Grenz rays: an alternative treatment for superficial skin cancers in elderly patients

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Grenz rays are electromagnetic waves (i.e., x-rays of very low energy and situated in the electromagnetic spectrum between UV and x-rays). This kind of x-ray is suitable for very superficial processes in the skin. This means that lesions up to a thickness of 1 mm can be irradiated. For these reasons, chronic dermatoses, precancerous lesions or superficial skin cancers can be treated. Since the introduction of this very superficial and low-energy treatment modality, Grenz rays have shown no serious side effects. Good indications for a Grenz ray treatment are psoriasis of the scalp and of the nails, chronic eczemas, disseminated superficial actinic porokeratosis, Bowen's disease, Paget's disease, lentigo maligna, superficial basal cell carcinoma or squamous cell carcinoma. The only side effects are slight hypo-/hyper-pigmentation of the skin and it has to be noticed that there is no hair loss after Grenz ray treatment, and no side effects to deeper situated structures.

Grenz rays are electromagnetic waves lying in the spectrum between UV and x-rays. The x-rays were discovered by Wilhelm C Roentgen in 1885, but in 1910, Schultz described the very soft x-rays and Bucky called them low-energy x-rays in 1923. In his honor, these rays are sometimes called 'Bucky rays'. Since these rays are lie at the border zone between UV and x-rays, and as the German translation of border is 'Grenze', these rays were also called 'grenz rays'. Another denomination is ultrasoft x-rays. These Grenz rays are produced by machines operating mainly between 8 and 20 kV. Some x-ray machines deliver soft x-rays, including Grenz rays. Nowadays, machines operate with a spectrum going from 10 to 100 kV or 150 kV. There are only few manufacturers producing only Grenzray machines. Grenz rays have a half-value depth, in other words a 50% isodose, in the range of 0.5 to 1.0 mm. This means that dermatoses or tumorous lesions of up to 1 mm thickness, especially the epidermal and upper dermal layers, can be treated with these x-rays [1-3].

Benign skin diseases

Among the benign skin diseases, psoriasis and chronic eczemas should be mentioned [1,4], as well as disseminated superficial actinic porokeratosis [5]. For these benign dermatoses, several treatment options are available, but since they are often chronic and recalcitrant, a second- or third-line treatment option with radiation therapy is welcome [6]. Among psoriasis, we know that the psoriasis of the scalp and of the nails are especially difficult to treat and we want to stress that for these lesions, treatment series of 2 Gy six times is helpful. The same treatment schedule can be used for chronic eczemas of the hands, especially in patients who were metalworkers and have chronic professional eczema. The advantage of Grenz rays is that a second or even a third treatment series can be applied, which is not possible if we use higher x-ray energies (>20 kV, orthovoltage treatment). Finally, the disseminated superficial actinic porokeratosis, often not responding to topical treatments, will respond to this treatment.

In summary, the main indications among benign skin diseases treated with Grenz rays are psoriasis and eczemas.

Malignant skin diseases

Regarding indications for malignant skin diseases, extensive actinic keratoses should be mentioned, especially over the scalp or over the forearms, which respond well to a treatment of 4 Gy six times. In theses cases, erythematous reactions, towards the end of treatment, have to be considered and the patients must be informed before the treatment starts. Using the same method, Bowen's disease of the genital area can be treated with good success. Similarly, extramammary Paget's disease responds to this treatment [7]. Here we have to look for underlying carcinomas that are seldomly found. The excellent cosmetic result for lentigo malignas among elderly patients should be stressed [8]. In this case, the treatment schedule is a little bit different: we use higher single doses, that is 10 Gy 10–12 times (twice per week) or 20 Gy 5-6 times (once per week), depending on the diameter of the lesion, with the latter used for smaller lesions (up to 2.5 cm). Here again, the skin shows a heavy reaction at the end of the treatment, but there is

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a good regression after several weeks. Since the half-value depth is 1 mm in atrophic older skin, the atypical melanocyte can be reached even if located in the hair follicles. Superficial basal cell carcinomas or superficial squamous cell carcinomas may also be treated with 6 Gy 12 times, twice per week [9]. On the other hand, one must be aware of possible deeper infiltration of skin cancers. In particular, squamous cell cancer may present a much deeper infiltration depending on their diameter and localization and the possible extension along hair follicles, nerves and so on. In these cases, orthovoltage radiotherapy can be the choice of energy in order to avoid underdosage of the lesion and an in-field recurrence. The advantage of Grenz rays is that we are able to repeat the treatment series if necessary since we observe only few long-term side effects, such as hyper- or hypo-pigmentation. There is no alopecia after treatment, and tumor development in the radiation field is only rarely observed [3]. This only happens if the lifetime total dose is over 100 Gy, if fractionated doses are not used, if the minimum interval between series is not at least 6 months and if doses are not adapted to the surface area [3].

Conclusion

Disseminated actinic keratoses, Bowen's disease and lentigo maligna are ideal indications for Grenz ray treatment.

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In conclusion, Grenz ray therapy is a simple, affordable, painless and effective option to manage several refractory benign dermatoses and superficial tumors, and is a safe treatment modality if administrated according to the guidelines recommended. In combination with orthovoltage radiotherapy, Grenz ray therapy is the ideal choice in dermatological radiotherapy.

Future perspective

Since the general population is getting older and older, we expect an increase of chronic benign dermatoses as well as skin tumors. Therefore, we imagine that elderly patients will easily accept an x-ray treatment. Grenz ray therapy is an excellent modality, especially if diagnosed early. The only condition is that the manufacturers include Grenz ray quality in their superficial or orthovoltage machines. In addition, more clinical trials with this therapy are needed.

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