

Skin care during radiotherapy - soothing, vitalizing and protecting

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Cancer therapies usually involve quite negative side effects and radiotherapy affects the skin in both ways: from the outside when it was used as a passageway for radiation and from the inside when the skin reacts to scattered radiation. How can skin care measures contribute to minimize the negative effects of the therapy? What kind of preventive measures are available?

Besides the targeted malignant tissue, radiotherapy also has detrimental effects on the skin. Although tumor cells react more sensitive to radiation, a damage of healthy skin cells can hardly be avoided.

Reactions of the skin

Reactions involve a delayed formation of basal cells as well as reversible and irreversible damage of the DNA depending on the radiation dose. The natural collagen degrading matrix metallo-proteinases are stimulated corresponding to the dose of radiation which may cause atrophic skin symptoms. Also actinic skin damages may develop. The sebum secretion is reduced and the skin barrier severely disturbed. Visible aftereffects are dry skin due to an increased transepidermal water loss (TEWL) and reddened skin (erythema) similar to sun burn symptoms. The irritations combined with the forming erythema may be rather intense. In this context we also speak of radio dermatitis. Due to the increased cell proliferation following the radiation damage the skin starts to desquamate which means that the uppermost barrier layers of the stratum corneum are shed. High radiation doses and consequently rather intense damages of the basal layer lead to a moist desquamation of the barrier layer that may even result in necrotic skin manifestations and oedema. Simultaneously the enzyme tyrosinase may be stimulated which causes a darkening of the skin due to the increased melanin formation. Radiation may also damage the hair follicle cells - with the consequence of hair loss and a reduced function of the sweat glands.

Immediate reaction: erythema

The radiotherapy dose is indicated in **Gy** in honor of the British physicist Louis Harold Gray. The energy dose of **1 Gy corresponds to 1 Joule (J) per kg**. Whereas even low doses of up to 20 Gy result in radiation-related skin modifications similar to light **sunburn**, high

doses of more than 50 Gy usually will cause **erythema**. The radiation dose depends on the specific type of tumor, its sensitivity to radiation and how deep in the body it is located.

Erythema belongs to the immediate reactions which develop after two to three weeks of treatment. Late reactions like vasodilatation, telangiectases, pigmentation marks and atrophic skin may appear even years after the treatment. Three different factors influence the intensity of the side effects

- overall radiation dose
- specific focus of the radiation source
- intervals between the single doses.

The basic idea behind the application of several single doses is to damage the tumor cells during their different growth cycles. If the tumor growth cycles largely correspond with the skin recovery cycles the damage to the skin is more intense. Not only the radiation entrance zones are relevant as to skin reactions but also the exit zones and the surrounding skin areas (scattered radiation). It goes without saying that additional strain due to exposure to UV radiation should be avoided during radiotherapy. If such exposure is indispensable, the skin should at least be protected with sun screens with high sun protection factor.

Irritations, soreness, itching

Typical incident after ultra-high energy radiation is the formation of radicals in the skin. In this respect radioactive radiation and UV radiation of the sun have the same effects with the only difference that the radiation will enter deeper into the tissue and the visible effect will occur later. Among others high-energy oxygen radicals and peroxy-nitrite are formed. Consequences here are inflammations of the skin whereas the extent of the irritations may vary depending on the different skin zones similar to sunburn reactions. The neck area for instance

shows rather severe reactions. The inflammation may be accompanied by soreness and itching. Radicals are partly scavenged by amino acids (NMF) but also by hyaluronic acid which is important for the turgor in the skin. Hyaluronic acid occurs in the extracellular matrix and will be degraded in this process. This also is responsible for the above mentioned atrophic skin condition.

Consequently, NMF and hyaluronic acid are rather important agents for a conditioning skin care preceding the radiotherapy.

Adequate skin care

Active agents • If the skin barrier shows severe damages the risk of infections runs parallel to the increasing transepidermal water loss as the involuntary opening of the skin barrier is not only a one way street. While the vapor moves from the interior to the outside, also germs enter from the outside into the skin. If on top of that the skin starts to crack it is recommended to use skin care products with astringent agents as a first aid measure. Hamamelis extract, tannic acid containing tea and pure tannin products belong to this group of agents. Open sores of course are strictly taboo for skin care treatments.

Skin cleansing • Substances with irritating potential may be another problem. That is the reason why cleansing products with aggressive tensides like e.g. lauryl sulfate, laurylether sulfate etc. should be avoided if possible. It is adequate to cleanse the skin with lukewarm water. Alternatively low foaming cleansing products as e.g. sugar tensides are available for this purpose. In the past physicians even interdicted patients to clean the radiotherapy treated areas at all. In order to avoid swellings though showers should be pared down to an absolute minimum. Low concentrated conventional soaps with a high content of free palmitic or stearic acid can also be helpful. As to the physiological aspects these acids and their salts are unproblematic, they provide a rather favorable pH value and have also been successfully used on atopic skin. A short bath with chamomile extract has soothing effects.

Another source for irritations may be wet shaving using shaving soap. It is hence recommended to switch to dry shaving if the hair growth in the radiotherapy treated zone has not already been considerably disturbed. Instead of concentrated alcohol containing after-shave lotions a CM glucan containing gel can be used in order to soothe the skin and inhibit inflammations.

Additives • Perfume containing skin care pro-

ducts should be avoided at all because of the sensitizing potential. This also applies for preservatives which may penetrate into deeper skin layers. Emulsifiers derived from polyethylene glycol still are hardly known as irritating substances in skin care products. In high-energy radiation and in presence of atmospheric oxygen they may develop inflammatory reactive substances. In this respect a check of the INCI list is indispensable. Regarding skin care products it should always be paid attention to the fact that emulsifiers are degradable in the skin and will not be an additional strain for the integrity of the skin barrier. Recommended here are emulsifier free products and specifically vegetable oils although their application is not really appreciated.

Skin care gels • Vegetable oils in form of oleogels however can be applied like creams. In contrast to traditional vaseline products these oleogels have the positive effect of abundantly greasing the skin combined with excellent penetrating features. The described features are comparable to the care of atopic skin with the same symptoms like barrier disorders and dehydration. Also this specific skin disease implies to avoid mechanical irritations like e.g. tight clothing.

Gels with alginates, hyaluronic acid, CM glucan, aloe vera, D-panthenol and amino acids (NMF) are appropriate moisturizers in this context. They correspond with Professor Kligman's corneotherapeutic theory which is based on the idea that skin hydration is the most significant prerequisite for a healthy skin. With the appropriate formulation gels are also able to integrate lipid substances in form of vegetable oils. The metabolites of the essential omega-6 and omega-3 fatty acids are formed in the skin and have anti-inflammatory effects.

Phosphatidylcholine • First practical experiences using combinations of DMS base creams with linseed nanoparticles during radiotherapy also seem very promising. For the adjuvant treatment in cases of actinic keratoses also nanoparticles with boswellia resin showed successful. For the therapy of radiotherapy damaged skin nanoparticles are less interesting as to their size which on average amounts to somewhere between 50 to 150 nm but rather more because of their phosphatidylcholine content which allows the fusion with the barrier layer similar to liposomal products. Furthermore phosphatidylcholine (PC) has a cell protective effect against γ -radiation. PC liposomes have recovering effects for skin damages caused by γ - as well as UV-radiation and hence are also successfully used in after sun products for the treatment of sun induced erythema.

Water soluble PC oil compounds may be successfully used for skin cleansing purposes with simultaneous skin care effects. These products however are rather expensive compared to traditional skin cleansing products which is quite a disadvantage. In this context though the excellent characteristics of these products have to be taken into account.

Powders & Co. • The formerly highly appraised powders only make sense if they are free of dehydrating effects as e.g. specific powders with urea content. They additionally have anti-itching properties.

As far as decorative products are used after consulting the responsible radiotherapist the products are submitted to the same criteria as skin care products i. e. as less additives as pos-

sible and no substances that influence the natural skin recovery process. In other words, covering mineral oils and mineral waxes should be avoided.

In how far particular skin care products can be applied in which specific case depends on the individual situation and can only be decided in consultation with the therapist. A very important prerequisite for a quick recovery of the skin is taking care for the best possible skin condition before beginning the treatment. That is the reason why already weeks before the scheduled radiotherapy specific skin protecting measures should be started. For the shaky self-esteem of the patients it is important to keep skin damages at a minimum.

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