the experimental group, FIR was applied to three chosen acupuncture points by a patch-like sticker for a period of 15 minutes twice a week. The three acupuncture points are Nei-Kuan (PC6), Shenmen (HT7) and Sanyinjiao (SP6). The total duration of experiment was four weeks. For both experimental and control groups, serum levels of serotonin (5HT) and malondialdehyde (MDA) were examined before and after the introduction of FIR. The experimental group revealed disparate changes over different dependent variables, in which serotonin increased but MDA decreased after the introduction of FIR. These observations indicate that the serotonin pathway is involved in the pathophysiological mechanism responsible for the damaging effects of MDA on depressed patients with insomnia.

Psychosom Med. 2005 Jul-Aug;67(4):643-7.

Repeated thermal therapy diminishes appetite loss and subjective complaints in mildly depressed patients.

Masuda A, Nakazato M, Kihara T, Minagoe S, Tei C.

Psychosomatic Medicine, Respiratory and Stress Care center, Kagoshima University Hospital, Kagoshima City, Japan.

Abstract

OBJECTIVE: We observed that repeated thermal therapy improved appetite loss and general well-being in patients with chronic heart failure. The purpose of this study is to clarify the effects of repeated thermal therapy in mildly depressed patients with appetite loss and subjective complaints.

METHODS: Twenty-eight mildly depressed inpatients with general fatigue, appetite loss, and somatic and mental complaints were randomly assigned to thermal therapy group (n = 14) or nonthermal therapy group (n = 14). Patients in the thermal therapy group were treated with 60 degrees C far-infrared ray dry sauna for 15 minutes and were then kept at bed rest with a blanket for 30 minutes once a day, 5 days a week for a total of 20 sessions in 4 weeks.

RESULTS: Four weeks after admission, somatic complaints, hunger, and relaxation scores significantly improved (p < .001, p < .0001, p < .0001, respectively) and mental complaints slightly improved (p = .054) in the thermal therapy group compared with the nonthermal therapy group. Furthermore, the plasma ghrelin concentrations and daily caloric intake in the thermal therapy group significantly increased compared with the nonthermal therapy group (p < .05).

CONCLUSIONS: These findings suggest that repeated thermal therapy may be useful for mildly depressed patients with appetite loss and subjective complaints.

Cancer

Crit Rev Oncol Hematol. 2002 Jul;43(1):33-56.

The cellular and molecular basis of hyperthermia.

Hildebrandt B, Wust P, Ahlers O, Dieing A, Sreenivasa G, Kerner T, Felix R, Riess H.
Medical Clinic, Department of Hematology and Oncology, Charite Medical School, Humboldt-University, Campus Virchow Clinic, D-13344 Berlin, Germany.

Abstract

In oncology, the term 'hyperthermia' refers to the treatment of malignant diseases by administering heat in various ways. Hyperthermia is usually applied as an adjunct to an already established treatment modality (especially radiotherapy and chemotherapy), where tumor temperatures in the range of 40-43 degrees C are aspired. In several clinical phase-III trials, an improvement of both local control and survival rates have been demonstrated by adding local/regional hyperthermia to radiotherapy in patients with locally advanced or recurrent superficial and pelvic tumors. In addition, interstitial hyperthermia, hyperthermic chemoperfusion, and whole-body hyperthermia (WBH) are under clinical investigation, and some positive comparative trials have already been completed. In parallel to clinical research, several aspects of heat action have been examined in numerous pre-clinical studies since the 1970s. However, an unequivocal identification of the mechanisms leading to favorable clinical results of hyperthermia have not yet been identified for various reasons. This manuscript deals with discussions concerning the direct cytotoxic effect of heat, heat-induced alterations of the tumor microenvironment, synergism of heat in conjunction with radiation and drugs, as well as, the presumed cellular effects of hyperthermia including the expression of heat-shock proteins (HSP), induction and regulation of apoptosis, signal transduction, and modulation of drug resistance by hyperthermia.

Expert Rev Med Devices. 2010 May;7(3):407-23.

Current devices for high-performance whole-body hyperthermia therapy.

Jia D, Liu J.

Department of Biomedical Engineering, School of Medicine, Tsinghua University, Beijing, PR China.

Abstract

For late-stage cancer, whole-body hyperthermia (WBH) is highly regarded by physicians as a promising alternative to conventional therapies. Although WBH is still under scrutiny due to potential toxicity, its benefits are incomparable, as diversified devices and very promising treatment protocols in this area are advanced into Phase II and III clinical trials. Following the introduction of the WBH principle, this paper comprehensively reviews the state-of-art high-performance WBH devices based on the heat induction mechanisms - radiation, convection and conduction. Through analyzing each category's physical principle and heat-induction property, the advantages and disadvantages of the devices are evaluated. Technical strategies and critical scientific issues are summarized. For future developments, research directions worth pursuing are presented in this article.

Ann Oncol. 2002 Aug;13(8):1173-84.

Heating the patient: a promising approach?

van der Zee J.

Erasmus Medical Center-Daniel den Hoed Cancer Center, Department of Radiation Oncology, Hyperthermia Unit, Rotterdam, The Netherlands.

Abstract

There is a clear rationale for using hyperthermia in cancer treatment. Treatment at temperatures between 40 and 44 degrees C is cytotoxic for cells in an environment with a low pO₂ and low pH, conditions that are found specifically within tumour tissue, due to insufficient blood perfusion. Under such conditions radiotherapy is less effective, and systemically applied cytotoxic agents will reach such areas in lower concentrations than in well perfused areas. Therefore, the addition of hyperthermia to radiotherapy or chemotherapy will result in at least an additive effect. Furthermore, the effects of both radiotherapy and many drugs are enhanced at an increased temperature. Hyperthermia can be applied by several methods: local hyperthermia by external or internal energy sources, regional hyperthermia by perfusion of organs or limbs, or by irrigation of body cavities, and whole body hyperthermia. The use of hyperthermia alone has resulted in complete overall response rates of 13%. The clinical value of hyperthermia in addition to other treatment modalities has been shown in randomised trials. Significant improvement in clinical outcome has been demonstrated for tumours of the head and neck, breast, brain, bladder, cervix, rectum, lung, oesophagus, vulva and vagina, and also for melanoma. Additional hyperthermia resulted in remarkably higher (complete) response rates, accompanied by improved local tumour control rates, better palliative effects and/or better overall survival rates. Generally, when combined with radiotherapy, no increase in radiation toxicity could be demonstrated. Whether toxicity from chemotherapy is enhanced depends on sequence of the two modalities, and on which tissues are heated. Toxicity from hyperthermia cannot always be avoided, but is usually of limited clinical relevance. Recent developments include improvements in heating techniques and thermometry, development of hyperthermia treatment planning models, studies on heat shock proteins and an effect on anti-cancer immune responses, drug targeting to tumours, bone marrow purging, combination with drugs targeting tumour vasculature, and the role of hyperthermia in gene therapy. The clinical results achieved to date have confirmed the expectations raised by results from experimental studies. These findings justify using hyperthermia as part of standard treatment in tumour sites for which its efficacy has been proven and, furthermore, to initiate new studies with other tumours. Hyperthermia is certainly a promising approach and deserves more attention than it has received until now.

Int J Hyperthermia. 2001 Jan-Feb;17(1):1-18.

Hyperthermia in oncology.

Falk MH, Issels RD.

Medizinische Klinik III, Klinikum Grosshadern, Munich, Germany.

Abstract

The purpose of this article is to provide an overview on the current clinical application of hyperthermia combined with conventional treatment modalities (e.g. ionizing radiation, chemotherapy) in the treatment of malignant disease. The clinical application of hyperthermia with increase of tissue temperatures (range 40-44 degrees C) has been integrated in multimodal anti-cancer strategies. This review describes selected phase I or II (n = 17) and phase III trials (n = 16) investigating the effect of hyperthermia combined with radiotherapy (n = 10 trials), chemotherapy (n = 15 trials), or both (n = 8 trials) in a total of more than 2200 patients. The trials were performed in a variety of solid tumours (e.g. melanoma, head and neck cancer, breast cancer, cancer of the gastrointestinal or urogenital tract, glioblastoma, sarcoma) in paediatric or adult patients. Profound research has produced a scientific basis for the simultaneous application of hyperthermia in combination with ionizing radiation and/or systemic chemotherapy. Hyperthermia is becoming more accepted clinically, due to the substantial technical improvements made in achieving selected increase of temperatures in superficial and deep-seated tumours. At present, the combination of hyperthermia and chemotherapy or radiochemotherapy is further tested within clinical

protocols (phase II/III) in order to improve local tumour control and relapse-free survival in patients with high-risk or advanced tumours of different entities.

Anticancer Res. 1999 Sep-Oct;19(5B):4125-30.

Inhibition by whole-body hyperthermia with far-infrared rays of the growth of spontaneous mammary tumours in mice.

Udagawa Y, Nagasawa H, Kiyokawa S.

Experimental Animal Research Laboratory, Meiji University, Kawasaki, Japan.

Abstract

To evaluate possible therapeutic benefits of irradiation with far-infrared rays (FIR) on breast cancer, we examined combined effects of the chronic exposure to FIR at ambient temperature (26.5-27.5 degrees C) and the whole-body hyperthermia induced by FIR (WBH) (35-41 degrees C) on the growth of spontaneous mammary tumours of mice. A high mammary tumour strain of SHN virgin mice born on the normal rack or FIR rack were maintained on the respective racks until mammary tumour appearance. When the mammary tumour size reached approximately 7 mm, some mice in each group received no further treatment (Control and FIR groups, respectively) and the remaining mice received 3 hours of WBH each of 5 consecutive days (C + WBH and FIR + WBH groups, respectively). There was little difference between the control and FIR groups in the tumour growth over 10 days of examination. On the other hand, the tumour growth was inhibited significantly in both C + WBH and FIR + WBH groups and the degree of inhibition was similar. The data confirmed that the chronic exposure to FIR at ambient temperature has little effect on the growth of spontaneous mammary tumours in mice. WBH with FIR, however, strongly inhibited the tumour growth without deleterious side-effects, while chronic FIR irradiation itself again had little effect in this process. This WBH regimen may serve as a useful animal model for long-term studies of a noninvasive treatment of breast cancer.

Int J Hyperthermia. 2007 Nov;23(7):591-8.

Antitumor effect of whole body hyperthermia with alpha-galactosylceramide in a subcutaneous tumor model of colon cancer.

Hattori T, Kokura S, Okuda T, Okayama T, Takagi T, Handa O, Naito Y, Yoshida N, Yoshikawa T.

Inflammation and Immunology, Kyoto Prefectural University of Medicine, Kyoto, Japan.

Abstract

AIM: Whole body hyperthermia (WBH) has been used clinically as an adjunct to radio- and chemotherapy in patients with various cancers. Recently, it has been reported that an activation of the immune system has recently been reported as a possible contributor to the therapeutic effects of WBH. Conversely, the glycolipid alpha-galactosylceramide (alpha-GalCer) is recognized by natural killer (NK) T cells together with the monomorphic MHC-like antigen, CD1d, in mice and humans. This study investigated the antitumor effects of WBH combined with alpha-GalCer in a mouse subcutaneous tumor model of colon cancer. METHODS: Colon26 cells were inoculated subcutaneously into male BALB/c mice to establish subcutaneous tumor. Colon26-bearing mice were treated with WBH using far infrared rays three times/week. Rectal temperature was maintained for 60 min at 41 degrees C. In some experimental groups, alpha-GalCer was intraperitoneally injected before WBH. We investigated the therapeutic effects of WBH, alpha-GalCer and combined therapy. RESULTS: (1) Compared with controls, WBH alone resulted in significant inhibition of tumor growth. (2) No inhibitory effect on tumor growth was seen with alpha-GalCer. (3) The combination of WBH and alpha-GalCer showed significant inhibition of tumor growth and prolongation of survival. (4) Serum IFN-gamma increased after 3 h and returned to basal levels by 24 h after alpha-GalCer administration. (5) CTL activity was enhanced following combination therapy with WBH and alpha-GalCer. CONCLUSION: WBH showed antitumor

effects in a mouse subcutaneous tumor model of colon cancer. Addition of alpha-GalCer increased the efficacy of WBH, probably via enhancement of immune response.

Cancer Chemother Pharmacol. 2009 Nov;64(6):1079-83.

Epub 2009 Mar 11.

Preliminary results of M-VAC chemotherapy combined with mild hyperthermia, a new therapeutic strategy for advanced or metastatic transitional cell carcinoma of the urothelium.

Yamada Y, Itoh Y, Aoki S, Nakamura K, Taki T, Naruse K, Tobiume M, Zennami K, Katsuda R, Kato Y, Watanabe M, Nishikawa G, Minami M, Nakahira M, Ukai S, Sawada M, Kitamura A, Honda N.

Department of Urology, Aichi Medical University School of Medicine, Nagakute, Aichi 480-1195, Japan.

Abstract

OBJECTIVE: We evaluated the efficacy and safety of M-VAC chemotherapy combined with mild hyperthermia, a new therapeutic strategy for advanced metastatic transitional cell carcinoma of the urothelium.

SUBJECTS AND METHODS: The subjects were 12 patients diagnosed with advanced metastatic transitional cell carcinoma of the urothelium. For mild hyperthermia, the patients' oral temperature was elevated to about 38 degrees C by heating for 20 min and retaining the heat for 20 min with a far-infrared heater. The antitumor effect was evaluated according to the RECIST, while adverse drug reactions were assessed based on the NCI-CTC.

RESULTS: The antitumor effect was rated as partial remission (PR) in 10 of the 12 patients and stable disease in 2 patients, with an efficacy rate of 83% (10/12). All 10 patients who had achieved PR received three courses of treatment. Of the 12 patients, 5 died during the observation period, with survival for 9-23 months (mean: 15.6 months). Adverse drug reactions included myelosuppression in all patients (Grade 3 in 4 patients, Grade 4 in 8), and gastrointestinal toxicity, such as nausea or vomiting, which was mild (Grade 0 in 2 patients, Grade 1 in 8, Grade 2 in 1, Grade 3 in 1).

CONCLUSIONS: The results of the present study suggest that M-VAC chemotherapy combined with mild hyperthermia, which potentiates the anticancer effect and reduces adverse drug reactions such as gastrointestinal symptoms, is a useful and safe method for the treatment of advanced transitional cell carcinoma of the urothelium.

Med Oncol. 2008;25(2):229-37. Epub 2007 Oct 30.

The effects inhibiting the proliferation of cancer cells by far-infrared radiation (FIR) are controlled by the basal expression level of heat shock protein (HSP) 70A.

Ishibashi J, Yamashita K, Ishikawa T, Hosokawa H, Sumida K, Nagayama M, Kitamura S.

Department of Oral and Maxillofacial Anatomy, Medical Science for Oral and Maxillofacial Regeneration, Graduate School of Health Biosciences, University of Tokushima, 3-18-15 Kuramoto, Tokushima 770-8504, Japan.

Abstract

We developed a tissue culture incubator that can continuously irradiate cells with far-infrared radiation (FIR) of wavelengths between 4 and 20 microm with a peak of 7-12 microm, and found that FIR caused different inhibiting effects to five human cancer cell lines, namely A431 (vulva), HSC3 (tongue), Sa3

(gingiva), A549 (lung), and MCF7 (breast). Then, in order to make clear the control system for the effect of FIR, the gene expression concerned to the inhibition effect by FIR were analyzed. In consequence, basal expression level of HSP70A mRNA was higher in A431 and MCF7 cells than in the FIR-sensitive HSC3, Sa3, and A549 cells. Also, the over expression of HSP70 inhibited FIR-induced growth arrest in HSC3 cells, and an HSP70 siRNA inhibited the proliferation of A431 cells by irradiation with FIR. These results indicate that the effect of a body temperature range of FIR suppressing the proliferation of some cancer cells is controlled by the basal expression level of heat shock protein (HSP) 70A. This finding suggested that FIR should be very effective medical treatment for some cancer cells which have a low level of HSP70. Still more, if the level of HSP70 in any cancer of a patient was measured, the effect of medical treatment by FIR can be foreseen for the cancer.

Diabetes

Acta Med Okayama. 2010 Apr;64(2):143-7.

The effect of leg hyperthermia using far infrared rays in bedridden subjects with type 2 diabetes mellitus.

Kawaura A, Tanida N, Kamitani M, Akiyama J, Mizutani M, Tsugawa N, Okano T, Takeda E.
Department of Physical Therapy, School of Health Science, KIBI International University, Takahashi, Okayama 716-8508, Japan.

Abstract

We examined the effect of leg hyperthermia on oxidative stress in bedridden subjects with type 2 diabetes mellitus using 15-min sessions of far infrared rays over a two-week period. Four subjects (male 1, female 3) incapacitated by a stroke were recruited for this study. All patients were admitted to Takahashi Central Hospital and ate the same hospital meals. Fasting plasma glucose, HbA1c, tumor necrosis factor (TNF)alpha, free fatty acid, leptin, adiponectin and plasma 8-epi-prostaglandin F2alpha (8-epi-PGF2alpha) levels as a marker of oxidative stress were measured on admission, just before and 2 weeks after local heating of the leg. Results showed that plasma total 8-epi-PGF2alpha levels were decreased significantly while TNFalpha levels were increased significantly. On the other hand, glucose, HbA1c, free fatty acid, leptin and adiponectin levels were not changed during the study period. These results suggest that repeated leg hyperthermia may protect against oxidative stress.

J Altern Complement Med. 2010 Jun;16(6):677-81.

The effects of repeated thermal therapy on quality of life in patients with type II diabetes mellitus.

Beever R.

Department of Family Medicine, University of British Columbia, British Columbia, Canada.

Abstract

OBJECTIVES: Decreased quality of life in diabetes is associated with poor health outcomes. Far-infrared sauna treatments improve the quality of life for those with chronic pain, chronic fatigue syndrome, depression, and congestive heart failure. The objective of this study is to determine whether far-infrared saunas have a beneficial effect on quality of life in those with type II diabetes.

DESIGN: This was a sequential, longitudinal, interrupted time series design study.

SETTING/LOCATION: The setting was Fraser Lake BC, a rural village in central British Columbia, Canada.

SUBJECTS: All patients of the Fraser Lake Community Health Center with type II diabetes were invited to participate in this study.

INTERVENTIONS: The study consisted of 20-minute, 3 times weekly infrared sauna sessions, over a period of 3 months.

OUTCOME MEASURES: To assess quality of life, subjects completed the 36-item Short-form Health Survey Version 2 (SF-36v2) questionnaire as well as "Zero-to-Ten" Visual Analogue Scales. Baseline study parameters were measured within 1 week prior to commencing sauna sessions. Postintervention measurements were collected between 1 and 3 days after the last sauna session.

RESULTS: Physical health, general health, and social functioning indices of the SF-36v2 improved. Visual Analogue Scales for stress and fatigue improved.

CONCLUSIONS: Far-infrared sauna use maybe associated with improved quality of life in people with type II diabetes mellitus. Uptake of infrared saunas use is greater than the uptake of other lifestyle interventions.

Cardiovascular Disease

Circ J. 2011 Feb;75(2):348-56. Epub 2010 Dec 14.

Effect of Waon therapy on oxidative stress in chronic heart failure.

Fujita S, Ikeda Y, Miyata M, Shinsato T, Kubozono T, Kuwahata S, Hamada N, Miyauchi T, Yamaguchi T, Torii H, Hamasaki S, Tei C.

Department of Cardiovascular, Respiratory and Metabolic Medicine, Graduate School of Medicine, Kagoshima University, Kagoshima, Japan.

Abstract

BACKGROUND: A previous report by our team showed that Waon therapy, using a far infrared-ray dry sauna at 60°C, improves cardiac and vascular function in patients with chronic heart failure (CHF). The purpose of the present study was to clarify the effect of Waon therapy on oxidative stress in CHF patients and investigate its mechanism by animal experiments.

METHODS AND RESULTS: Forty patients with CHF were divided into control (n=20) and Waon therapy (n=20) groups. All patients received standard optimal medications for CHF. Waon therapy group was treated with Waon therapy daily for 4 weeks. After 4 weeks of Waon therapy, concentrations of hydroperoxide and brain natriuretic peptide (BNP) decreased significantly (hydroperoxide, 422±116 to 327±88U.CARR, P<0.001; BNP, 402±221 to 225±137pg/ml, P<0.001), and the nitric oxide metabolites increased (71.2±35.4 to 92.0±40.5mmol/L, P<0.05). In contrast, none of these variables changed over the 4-week interval in the control group. Furthermore, animal experiments were performed using TO-2 cardiomyopathic hamsters. On immunohistochemistry, cardiac expression of 4-hydroxy-2-nonenal, a marker of oxidative stress, was decreased in the 4-week Waon therapy compared to untreated hamsters. On Western blotting, cardiac expressions of heat shock protein (HSP) 27, manganese superoxide dismutase and HSP32, which reduce oxidative stress, were significantly upregulated in the 4-week Waon therapy compared to untreated hamsters.

CONCLUSIONS: Waon therapy decreases oxidative stress in patients and hamsters with heart failure.

J Cardiol. 2009 Apr;53(2):214-8. Epub 2009 Jan 18.

Waon therapy improves the prognosis of patients with chronic heart failure.

Kihara T, Miyata M, Fukudome T, Ikeda Y, Shinsato T, Kubozono T, Fujita S, Kuwahata S, Hamasaki S, Torii H, Lee S, Toda H, Tei C.

Department of Cardiovascular, Respiratory and Metabolic Medicine, Graduate School of Medicine, Kagoshima University, 8-35-1 Sakuragaoka, Kagoshima 890-8520, Japan.

Abstract

BACKGROUND: We developed a Waon therapy (soothing warm therapy) and have previously reported that repeated Waon therapy improves hemodynamics, peripheral vascular function, arrhythmias, and clinical symptoms in patients with chronic heart failure (CHF). The aim of this study was to investigate the effect of Waon therapy on the prognosis of CHF patients.

PATIENTS AND METHODS: We studied 129 patients with CHF in NYHA functional class III or IV who were admitted to our hospital between January 1999 and March 2001. In the Waon therapy group, 64 patients were treated with a far infrared-ray dry sauna at 60 degrees C for 15 min and then kept on bed rest with a blanket for 30 min. The patients were treated daily for 5 days during admission, and then at least twice a week after discharge. In the control group, 65 patients, matched for age, gender, and NYHA functional class, were treated with traditional CHF therapy. The follow-up time was scheduled for 5 years.

RESULTS: Recent, complete follow-up data on each patient were obtained. The overall survival rate was 84.5% (Kaplan-Meier estimate). Twelve patients died in the control group and 8 patients died in the Waon therapy group at 60 months of follow-up. Cardiac events due to heart failure or cardiac death occurred in 68.7% of the control group but only 31.3% of the Waon therapy group ($P < 0.01$) at 60 months of follow-up.

CONCLUSION: Waon therapy reduced cardiac events in patients with CHF. This therapy is a promising non-pharmacological treatment for CHF.

Photodermatol Photoimmunol Photomed. 2006 Apr;22(2):78-86.

Biological effect of far-infrared therapy on increasing skin microcirculation in rats.

Yu SY, Chiu JH, Yang SD, Hsu YC, Lui WY, Wu CW.

Institute of Molecular and Cellular Biology, Department of Life Science, National Tsing-Hua University, Hsinchu, and Division of General Surgery, Department of Surgery, Veterans General Hospital, Taipei, Taiwan.

Abstract

BACKGROUND/PURPOSE: Insufficient microcirculation of skin leads to acute and chronic tissue ischemia in cases of trauma, reconstructive surgery, diabetes mellitus and peripheral arterial occlusive disease. The autonomic nervous system and nitric oxide (NO) play important roles in maintaining blood perfusion of the skin. Far-infrared (FIR) therapy provides low energy of light emitted from an artificial radiator and has been used to treat many vascular-related disorders. Nevertheless, the mechanisms through which FIR works remain unclear. The present study aims to test the hypothesis that the effect of FIR is through increasing skin microcirculation by a mechanism other than its thermal effect.

METHODS: Sixty rats were used in the present study. A WS TY301 FIR emitter was placed 20 cm above the rats. Skin temperature and blood flow were continuously measured by a K-type thermocouple. Under laboratory control, the abdominal skin temperature steadily increased from 38-39 degrees C, and was kept at constant temperature. Skin microcirculation was measured with a continuous laser Doppler flowmeter.

RESULTS: There was no significant change of skin blood flow during FIR treatment. Skin blood flow increased significantly soon after the removal of the FIR emitter. The stimulating effect on skin blood flow was more significant in the rats treated with FIR for 45 min and could be sustained as long as 60 min. These findings suggested a non-thermic biological effect of FIR on skin microcirculation. The

promotive effect of FIR on increasing skin blood flow was not influenced by pretreatment of APP (atropine, propranolol and phentolamine), but was suppressed by pretreatment with NG-nitro-L-arginine methyl ester (an endothelial nitric oxide synthase inhibitor).

CONCLUSION: In conclusion, FIR therapy exerts a NO-related biological effect to increase skin microcirculation in rats. This might bring into perspective the clinical application of FIR to treat ischemic disease by augmenting L-arginine/NO pathway.

Circ J. 2004 Dec;68(12):1146-51.

Effects of repeated sauna treatment on ventricular arrhythmias in patients with chronic heart failure.

Kihara T, Biro S, Ikeda Y, Fukudome T, Shinsato T, Masuda A, Miyata M, Hamasaki S, Otsuji Y, Minagoe S, Akiba S, Tei C.

Department of Cardiovascular, Graduate School of Medicine, Kagoshima University, Sakuragaoka, Kagoshima, Japan.

Abstract

BACKGROUND: The aim of the present study was to determine whether repeated 60 degrees C sauna treatment improves cardiac arrhythmias in chronic heart failure (CHF) patients, because ventricular arrhythmias are an important therapeutic target in CHF.

METHODS AND RESULTS: Thirty patients (59 \pm 3 years) with New York Heart Association functional class II or III CHF and at least 200 premature ventricular contractions (PVCs)/24 h assessed by 24-h Holter recordings were studied. They were randomized into sauna-treated (n=20) or non-treated (n=10) groups. The sauna-treated group underwent a 2-week program of a daily 60 degrees C far infrared-ray dry sauna for 15 min, followed by 30 min bed rest with blankets, for 5 days per week. Patients in the non-treated group had bed rest in a temperature-controlled room (24 degrees C) for 45 min. The total numbers of PVCs/24 h in the sauna-treated group decreased compared with the non-treated group [848 \pm 415 vs 3,097 \pm 1,033/24 h, p<0.01]. Heart rate variability (SDNN, standard deviation of normal-to-normal beat interval) increased [142 \pm 10 (n=16) vs 112 \pm 11 ms (n=8), p<0.05] and plasma brain natriuretic peptide concentrations decreased [229 \pm 54 vs 419 \pm 110 pg/ml, p<0.05] in the sauna-treated group compared with the non-treated group.

CONCLUSION: Repeated sauna treatment improves ventricular arrhythmias in patients with CHF.

J Am Coll Cardiol. 2001 Oct;38(4):1083-8.

Repeated thermal therapy improves impaired vascular endothelial function in patients with coronary risk factors.

Imamura M, Biro S, Kihara T, Yoshifuku S, Takasaki K, Otsuji Y, Minagoe S, Toyama Y, Tei C. First Department of Internal Medicine, Faculty of Medicine, Kagoshima University, Sakuragaoka, Kagoshima, Japan.

Abstract

OBJECTIVES: We sought to determine whether sauna therapy, a thermal vasodilation therapy, improves endothelial function in patients with coronary risk factors such as hypercholesterolemia, hypertension, diabetes mellitus and smoking.

BACKGROUND: Exposure to heat is widely used as a traditional therapy in many different cultures. We have recently found that repeated sauna therapy improves endothelial and cardiac function in patients with chronic heart failure.

METHODS: Twenty-five men with at least one coronary risk factor (risk group: 38 \pm 7 years) and 10 healthy men without coronary risk factors (control group: 35 \pm 8 years) were enrolled. Patients in the risk group were treated with a 60 degrees C far infrared-ray dry sauna bath for 15 min and then kept in a

bed covered with blankets for 30 min once a day for two weeks. To assess endothelial function, brachial artery diameter was measured at rest, during reactive hyperemia (flow-mediated endothelium-dependent dilation [%FMD]), again at rest and after sublingual nitroglycerin administration (endothelium-independent vasodilation [%NTG]) using high-resolution ultrasound.

RESULTS: The %FMD was significantly impaired in the risk group compared with the control group (4.0 +/- 1.7% vs. 8.2 +/- 2.7%, $p < 0.0001$), while %NTG was similar (18.7 +/- 4.2% vs. 20.4 +/- 5.1%). Two weeks of sauna therapy significantly improved %FMD in the risk group (4.0 +/- 1.7% to 5.8 +/- 1.3%, $p < 0.001$). In contrast, %NTG did not change after two weeks of sauna therapy (18.7 +/- 4.2% to 18.1 +/- 4.1%). **CONCLUSIONS:** Repeated sauna treatment improves impaired vascular endothelial function in the setting of coronary risk factors, suggesting a therapeutic role for sauna treatment in patients with risk factors for atherosclerosis.

Other Conditions

Am J Chin Med. 2009;37(2):215-26.

Effects of far infrared acupoint stimulation on autonomic activity and quality of life in hemodialysis patients.

Su LH, Wu KD, Lee LS, Wang H, Liu CF.

Nursing Department, National Taiwan University Hospital, Yun-Lin Branch, Yun-Lin County, Taiwan.

Abstract

Patients receiving regular hemodialysis sessions have been known to suffer from fatigue and depression. This experiment was designed to determine the effects of far infrared ray (FIR) stimulation on acupoints of patients suffering from renal failure who are receiving regular hemodialysis. Patients receiving long-term and regular hemodialysis who volunteered for this procedure were randomly selected to undergo either FIR or heat pad (HP) therapy to determine the impact of FIR treatment on these patients. Both the activities of the autonomic nervous system and changes in quality of life were measured before and after treatment to determine the effectiveness of the FIR treatment. Results from this study show that FIR therapy decreases both stress and fatigue levels of these patients. It also stimulates autonomic nervous system (ANS) activity in patients who are diagnosed with end-stage renal disease (ESRD) and are receiving regular hemodialysis (HD). Therefore, benefits of FIR stimulation on these patients are clearly demonstrated in this preliminary study.

Exp Biol Med (Maywood). 2003 Jun;228(6):724-9.

Promotive effects of far-infrared ray on full-thickness skin wound healing in rats.

Toyokawa H, Matsui Y, Uhara J, Tsuchiya H, Teshima S, Nakanishi H, Kwon AH, Azuma Y, Nagaoka T, Ogawa T, Kamiyama Y.

First Department of Surgery and Regeneration Research Center for Intractable Diseases, Kansai Medical University, Moriguchi City, Osaka, 570-8507, Japan.

Abstract

The biological effects of far-infrared ray (FIR) on whole organisms remain poorly understood. The aim of our study was to investigate not only the hyperthermic effect of the FIR irradiation, but also the biological

effects of FIR on wound healing. To evaluate the effect of FIR on a skin wound site, the speed of full-thickness skin wound healing was compared among groups with and without FIR using a rat model. We measured the skin wound area, skin blood flow, and skin temperature before and during FIR irradiation, and we performed histological inspection. Wound healing was significantly more rapid with than without FIR. Skin blood flow and skin temperature did not change significantly before or during FIR irradiation. Histological findings revealed greater collagen regeneration and infiltration of fibroblasts that expressed transforming growth factor-beta1 (TGF-beta1) in wounds in the FIR group than in the group without FIR. Stimulation of the secretion of TGF-beta1 or the activation of fibroblasts may be considered as a possible mechanisms for the promotive effect of FIR on wound healing independent of skin blood flow and skin temperature.

In Vivo. 2000 Mar-Apr;14(2):321-6.

Effects of far-infrared ray on reproduction, growth, behaviour and some physiological parameters in mice.

Udagawa Y, Nagasawa H.

Experimental Animal Research Laboratory, Meiji University, Kanagawa, Japan.

Abstract

The effects of chronic exposure to far-infrared ray (FIR) on reproduction, growth, behaviour, survival time and some related parameters were examined in SHN mice. The reproductive parameters differed slightly between the females on the normal racks and those on the FIR racks, which emitted FIR from the ceiling. The age and body weight on the day of vaginal opening was lower in the experimental mice born and maintained on the FIR rack than in the control on the normal rack. In both sexes, the levels of urinary components in the experimental group was significantly higher than the control at 6-7 months of age. Spontaneous motor activity of females during the light and dark phases were higher and lower, respectively, in the experimental group than the control. The survival rate was significantly higher in the experimental group than the control. These findings suggest that FIR has 'normalization effects' on the organisms.

Conf Proc IEEE Eng Med Biol Soc. 2007;2007:1479-82.

Clinical effects of far-infrared therapy in patients with allergic rhinitis.

Hu KH, Li WT.

Department of Biomedical Engineering, Chung-Yuan Christian University, Chung-Li, 32023 Taiwan, ROC.

Abstract

Allergic rhinitis (AR) is the sixth most common chronic illness worldwide, which has a significant impact on patients' quality of life. The actual cost of AR is staggering, approximately \$5.6 billion being spent annually in direct medical costs and other indirect costs. Therefore, it should be taken seriously upon its evaluation and treatment. AR is an IgE-mediated inflammation, which symptoms are likely due to increased vascular permeability. Current therapeutic options such as avoidance of allergen, medication and immunotherapy are unsatisfactory. Far-infrared (FIR) is an invisible electromagnetic wave with a wavelength longer than that of visible light. It has been used to treat vascular diseases as a result of an increase in blood flow. The objective of this study was to evaluate the clinical effects of FIR therapy in patients with AR. Thirty-one patients with AR were enrolled in this study. A WS TY101 FIR emitter was placed to face the patient's nasal region at a distance of 30 cm. The treatment was performed for 40 min every morning for 7 days. Every day, patients recorded their symptoms in a diary before and during treatment. Each symptom of rhinitis was rated on a 4-point scale (0-3) according to severity. During the

period of FIR therapy, the symptoms of eye itching, nasal itching, nasal stuffiness, rhinorrhea and sneezing were all significantly improved. Smell impairment was not improved until after the last treatment. No obvious adverse effect was observed in the patients during treatment and follow-up. We concluded that FIR therapy could improve the symptoms of AR and might serve as a novel treatment modality for AR.