

SHORT REPORTS

Transmission of 12 kV Grenz rays and 29 kV X-rays through Normal and Diseased Nails

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The discussion of the relationship between treatment dosage and therapeutic effect does not, however, take the variation in thickness between different nails into consideration, although the energy absorption in nails must influence the treatment schedule. Since this problem has not been evaluated previously, we have measured transmission through different nail types to obtain results which might be used as a guide to further nailbed treatment.

MATERIAL

Abstract. Bucky and X-rays are used in the treatment of nailbed diseases. Transmission through normal and diseased nails has been measured. Nails of normal thickness transmit about 30% of Bucky rays and about 85% of X-rays. Bucky rays cannot be used when the diseased nails are thickened, whereas 60% of X-rays are transmitted.

Key words: Bucky rays; X-rays; Transmission through nails

The material comprised 37 healthy nails and 13 diseased nails with abnormal thickness and subungual hyperkeratoses. The normal nails were obtained at the emergency ward, where they had been removed from patients with various traumatic lesions of the fingers without involvement of the nails. The abnormal nails were removed due to established or suspected severe fungus infection.

METHOD

Various therapeutic principles are used in the treatment of nail diseases, but the results are usually unpredictable and not always successful.

X-ray and Grenz-ray therapy has been widely used, either alone, or in combination with topical medicaments, especially in the treatment of psoriatic nails (1, 2). The irradiation is usually given at weekly intervals, but there is some disagreement regarding the optimal dose.

The radiation was produced by a Siemens Dermopan unit with a Beryllium window. Radiation factors: Grenz-rays: 12 kV; HVL: 0.27 mm cello. O-Filter. X-rays: 29 kV, 0.3 mm Al-filter; HVL: 2.2 mm cello.

The measurements were performed with a thin-window ionization chamber with a diameter of 8 mm and a height of 6 mm in combination with a Baldwin-Farmer substandard dosimeter. The ionization chamber was placed 20 cm distant from the focal spot. A reference value exposure time of both Grenz-rays as well as X-rays was determined without intervening nails.

Table 1. Nail thickness and transmission of 12 kV Grenz-rays and 29 kV X-rays

The figures given are means and (ranges)

	Normal fingernails		Diseased nails
	Children (n=4)	Adults (n=32)	Adults (n=13)
Thickness in mm	0.36 (0.22-0.42)	0.54-(0.36-0.88)	2.28 (0.92-3.90)
Transmission of Bucky rays, 12 kV	36% (28-50)	25% (12-52)	7% (2-17)
Transmission of X-rays	86% (82-91)	80% (69-87)	58% (45-76)

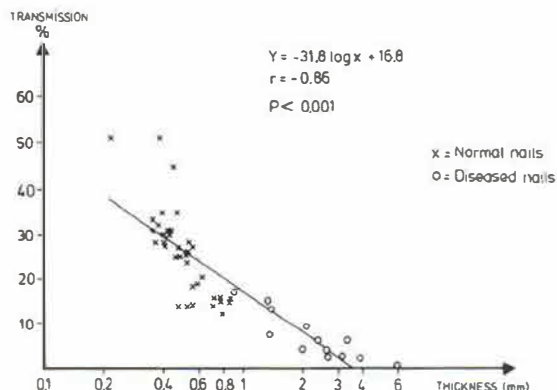


Fig. 1. Transmission percentage of 12 kV Bucky rays through nails with the thickness as given on the abscissa.

Thereafter a nail was placed in the ionization chamber and the exposure time for the corresponding radiation dose was determined (3). The measurements were performed with both Grenz-rays and X-rays and each value presented is an average of two measurements. As the output of the X-ray unit was kept constant during the measurements, the transmission could be determined as the ratio between the exposure times at the two measurements.

$$\text{i.e. transmission} = \frac{\text{ref. value (minutes)} \times 100}{\text{time (minutes) with nail}}$$

Nail appearance and prior localization were registered. The thickness of the nail was measured twice with a screw micrometer. The mean value was used and for statistical purposes, linear regression analysis was used.

RESULTS

The thicknesses of normal and diseased nails are shown in Table I together with the transmission of 12 kV Grenz-rays and 29 kV X-rays through the nails.

The relation between nail thickness and transmission of 12 kV Grenz-rays is seen in Fig. 1. There

Table II. Rads to be given to the nail if the nail bed is to receive 100 rads

	Normal fingernails		Diseased nails Adults
	Children	Adults	
Bucky, 12 kV	275	400	1 400 ^a
X-ray, 29 kV	100	125	175

^a This dose is so high that it will damage the skin around the nail if it is not properly protected.

is a very high degree of correlation ($r=0.86$, $p<0.001$) between log thickness and transmission.

DISCUSSION

In clinical practice it is obvious that measurements of nail thickness cannot be made. Therefore the results have been transformed into a simple scheme which we believe can be of some practical value (Table II). It can be seen from this that in the treatment of thick nails (1–4 mm) a sufficient radiation dose cannot be given with Bucky rays without risk of skin damage, and this implies that Bucky rays should only be applied to nails of normal thickness (<0.9 mm), i.e. all normal nails except some big toe nails. X-rays 29 kV, however, can be used in the treatment of normal as well as pathologically thickened nails.

With the doses as given in Table II the greatest therapeutic effect is obtained with the least risk of side effects.

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Normal Function of the Thyroid Gland in PUVA-Treated Psoriatics

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Abstract. Ten psoriatics who were started on therapy with psoralen plus long-wave ultraviolet radiation (PUVA) were investigated for a possible influence of the treatment on the thyroid gland function. No statistically significant changes were found in the levels of serum thyroxine, triiodothyronine or thyrotropin obtained after 2 and 4 weeks' therapy and 3 months after cessation of therapy.

Key words: Psoriasis; Photochemotherapy; PUVA; Thyroid gland