

High frequency HIFU: a new modality for treatment of skin cancer and other dermatological indications

Tomasz Zawada *, Torsten Bove

TOOsonix A/S, Hoersholm, Denmark

* tomasz.zawada@toosonix.com

Abstract

Recently, a new modality for dermatological intervention using strongly focused 20 MHz transducers with an integrated optical imaging [1] for treatment of several indications in human skin has been demonstrated [2]. The shape and size of the focal zone pre-defined by the wavelength and the design of the acoustic source are the key parameters. In case of dermatological intervention, it is preferable to operate at high frequencies above 12 MHz with a focused acoustic source of F-number smaller than 1. The integrated optical imaging system allows for a real-time observation of the surface of the skin, which is the major advantage of the presented method. The method has been already proven to be effective in treatment of several non-medical, as well as medical skin conditions including skin cancer [3].

Theoretical foundations of the high frequency HIFU will be presented along with examples of acoustic field distributions generated by strongly focused transducers. Moreover, pre-clinical results including HIFU lesioning in a tissue mimicking phantom and safety tests results in minipigs will be shown, as well [4]. To this day many successful treatments of human skin have been performed and examples of treatments of selected indications will be presented including treatment of actinic keratosis, basal cell carcinoma, as well as less severe conditions such as viral warts, vascular malformations and seborrheic keratosis [5], [6]. It will be shown that dermatology is yet another field where high intensity focused ultrasound can be successfully applied for the benefit of patients.

References

- [1] T. Zawada and T. Bove, "Strongly Focused HIFU Transducers With Simultaneous Optical Observation for Treatment of Skin at 20 MHz," *Ultrasound in Medicine & Biology*, vol. 48, no. 7, pp. 1309–1327, Jul. 2022, doi: 10.1016/j.ultrasmedbio.2022.03.002.
- [2] T. Bove, T. Zawada, J. Serup, A. Jessen, and M. Poli, "High-frequency (20-MHz) high-intensity focused ultrasound (HIFU) system for dermal intervention: Preclinical evaluation in skin equivalents," *Skin Res Technol*, vol. 25, no. 2, pp. 217–228, Mar. 2019, doi: 10.1111/srt.12661.
- [3] J. Serup, T. Bove, T. Zawada, A. Jessen, and M. Poli, "High-frequency (20 MHz) high-intensity focused ultrasound: New Treatment of actinic keratosis, basal cell carcinoma, and Kaposi sarcoma. An open-label exploratory study," *Skin Res Technol*, vol. 26, no. 6, pp. 824–831, Nov. 2020, doi: 10.1111/srt.12883.
- [4] S. Soegaard *et al.*, "High-frequency (20 MHz) high-intensity focused ultrasound system for dermal intervention: A 12-week local tolerance study in minipigs," *Skin Res Technol*, vol. 26, no. 2, pp. 241–254, Mar. 2020, doi: 10.1111/srt.12786.
- [5] J. Calik, T. Zawada, and T. Bove, "Treatment of superficial benign vascular tumors by high intensity focused ultrasound: Observations in two illustrative cases," *J Cosmet Dermatol*, Dec. 2021, doi: 10.1111/jocd.14682.
- [6] J. Calik, M. Migdal, T. Zawada, and T. Bove, "Treatment of Seborrheic Keratosis by High Frequency Focused Ultrasound - An Early Experience with 11 Consecutive Cases," *Clin Cosmet Investig Dermatol*, vol. 15, pp. 145–156, 2022, doi: 10.2147/CCID.S348106.

