Locally recurrent breast cancer after previous radiotherapy is a challenging clinical situation since initial RT considerably limits the level of re-irradiation (re-RT). Under these conditions, the combination with superficial hyperthermia (sHT) offers the possibility of achieving local control even with lower RT doses as recently shown by Notter et al. (IHJ, 2016). In this retrospective study, 73 patients with large-area, locally recurrent breast cancer (46 patients with lymphangiosis included) were treated with combined hypo-fractionated, low-dose re-RT (4 Gy 1x/week up to a total dose of 20 Gy), delivered 1-4 min after thermography-controlled water-filtered infrared A hyperthermia (wIRA-HT). Response rates in patients with macroscopic disease were 61% CR and 33% PR.

In this study, good local control of heavily pretreated, large-area breast cancer recurrences is based on a sufficiently homogeneous and most compliant heat deposition with therapeutically relevant temperatures of 39.6-40.1°C in a depth of 20 mm (invasive temperature monitoring at maximum skin temperatures of 42-43°C), the maximum radiative penetration depth of wIRA being 5 mm (10% of incident irradiance). Due to conduction, convection, and MIE-scattering (i.e., "forward scattering"), the primary absorbed radiation energy is dissipated within the target volume. Thus, under steady conditions, the ultimately heated tissue volume (with treatment temperatures reached within 2-4 min) is much larger than the original column of absorption. Irradiances up to 150-200 mW/cm² were applied without generation of heat pain and thus limited patient compliance. In contrast, conventional, unfiltered NIR only allows irradiances <100 mW/cm² and short exposure times.

The clinical wIRA/sHT-setting (hydrosun 750) used offers a series of advantages over other techniques currently used in clinical oncology. These include: contact-free heating (e.g. of ulcerated, bleeding tumors) and treatment of irregularly shaped, widespread lesions. No patchwork technique is required for larger sizes (diameter of treatment field is 23-26 cm per applicator with approx. 7% inhomogeneity of irradiance, circular field area = 420-530 cm²). Adaptation to larger areas can be achieved by a twin-applicator system. wIRA is independent of individual body contours. While thermal dosimetry for HT is generally performed with fiberoptic probes that sample only a small number of fixed locations, in the system applied real-time thermography is used which measures large surface temperature distributions allowing for the observation of dynamic developments during sHT sessions. Thermography also enables the instant and easily achievable protection of heat-sensitive tissue structures (e.g. scars) and can thus avoid hot spots and grade 2-4 toxicities. Because of low toxicity with this treatment schedule, wIRA-RT can be used for re-reRT-settings (e.g. in 17 patients in our study).

Limitations for wIRA-HT are diffuse, large-sized tumor lesions with depth extensions >20 mm. wIRA-HT is not recommended for nodular tumors with depth extensions >20 mm.

wIRA-sHT/re-RT is ready to be prospectively tested against standard schedules.