idw - Informationsdienst Wissenschaft
Nachrichten, Termine, Experten

Pressemitteilung

Arbeitsgemeinschaft der Wissenschaftlichen Medizinischen Fachgesellschaften
Wolfgang Müller M.A., Prof. Dr. G. Hoffmann

23.07.2008
http://idw-online.de/de/news271814

Forschungsergebnisse, Wissenschaftliche Publikationen
Ernährung / Gesundheit / Pflege, Medizin
überregional

Water-filtered infrared-A (wIRA) can act as a penetration enhancer for topically applied substances - an alternative to an occlusive dressing

An irradiation with water-filtered infrared-A (wIRA) represents a contact free, easily applied alternative to an occlusive dressing for the improvement of the penetration of topically applied substances. Unlike other penetration increasing procedures (which are based e.g. on a mechanical or chemical alteration of the skin), an irradiation with wIRA maintains the integrity of the skin (including structure integrity), which is important for fulfilling protection functions, and shows good skin turgor and no signs of desiccation. Therefore wIRA has an immediate broad relevance for clinical application, e.g. for the therapeutic application in dermatology, internal medicine, orthopedics, rheumatology etc. As already a pure pre-irradiation with wIRA (without irradiation after application of the substance) improves penetration, wIRA can be used to improve penetration even of thermolabile substances.

Water-filtered infrared-A (wIRA) irradiation has already been shown to enhance penetration of clinically used topically applied substances in humans through investigation of functional effects of penetrated substances like vasoconstriction by cortisone.
A study of the Charité Berlin, just published on July 21st, 2008, in the interdisciplinary medical e-Journal "GMS German Medical Science" of the Association of the Scientific Medical Societies in Germany (AWMF) [1], investigated the influence of wIRA irradiation on the dermatopharmacokinetics of topically applied substances by use of optical methods, especially to localize penetrating substances, in a prospective randomised controlled study in humans.
The penetration profiles of the hydrophilic dye fluorescein and the lipophilic dye curcumin in separate standard water-in-oil emulsions were determined on the inner forearm of test persons by tape stripping in combination with spectroscopic measurements. Additionally, the penetration was investigated in vivo by laser scanning microscopy. Transepidermal water loss, hydration of the epidermis, and surface temperature were determined. Three different procedures (modes A, B, C) were used in a randomised order on three separate days of investigation in each of 12 test persons. In mode A, the two dyes were applied on different skin areas without water-filtered infrared-A (wIRA) irradiation. In mode B, the skin surface was irradiated with wIRA over 30 min before application of the two dyes (water-filtered spectrum: 590-1400 nm with dominant amount of wIRA). In mode C, the two dyes were applied and immediately afterwards the skin was irradiated with wIRA over 30 min. In all modes, tape stripping started 30 min after application of the formulations. Main variable of interest was the ratio of the amount of the dye in the deeper (second) 10% of the stratum corneum to the amount of the dye in the upper 10% of the stratum corneum.
The penetration profiles of the hydrophilic fluorescein showed in case of pretreatment or treatment with wIRA (modes B and C) an increased penetration depth compared to the non-irradiated skin (mode A): The ratio of the amount of the dye in the deeper (second) 10% of the stratum corneum to the amount of the dye in the upper 10% of the stratum corneum showed medians for mode A of 0.017, for mode B of 0.084, for mode C of 0.104 (significant difference between modes). In contrast to fluorescein, the lipophilic curcumin showed no differences in the penetration kinetics, in reference to whether the skin was irradiated with wIRA or not. These effects were confirmed by laser scanning microscopy.
Water-filtered infrared-A irradiation increased the hydration of the stratum corneum: transepidermal water loss rose from approximately 8.8 g m-2 h-1 before wIRA irradiation to 14.2 g m-2 h-1 after wIRA irradiation and skin hydration rose from 67 to 87 relative units. Skin surface temperature increased from 32.8°C before wIRA to 36.4°C after wIRA

irradiation.
The better penetration of the hydrophilic dye fluorescein after or during skin irradiation (modes B and C) can be explained by increased hydration of the stratum corneum by irradiation with wIRA.
As most topically applied substances for the treatment of patients are mainly hydrophilic, wIRA can be used to improve the penetration of substances before or after application of substances, in the first case even of thermolabile substances. wIRA therefore has broad clinical relevance as a contact free alternative to an occlusive dressing, e.g. to improve the penetration and effect of topically applied cortisone in psoriasis or neurodermitis, of acyclovir in herpes zoster or herpes labialis, or of an acne therapeutic in acne papulopustulosa.

Water-filtered infrared-A (wIRA) as a special form of heat radiation (within 780-1400 nm) mainly consists of radiation with good penetration properties into tissue and therefore allows - compared to unfiltered heat radiation - a multiple energy transfer into tissue without irritating the skin, similar to the sun's heat radiation in moderate climatic zones. wIRA increases temperature, oxygen partial pressure, and perfusion in the tissue. In addition wIRA has non-thermal and non-thermic effects, which are based on putting direct stimuli on cells and cellular structures. wIRA can considerably alleviate pain and diminish elevated exudation and inflammation. wIRA can also show positive immunomodulatory effects.
Extended clinical observation over months and years shows that skin, which is irradiated daily with wIRA, presents an improved appearance with good skin turgor and no signs of desiccation.
Recent publications of the last months concerning wIRA give an overview about clinical applications in general [2] and about principles and working mechanisms of wIRA and the therapy of wounds [3], [4], [5], [6]. The handbook Wallhäußer's practice of sterilization, disinfection, antisepsis and conservation [7], which has just been published, includes as well a section about wIRA.

Publications:
[1] Otberg N, Grone D, Meyer L, Schanzer S, Hoffmann G, Ackermann H, Sterry W, Lademann J. Water-filtered infrared-A (wIRA) can act as a penetration enhancer for topically applied substances. Wassergefiltertes Infrarot A (wIRA) kann als Penetrationsverstärker für topisch aufgetragene Substanzen wirken. GMS Ger Med Sci. 2008; 6:Doc08.
Online available from: www.egms.de/en/gms/2008-6/000053.shtml (shtml) and www.egms.de/pdf/gms/2008-6/000053.pdf (PDF).
[2] Hoffmann G. Klinische Anwendungen von wassergefiltertem Infrarot A (wIRA) [Clinical applications of water-filtered infrared-A (wIRA)]. In: Kaase H, Serick F, eds. Sechstes Symposium "Licht und Gesundheit" [Sixth symposium "Light and health"]. Eine Sondertagung der Technischen Universität Berlin und der Deutschen Gesellschaft für Photobiologie mit der Deutschen Akademie für Photobiologie und Phototechnologie und der Deutschen Lichttechnischen Gesellschaft, Berlin, 13./14.03.2008. Berlin; 2008. pp. 130-146. ISBN: 3-9807635-0-3.
As well online available from: publikationen.ub.uni-frankfurt.de/volltexte/2008/5484/ (including German summary and English abstract)
[3] Hoffmann G. Principles and working mechanisms of water-filtered infrared-A (wIRA) in relation to wound healing [review]. Grundlagen und Wirkprinzipien von wassergefiltertem Infrarot A (wIRA) in Bezug zur Wundheilung [Übersichtsarbeit]. GMS Krankenhaushyg Interdiszip. 2007;2(2):Doc54.
Online available from: www.egms.de/pdf/journals/dgkh/2007-2/dgkh000087.pdf (PDF) and www.egms.de/en/journals/dgkh/2007-2/dgkh000087.shtml (shtml).
[4] Hartel M, Illing P, Mercer JB, Lademann J, Daeschlein G, Hoffmann G. Therapy of acute wounds with water-filtered infrared-A (wIRA) [review]. Therapie akuter Wunden mit wassergefiltertem Infrarot A (wIRA) [Übersichtsarbeit]. GMS Krankenhaushyg Interdiszip. 2007;2(2):Doc53.
Online available from: www.egms.de/pdf/journals/dgkh/2007-2/dgkh000086.pdf (PDF) and www.egms.de/en/journals/dgkh/2007-2/dgkh000086.shtml (shtml).
[5] von Felbert V, Schumann H, Mercer JB, Strasser W, Daeschlein G, Hoffmann G. Therapy of chronic wounds with water-filtered infrared-A (wIRA) [review]. Therapie chronischer Wunden mit wassergefiltertem Infrarot A (wIRA) [Übersichtsarbeit]. GMS Krankenhaushyg Interdiszip. 2007;2(2):Doc52.
Online available from: www.egms.de/pdf/journals/dgkh/2008-2/dgkh000085.pdf (PDF) and www.egms.de/en/journals/dgkh/2008-2/dgkh000085.shtml (shtml).

[6] Hoffmann G. Wassergefiltertes Infrarot A (wIRA) zur Verbesserung der Wundheilung bei akuten und chronischen Wunden. Water-filtered infrared-A (wIRA) for the improvement of wound healing of acute and chronic wounds. Wundmanagement 2008;2:72-80.
As well online available from: publikationen.ub.uni-frankfurt.de/volltexte/2008/5429/
[7] Hoffmann G. Wassergefiltertes Infrarot A (wIRA) [Water-filtered infrared-A (wIRA)]. In: Kramer A, Assadian O, eds. Wallhäußers Praxis der Sterilisation, Desinfektion, Antiseptik und Konservierung. Qualitätssicherung der Hygiene in Industrie, Pharmazie und Medizin. [Wallhäußer's practice of sterilization, disinfection, antisepsis, and conservation. Quality assurance of the hygiene in industry, pharmacy, and medicine]. Stuttgart: Thieme; 2008. pp. 899-900. ISBN: 978-3-13-141121-1.