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T h e s i s    o n

THE TREATMENT OF RINGWORM, SYCOSIS AND

ALOPECIA AREATA.

by

THE X RAYS.

by

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M.A., M.B., C.M.



## HISTORICAL.

Soon after the discovery of the X-Rays, and their employment in medicine for diagnostic purposes, another discovery was made.

It was found that the rays affected the human skin, causing a dermatitis, which was delayed in its appearance, and varied in severity, according generally to the length of exposure, from a slight transitory redness of the part to deep ulceration and sloughing.

This discovery naturally led to experiments with the rays both in man and in animals.

Freund in 1897 was the first to use the X-rays as a remedial agent, and he was soon followed by a host of others, whose names are familiar to every student of radio-therapy, but probably none more so than those of Holzkecht, Kienbock, Sabomand, and McIntyre.

Naturally for many years the method of applying the rays was empirical. The distance of the X ray tube from the patient varied; the duration of the sittings were sometimes long, sometimes short, and were repeated at intervals which varied with the fancy of the operator, nor was there any satisfactory means of ascertaining the dose of X rays received.

No satisfactory progress was possible under such conditions. Successful cases were published, but the details given were of such a nature as to render them/

them practically worthless as a guide to others, and probably also to the author himself.

DOSE  
MEASUREMENT

In short it became obvious that in X ray treatment, "the dose" was as important as in treatment by drugs.

It is unnecessary for my purpose to give a detailed description of the various ways and means adopted to over-come this difficulty: how the current through the primary of the coil was noted, the equivalent spark gap measured, the current passing through the tube registered, and the penetration power of the rays themselves by ingenious instruments ascertained, factors all no doubt valuable in their way, but quite unreliable as determining the dose given. "For", as J. Wetterer, Handbuch der Röntgen Therapy, page 115, remarks, "in the Rontgen Tube we have no constant source of X rays, but a variable one, from which the intensity of the rays emitted undergoes great fluctuations. The amount of Rontgen Rays sent out by a tube is different, according to the degree of hardness of the tube, the strength of the secondary current from the coil, and the number of interruptions in the primary circuit." - therein, therefore, lay the difficulty. The Rontgen Tube was an inconstant source of X rays. All methods of measuring the output of X rays from the tube from behind had practically failed, and from the front, that of measuring the penetration power of the rays was no guage of quantity. Nor likewise was time to/

to be taken as a measure as in the earlier stages it was, because with such a variable source as the X ray tube is, time cannot be relied upon.

Obviously the problem of dose gradually reduced itself to finding a means of measuring the rays in front of the tube, and to Holzkecht belongs the credit of first devising such an instrument.

" In the year 1902 Holzkecht devised his Chromoradiometer, and at a bound raised radiotherapy from the condition of "rule of thumb" to that of a scientific method. " \*

The apparatus of Holzkecht consisted of a series of re-agents and a graduated scale of colours. The reagent was placed near the part to be irradiated. The tint changed gradually according to the amount of X rays received. A comparison with the graduated scale of colours enabled the physician to ascertain and record the dose given. This apparatus is as far as I know not in use in this country. It is expensive and difficult to obtain.

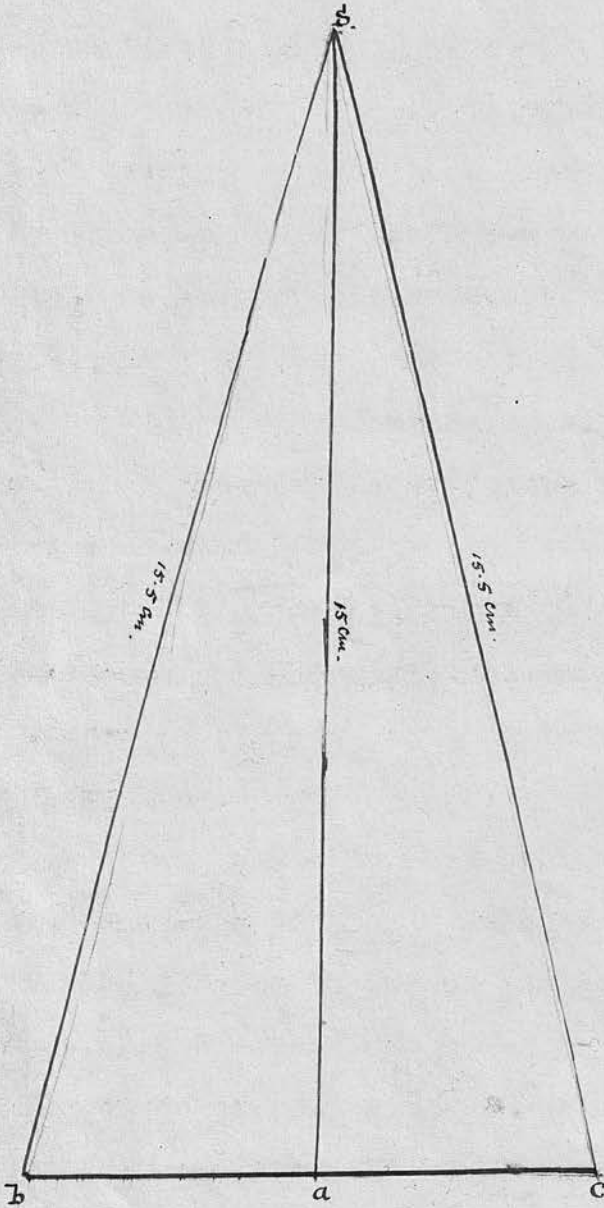
The Chromoradiometer (Radiometer X) of Sabouraud and Noire followed in 1904, and is the one in general use in France and this country. It is the measure of dose I have used in my own practice for the past two years, and I therefore give shortly its essential details.

The Radiometer X consists of a small pocket book containing 24 citron or greenish yellow discs, and two squares labelled A. and B. which are the standard tints for comparison.

*J. Wetters loc. Cit. p. 121.*

HOLZKNECHT'S  
CHROMORADIO-  
METER.

THE CHROMO-  
RADIOMETER OF  
SABOURAUD AND  
NOIRE.



S. = Source of Ray (Tube Target).  
b c flat surface to be rayed 7.5 cm. diameter.  
S a = 15 cm. in length S b, S c = respectively 15.5 cm.

Tint A corresponds to the original colour of the Pastille, tint B (a brownish or deep ochre colour) gives the maximum dose which is required for the depilation (falling out) of hairs without a resulting dermatitis. Greater or lesser doses are to be judged approximately by the tint deeper or less than B. The disc is held in a receiver midway between the part to be rayed and the target or Anode of the tube. The disc is examined from time to time during the sitting, and when the desired colouration has taken place the irradiation is stopped.

DISTANCE OF  
PART TO BE  
RAYED FROM  
TUBE.

The relative distance between the part to be rayed, pastille, and target of tube must always be carefully maintained. And this leads to the question: what is the most suitable distance? The answer depends upon the area of the part to be rayed. In order to obtain uniformity of result all the surface to be irradiated must receive a like or closely approximately like dose. But the X rays act on a part inversely as the square of the distance between source of rays and part, and they are divergent. Consequently the centre of a flat patch is nearer the point of emergence of the rays than the periphery. Therefore at the edges of a patch that has been irradiated, we find that the reaction is weaker than at the centre.

This condition has been represented diagrammatically on opposite page. It is obvious that the peripheral rays have a longer path to traverse, and that the reaction/

reaction they produce must be weaker than that effected by those rays nearer the centre. The obvious bearing of this law on surfaces which are not flat need not be insisted upon. In short the points to be borne in mind are:

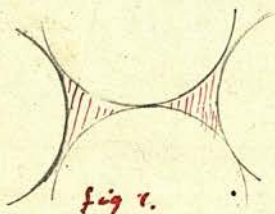
(1) the nearer the centre of emission of the rays a point is, the greater will be the reaction produced,

(2) the farther off the less the reaction, the variation being inversely as the square of the distance. A perpendicular ray falling upon a point thus produces the greatest reaction. All other rays decrease in effect as their angle of incidence varies from  $90^\circ$  downward. It is obvious that even in irradiating a completely flat surface we cannot obtain a theoretically uniform intensity of X ray action, but this is fortunately not of unsurmountable practical importance.

\* For Holzkecht found after a series of experiments that in practice a fairly uniform result can be got in a flat circular patch, when the distance of the focus (target) of the tube stands at double that of the diameter of the circular patch. Thus a circular patch with a diameter of 7.5 cm. would require to have the target of the tube at a distance of 15 cm. from the centre, while a diameter of from 30 to 40 cm. would mean a distance of from 60 to 80 cm. But increase of distance means great increase of time, and while a patch with a diameter of 7.5cm. might/

\* J. Wetten *loc. cit.* p. 334.

might be sufficiently irradiated in from 15 to 20 minutes, a patch of 60 cm. would require for a similar reaction from 2 to 3 hours<sup>\*</sup>, and in addition to this drawback a great increase in armamentarium such as lead, glass, specula etc., would be required. Accordingly, in practice it has been found necessary to have the tube placed at a fixed distance from the part to be rayed, the pastille midway between Target and that part. The tube is placed in a lead lined box or lead glass shield and lead glass specula are used of various sizes. This is necessary for the protection of the physician, nurse and patient. Areas larger than the largest speculum are irradiated one after the other. A difficulty crops up here caused by the specula, for where the edge of the speculum touches the part, no rays can strike, and if a series of rayings over a surface were given and the edges of the specula placed contiguously, parts of the surface would be untouched by the rays as shewn in fig I. This difficulty has been overcome by overlapping the circles slightly as shown in fig 2. Nor is there any practical disadvantage in this as the periphery of the circles is always irradiated to a lesser degree than the centre.



*Fig 1.*



*Fig 2.*

\* J. Wetterer loc. Cit. p.334.



APPARATUS  
FOR X RAY  
THERAPEUTIC  
WORK.

Bearing these points in mind the essentials of any apparatus for X ray therapeutic work are easily perceived. For the protection of the worker and patient (especially the former) the old method of open tube and pieces of lead foil, has of necessity been abandoned, and the tube is placed in a lead lined box or glass shield, and fitted with a pastille holder and suitable lead glass specula.

DEAN'S.

Dean of London has constructed a stand and shield which I have used in my work at the Elder Hospital, Govan for some years and found to fulfil the necessary requirements. This apparatus consists of a lead glass shield in which the X ray tube is placed, & lead glass circular specula varying in diameter from 1 to 10 cm. The 10 cm. diameter speculum is too large with tube target at 15 cm. distance. <sup>(as it is in Dean's shield)</sup> There is also a metal pastille holder, which can be easily removed for examination. A horizontal arm bears the shield at one end, and is jointed to a firm upright standard on a circular base provided with castors. This joint permits an upward and downward movement, while the shield is so jointed as to possess all movements necessary to apply the speculum to any surface of the body.

SCHALL'S.

Schall has also devised a stand and shield which I have used frequently in my private practice. It is likewise fitted with a pastille holder and lead glass specula.

In both Dean's and Schall's instruments the tube is fixed/

fixed and the length of all the specula is the same, therefore the area which can be irradiated at any one time is necessarily limited, and that a speculum with a larger diameter than 7.5 to 8.5 cm. should not be used.

CONDITION OF RAY TUBE BEST SUITED FOR THERAPEUTIC WORK

Whatever effect we wish to produce upon the skin and appendages with the X rays, it is necessary while keeping the points already mentioned in mind, to attend to the conditions of the tube itself.

For in X rays therapy as in X ray photography, the condition of the tube as regards its vacuum is all important. X ray tubes are classified as (1) Hard, (2) Medium, (3) Soft. In X ray therapeutic work both hard and soft tubes are to be avoided.

A medium tube suitable for X ray therapeutic work should have an equivalent spark gap of 4 inches or 10 cm. With this condition of vacuum the tube gives the best results when tested with Sabouraud's pastille. Indeed with a very hard tube, as with a very soft one, it is in my experience very difficult to get the required colouration of the pastille.

DERMATOLOGICAL EFFECTS OF X RAYS. MACROSCOPIC AND MICROSCOPIC LATENT PERIODS.

The reactions produced by the X rays upon the skin with its glands, blood vessels and appendages have been investigated by a number of observers: e.g. Holz knecht, Kienbock, Scholtz, Freund and others. The dermatological effects as a result of that work have been pretty thoroughly described both macroscopically, and microscopically, and the/

the latent period worked out.

The period of latency varies directly with the amount of X rays absorbed by the skin, and Kienbock has given a useful classification of the naked eye appearances of irradiated parts based on the latent period.

This classification is a useful one, and may be here stated as given by Dr. J. H. Sequeira in the British Medical Journal September 14th 1907, page 639.

The reactions are divided into four degrees according to the period of latency:

1st degree: latent period 3 weeks; no visible inflammation, temporary shedding of hair.

2nd degree: latent period 2 weeks; swelling and redness of skin lasting one to two weeks; shedding of hair.

3rd degree: latency of 10 days: the effects noted 1st and 2nd degree plus redness, vesication, superficial erosion and exudation: restoration of parts to their normal condition in from three to four weeks.

4th degree: latent period 7 days or less: reaction of 1st, 2nd, & 3rd degrees plus necrosis with ulceration, healing after six weeks often much longer.

In all degrees except the 1st, telangiectasis may appear in the scar; they are almost inevitable after a reaction of the 3rd degree. They may not appear for six to eighteen months after exposure.

KIENBOCK  
CLASSIFI-  
CATION.

It is obvious that a knowledge of this classification is of service to every worker in the domain of X ray therapy. An acquaintance with the microscopic effects is also of some considerable importance. During the so called latent period microscopic changes are occurring in the cellular elements and often in the blood vessels of the part irradiated, which more or less speedily manifest themselves to the naked eye.

The work of Scholtz in this field seems very complete and may be stated shortly as follows:-

SCHOLTZ'S  
FINDINGS.  
(histological.)

\*The experiments were carried out on the skin of an animal (hog). At stated intervals after raying, the piece of integument was excised, and the naked eye and histological appearances examined and described.

I. 24 hours after irradiation the integument showed no changes to naked eye. Some microscopic changes were observable in the cells of the epidermis.

II. In seven days after raying there was loosening of the hairs only. But important histological changes were found to have occurred.

The horny layer was seen to be breaking down and in parts gone, prickly cell layer shrunken and the cells much altered. Their protoplasm showing vacuolation and increased pigmentation, while the nucleus (swollen vacuolated and jagged) stained weakly: chromatin arranged in clumps: nuclear division into 2 or 3.

These signs of cellular degeneration are stronger near the horny layer. Hair follicles and root sheaths also show cellular changes. Corium is slightly oedematous, the connective tissue trabeculae homogeneous and slightly swollen but the elastic fibres are normal. Blood vessels - (a) capillary normal (b) larger vessels - cellular changes in intima<sup>ry</sup> and media. Connective tissue cells are less altered than epithelial. Cells of sweat glands are slightly desquamated.

III. In ten days after nine irradiations excision of integument and examination showed: macroscopic: hairs beginning to fall out, skin slightly redened and atrophic looking, microscopic: changes similar to those described in II, only more marked: beginning of inflammatory (vascular) reaction recognisable: perivascular exudation in the corium of red blood corpuscles and leucocytes: the capillary vessels of the papillae are dilated and engorged with blood.

IV. In seventeen days after eleven irradiations, excision of part and examination showed:- macroscopic: shedding of hairs and redening and atrophy of skin and formation of vesicles: microscopic: degeneration of cellular elements similar to II and III but more intense and a more marked vascular reaction. Masses of leucocytes have wandered into the epidermis and passed between and into the degenerated cells themselves. Blast cells are numerous. In the centre of the irradiated part the horny layer is blistered

and excoriated (origin of röntgen ulcer).

DEDUCTIONS  
FROM  
SCHOLTZ'S  
FINDINGS.

It is obvious from a consideration of the above evidence - (1) that the X rays have an elective affinity for the epithelial cells, causing rapid degeneration, atrophy and disintegration in them.

(2) That connective tissue elements are also affected, but to a less degree.

(3) That the cellular elements of the blood vessels are also affected (intima and media), that they become dilated, with perivascular exudation of blood corpuscles and leucocytes.

It is therefore obvious that in the X rays we have a powerful means of producing cellular and vascular changes in the integument, which can be graded so as to produce simply shedding of hairs up to the most intense inflammation and ulceration.

The main difficulty in the application of the X rays in therapeutics is to control their action within the desired limits. For our purpose it is fortunate that the epithelial tissues are first and most intensely affected, and that this effect is first manifested upon the hairs, which become loose and fall out. In the treatment of Ringworm and Sycosis this is the result which we wish to bring about. In alopecia areata according to my experience more is needed, and irradiation up to pigmentation and even to slight dermatitis is sometimes required.

Ringworm.

Tinea Tonsuraus or Ringworm of the scalp affects children almost exclusively and boys and girls

equally. Rare after puberty the ages of its selection range from 5 to 10 years or from the time the child enters school to the end of its first five years of school life.

As it is often very chronic and entails exclusion from school and isolation from other children an effective and speedy method of treatment has long been a desideratum. This has been found in the X ray tube.

The treatment of Ringworm of the scalp by the usual methods has often been an exceedingly prolonged and unsatisfactory affair, and the fact that so many remedies have enjoyed a reputation in the therapeutics of this disease, speaks ill for the effectiveness of any of them.

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"Clinically and practically the cause of Ringworm is a fungus - small spored and large spored."

But whatever be the species the treatment by X rays is equally effective, as it removes the hairs which the fungus has attacked and upon which it lives.

No doubt Ringworm often affects the skin of the face and body and even the nails. But in these regions the usual remedies are effective and rapid in their action. What renders the disease so peculiarly obstinate in the scalp and beard is the affection of the hair roots and intrafollicular portion of the hair stem, which unguents and lotions fail to reach. Epilation of the affected hairs by forceps is recommended in ringworm but is laborious and inefficient. The diseased hairs are brittle and

break in the endeavour to pull them out. Now after an efficient irradiation with the X rays, the hairs are loosening in a fortnight, and in a week or two later the patch is bald, smooth and free from scales and remains in this condition for several weeks, when a regrowth of fine lanugo hairs occurs. These are gradually replaced by stronger ones, and at the end of three months strong healthy hair will be found covering the part.

**SYCOSIS.** In Sycosis proper there is no fungus found in the affected hairs. Its habitat is the hirsute portions of the human face, in the hair follicles of which inflammation often accompanied by suppuration, induration and swellings takes place. The exciting cause is now held to be microbic, although for many years believed to depend upon more or less varied and obscure constitutional conditions. True Sycosis has been long a bugbear to the medical man resisting treatment of all sorts in many cases for years. Epilation by forceps is often recommended and antiseptic lotions, ointments of divers kinds applied.

I have had some experience in the treatment of this troublesome affection with the X rays and have had results with that treatment which seem to me very encouraging and which I will detail later on.

**ALOPECIA  
AREATA.**

Alopecia Areata is another chronic and troublesome affection of the scalp whose pathogenesis is still a matter of debate and doubt. The trend of opinion



seems to be in the direction of an active local agent - such as small spored ringworm, but in most cases no such spores can be found. Whatever the active cause, however, there is no doubt of the efficiency of the X rays in the treatment, as I shall endeavour to demonstrate from the cases which I have treated in hospital and private practice.

CASES OF RINGWORM, ALOPECIA AREATA & SYCOSIS TREATED.

Up to the end of 1909 I have treated in the Electrical Department of the Elder Hospital, Govan and in private:-

Ringworm . . . . .	34 cases.
Alopecia Areata . . . . .	11 "
Sycosis . . . . .	<u>4</u>
Total	49

This is certainly not a large number, but number is not everything. Those cases have all been treated observed and recorded by myself personally with care and it is on that, rather than on numbers, their value depends.

ADVANTAGE OF DOSIMETER.

In pages 1 and 2 of my Thesis, I have referred to the necessity of using Sabouraud's Pastille for measuring the dose of X rays given. Success in the field of Rontgen Therapy depends a great deal on that. In my earlier work with the X ray tube, I had no dosimeter of any description, and although I had some successful results, yet I had a number of unsuccessful ones. When I began to use the Pastilles systematically, my successful ringworm cases rose to 100 per cent, as shown by the following table:-

Table showing results before and after using  
Sabouraud's Pastilles

Number of cases of Ringworm treated . . . . .	34
"    "    successful results . . . . .	<u>23</u>
Treated unchecked by Sabouraud's Pastilles	19
Successful results . . . . .	9
Unsuccessful " . . . . .	<u>10</u>
 Treated checked by Sabouraud's Pastilles	 15
Successful results . . . . .	<u>15</u>

I found that without the guide of the Pastille failure was liable to occur through insufficient irradiation. There is naturally a fear in the mind of every X ray therapist that he may produce a permanent alopecia, and records and photographs depicting such disasters, render this fear a very lively one, which has an especially deterrent effect on one's earlier essays. But with the use of the Pastille all such timidity is set aside and the proper dose may be reached in all cases.

TECHNIQUE. The technique is simple and the operation painless. The only drawback is found in the case of children, who are sometimes restless, under the time required to bring the pastille to the B tint. But if suitably placed upon a couch they often fall asleep and in that condition give no trouble.

In the treatment of Ringworm of Scalp or Beard and in Sycosis, our object is to cause a shedding of the hairs in the effected regions as rapidly as is consistent with safety. The hair previous to the treatment being/

given should be cut very short with scissors in every case so that the scalp may be thoroughly examined and markings with an aniline pencil can be made on the head, this being necessary where one has to ray a large surface. These markings show where the glass specula have been applied and prevent raying of same patch twice which would be disastrous at least at one sitting.

The condition of the tube is first ascertained, and it is softened if required to an equivalent spark gap of 10 c.m. or 4 inches. If softer than that it ought to be replaced by another. The part to be rayed is then examined and a speculum selected which includes the patch and overlaps it, taking in a small margin of healthy scalp. If the patch is too large to be so included it is mapped out into areas as shown on page 6 and each area is marked with aniline pencil, and the irradiation is given, the part being kept carefully applied to the speculum during the whole time. In giving the irradiation some such shield must be used such as Dean's or Schall's as already pointed out. These Therapeutic Stands and shields are convenient to use, and through specula of various diameters enable one to concentrate the rays on the part desired and protect physician, nurse, and patient. In the case of a young child I prefer to have it lying on a couch, as if sitting it frequently slides away from the speculum, and on the couch it frequently falls asleep. The nurse

or mother must see that it does not shift or move its head during the treatment. In the case of adults, a chair with a moveable head rest is all that is required. The position of the patient must be made as comfortable as possible for the irradiation demands him to keep fixed for, in most cases, fifteen minutes, with a powerful modern coil, seven minutes may suffice.

From time to time during the irradiation, the Pastille is examined and when the desired tint B or over is reached, the irradiation is stopped. Sabouraud's B tint given with the book of pastilles is quite sufficient to cause a shedding of hair in children with fair hair and delicate skins in fourteen to twentyone days. On the other hand when the hair is dark and coarse the B tint must be slightly deeper than that figured in Sabouraud's book. This holds good also in the treatment of the adult beard and whisker regions. There the tinting of the Pastille must go beyond B tint if a satisfactory shedding of the hair is to result. Dark hairs require more than fair hairs. Experience soon guides one to the necessary amount.

In my experience it is only necessary to irradiate the affected regions taking care to overlap them slightly. But in the case of disseminated Ringworm where the whole scalp is more or less affected, it is necessary to systematically go over it all so as to remove all the hairs complete-

completely. It sometimes happens that new areas of infection arise after the irradiation has been given. These are simply irradiated in their turn. I have not found this a common occurrence.

When the irradiation is completed, some recommend the painting over of the patch or patches with Flexible Collodion and others an antiseptic wash of Perchloride of Mercury (1 in 1000).

I have tried both but prefer to use a 10 to 20% acid Salicylic spirit lotion. This leaves a fine dust of salicytic acid on the part and extracts moisture. Soap and water washings of the scalp are contra-indicated, as moisture favours the growth of the fungus. When the hairs have begun to loosen and shed, this process may be assisted by epilating forceps. The hairs pull out easily and do not break, and should be immediately burned. I usually inspect the scalp in a week after raying for fresh outbreaks and after another week to see if the hairs are loosening. Another inspection is made at the end of three weeks, new areas are dealt with, if any, and if the patch is not sufficiently bald a fresh irradiation may be given as before. This however, is seldom necessary. In the case of Alopecia Areata we are on quite different ground. Not to cause the falling out but the growing in of hairs is the object.

How the X rays came to be used in the treatment of this disease is a mystery. Superficially considered, it seems contradictory to ray to produce baldness at one time, and to ray a bald spot to remove its baldness, at another. But after all it is no more strange than to give a poison to cure a disease. The X rays act as an irritant producing increased cellular and vascular changes in a part, which if not carried too far, tend to increase its vital activity, vascular and cellular.

In irradiating for Alopecia Areata, my experience is, that in some cases the raying must be carried far enough to produce a slight X ray dermatitis. The treatment in chronic cases is sometimes a tedious one, the rayings requiring to be repeated at intervals of a month or six weeks from several up to many times. Often a successful result is brought about by a few rayings thus repeated.

ILLUSTRATIVE  
CASES.  
RINGWORM.

I divide my cases illustrating the X ray treatment of Ringworm into two groups.

Group I. treated without Sabouraud's Pastille.

Group II. " with " " .

Group I.

Case I. C. D. boy, aged 6 years, had patches of Ringworm distributed over whole scalp. Hair was redish fair, skin fine. The unprotected X ray tube was used at a distance of about 15 c.m. His scalp was gone over taking five separate radiations, each patch being rayed once only. 14,000 impulses through the coil were given as recorded by Dean's register (D/R) or counter to each patch. This would correspond to a period of about fifteen minutes. The rayings were given on separate days i.e. on May 7, 11, 15, 21, 29 - 1906. On June 8th the patches rayed on May 7th and 11th were bald. On June 21st whole scalp bald. November 6th, hair regrown and no trace of ringworm; scalp being free from scales and broken hairs.

Case II. S. D. boy 9 years, brother of above, had three patches of ringworm on scalp. He was treated in the same way as Case I. Irradiation on May 15th, 18th, and June 1st, 1906.

On June 8th hairs shedding on patches rayed on May 15th and 18th. On June 15th the patches were hairless. On September 4th fine lanugo hairs were growing in the patches, skin clear and free from scales and broken hair. November 6th - hair regrown and quite healthy.

Case III. J. McC. boy, aged 5 years, had patch of ringworm on crown of head about size of a half crown piece.

This case is of interest as showing that a very massive dose of X rays can be given without producing a permanent alopecia.

On October 30th 1907 the patch received a prolonged raying of 30 minutes or 30,000 as registered by Dean's counter. On November 5th, a week later, the hairs were shedding, and the patch was easily plucked quite bald. This loosening was a week earlier than is usually the case, and showed that the irradiation had been severe. On November 12th there was evidence of a dermatitis. January 17th 1908 - still some dermatitis, hairs regrowing but loose and easily plucked out. Some hairs on patch examined microscopically on February 4th showed no spores. March 4th. Hair growing in well and no evidence of the disease.

April 3rd. Patch quite covered with sound hair. The irradiation was much more severe than should be given: but this case serves to show that the margin of safety is not so easily overstepped as some think.

Group II.

Case IV. R. T. aged 6 years, had disseminated small spored ringworm practically affecting whole scalp. Fair hair, fine skin. The whole scalp was gone over in six rayings given in two separate sittings on November 13th and 17th, 1908. Sabouraud's Pastille was brought to B tint on each occasion. On November





R.T. Case IV. 1.



R.T. Case IV. 2.

27th the hairs were loosening, and could be pulled out easily. Father was instructed to hasten the process with forceps and within a week the whole scalp was bald as shown in accompanying reproduction of photograph taken at the time and labelled R.T. Case IV. 1. On January 19th, the scalp was covered with lanugo hairs except a small part in front.

Photograph Reproduction labelled R.T. Case IV. 2 shows the result after regrowth of hairs. Note that the opposite side of the head was inadvertently photographed in number 2 from number 1. but that does not matter as the whole scalp was as bald on one side as on the other.

Case V. F. A. dark haired girl, aged 6 years, had ringworm of the scalp for which she required six rayings given on February 12, 16, 19, 26, and March 30th 1909, and on May 7th a repeat raying.

On March 16th, occiput and top of head were bald, hairs loosening and shedding on other patches, but not quite bare yet.

On June 25th the result was seen and noted as successful.

Case VI., under this heading I include a family of four boys, suffering from patches of ringworm of scalp - Jas. Jno. W. and E. McK. aged 7, 13, 3 and 5 years. They were rayed in several sittings in July 1909. These cases were all successful, Sabouraud's Pastille being brought to B tint in each. The reproduction of photograph labelled Case VI.



Case VI. The M's.

shows the result during the progress of the case in three of the patients.

These boys were last seen on December 23rd, giving a sufficient time to leave no doubt as to the success of the treatment. Their scalps were found perfectly covered with sound hair.

SYCOSIS.

The following four cases were examples of true Sycosis and not of Tinea Barbae. The tendency to relapse and chronicity in this disease is well known. With the X ray treatment relapses occurred but the effect of the treatment seems to me much superior to manual epilation, lotions, and ointments. The inflammation and follicular suppuration rapidly diminish & with the falling out of the hairs the skin becomes healthy. Relapses are liable to occur but are easily dealt with.

Case I. J. W. A. male aged 35 years had Sycosis of beard (cheeks and chin) perifollicular inflammation and suppuration. For two years he had been under treatment by several dermatologists with only transitory benefit. On November 26th, 1906 I irradiated the affected parts not using Sabouraud's Pastille. The raying loosened the hairs and he easily plucked them out. He had however frequent slight relapses for which subsequent rayings had to be given, so that it was even necessary in March 1909 to irradiate for a slight recurrence. My experience with this and other cases has shewn me that error is liable to result from under dosing.

The hairs of the beard region are thick, strong, and deeply rooted, and B tint (Sabouraud's) is generally insufficient to cause a satisfactory shedding. My present practice is to irradiate so as to get B tint and a quarter to a half more. This patient had from 1906 to 1909 (3 years) ten irradiations, but the result of each was always to cause a disappearance of the disease at least for a time, and for a whole year there was no relapse, his last irradiation being in March 1909. The patient who had had considerable experience of other methods of treatment, expressed himself as highly in favour of the X rays.

Case II. A. McC. aged 27 came to me on November 8th 1909 with Sycosis of cheeks and chin. There was considerable redness, swelling and suppuration and four distinct hard inflammatory swellings. Some hairs pulled out were found bathed in pus, and a white translucent sheath surrounded the roots of some of them. Microscopic examination shewed no spores. On the 10th after some starch poltices had been applied the affected regions were irradiated. Sabouraud's Pastille was tinted a deep B. On the 25th the hairs were loosening and could be easily pulled out with forceps. This he did thoroughly. On February 9th 1910, I have a report from his medical man stating that the patient keeps perfectly well and free from recurrence.

Case III. T. M. on December 3rd 1909 had his chin and both whiskers irradiated for Sycosis. Sabouraud's Pastille was brought to B tint. The hairs became loose enough in a fortnight so that he could pull them out easily with forceps. Last seen March 1910 he was found perfectly well.

Case IV. H.A. had Sycosis of upper lip, under surface of lower lip and both whiskers. From November 1909 to January 28th 1910 he had eight rayings checked by Sabouraud's Pastilles. Both whisker regions were noted as well on March 24th, but upper lip and under lip were still requiring further treatment.

ALOPECIA  
AREATA.

In treating this affection with the X rays the main difficulty lies in determining the dose which should be given. As far as my experience goes, the dose should be pushed so as to produce a slight dermatitis, although I have had successful results, where no dermatitis was observed, yet in others I have had no success until the vascular condition of the patches was obviously increased.

Alopecia Areata often seems spontaneously to undergo a cure, whatever method of treatment be adopted, yet the experience derived from my small series of cases leaves little doubt in my mind that the X rays were efficient in bringing about a successful result. The first case made some impression on my mind, as to the potency of the rays in this disease.

Case I. H. W. girl, 6 years, one of a young family, never had ringworm, nor did the others show any signs of it. She was a dark haired healthy child. In August 1906 I treated her for Alopecia Areata with the high frequency currents. She had six typical looking patches scattered over the scalp. All got well except one patch in the occipital region. It was about the size of a five shilling piece and remained absolutely hairless for three years. I determined to try the X rays, and in March 5th to 31st 1909 gave her three rayings, bringing on each application Sabouraud's Pastille to B tint. A



*J. H. Case II. 1.*



*J. H. Case II. 2.*



dermatitis with slight pigmentation and desquamation resulted on April 19th. On May 10th the patch was observed to be growing smaller, and this continued, fine lanugo hairs growing at the circumference until in three months the whole patch was covered with healthy hairs. Seen last on November 27th. No trace of the patch could be seen.

Case II. J. H. aged 14 years had eight large patches of Alopecia Areata scattered over the scalp, one of which is seen in the accompanying reproduction of a photograph taken at the commencement of the treatment. The figure 4 seen on it, was written with a stick of Nitrate of silver.

The X ray treatment was begun on January 28th 1908 and was stopped on May 15th, when he had 10 sittings, irradiations pushed to B tint. Some patches received only one irradiation, others two or more. On February 11th fine lanugo hairs were observed growing at the periphery of some of the patches. On May 15th hair was growing in well on patch seen in accompanying print and numbered 4, and in most of the others. He was lost sight of for a time, but was again seen on September 24th. All the patches were then covered over with hair. The reproduction of a photograph taken later labelled J. H. Case II.2. shows the result.



M.D. Carl IV

Case III. Miss S., F. 23 years, had three irradiations for a patch of Alopecia Areata on occiput from May 15th 1908 to June 5th. On each occasion pastille was coloured a deep B.

Hair began to regrow in six weeks after last irradiation. Hair started regrowing from periphery and the patch grew gradually smaller and finally disappeared. Last seen on April 1909 showed a perfect result.

Case IV. M.D. 23 years, had two patches of Alopecia Areata on back of scalp of two month's duration. From July 27th to November 13th 1909 he received five irradiations, Pastille brought to B tint on each.

In a month after last raying hair was regrowing in the patches.

Photograph reproduction labelled M.D. Case IV shows hair in process of regrowth on one of the patches. The ultimate result was successful.

Case V. illustrates a very obstinate attack of Alopecia. W. McM, aged 17 had six patches over occipital and parietal regions, of three years duration. Nineteen irradiations were given - from August 25th 1908 till January 1910.

On December 1st 1909 all the patches were covered with hair; but on 18th January 1910 two new patches appeared and were treated. The final result was successful.

DANGERS OF THE X RAYS:-

That the X Rays may cause a telangiectasis, a very severe dermatitis, intractable ulceration, necrosis, permanent Alopecia, is not to be denied. Some even assert that they may cause cancer, and others that their use is dangerous in ringworm, as they may have a deleterious effect on the delicate nerve cells of the brain.

If, because they may produce or are capable of producing untoward results, the X rays are to be discarded in therapeutics, then a whole host of other remedies tried, valued, and in daily use, must also be abandoned. There is absolutely no evidence to show that they have any deleterious effect on the brain tissue, besides we must remember that here a layer of osseous tissue which is opaque to the rays is interposed, and I doubt if any rays penetrate into the brain in therapeutic applications, or if they do, in quantities incapable of doing harm.

With regard to the production of cutaneous cancer, I may state that I have had patients who have received more than fifty rayings in the course of two years, in whom no untoward manifestations of cancer or of any deleterious phenomena developed.

With regard to permanent Alopecia, my experience is, that it is not easily produced. The margin of safety is tolerably large as is shown in one of my ringworm cases - Case III page 22. The same observation holds good in regard to necrosis, ulceration and severe

dermatitis, and even telangiectasis may be avoided with care.

As I have tried to show, proper methods of working will prevent those dangers - the systematic use of a reliable dosimeter such as Sabouraud's Pastille, the proper regulation of the vacuum of the tube, distance of part from the tube, suitable protective covering for tube, and constant personal supervision on the part of the operator (physician or nurse).

Attention to these points, whatever be the power of the X ray outfit in use will obviate those dangers, and will enable the operator to irradiate any part so as to produce the effect required.

SUMMARY.

1. Paramount importance of a means of measuring or gauging the dose of X rays received by the patient. No means satisfactory up to the time of Holzkecht's invention of his Chromoradiometer, and later Sabouraud's Pastilles.
- m2. Short description of Holzkecht's and Sabouraud's Chromoradiometers. They essentially consist of chemical reagents which change their colour under the action of the X rays. In Holzkecht's a series of standard colours are given for comparison, in Sabouraud's only one. This latter may be called the depilation tint, or that which corresponds to the dose required to cause a falling out of hairs. Obviously only an approximation, but of great practical value.
3. Considerations regarding distance of part to be irradiated from anode or target of tube. Holzkecht's findings on that subject, based upon his experiments.
4. X ray therapeutic apparatus: Dean's and Schall's described.
5. Condition of X ray tube best suited for therapeutic work.
6. Dermatological effects of the X rays on the skin and appendages.  
Kienbock's classification according to latent period.

7. Histological effects: Scholtz's findings based on experiments.
8. The X rays effective in the treatment of Ringworm, Sycosis and Alopecia Areata.  
In Ringworm and Sycosis because they remove the hairs; in alopecia areata because, by their stimulating effect on cellular and vascular structures, they cause a regrowth of hairs.
9. Remarks on Ringworm, Sycosis and Alopecia Areata with special reference to their treatment by X rays.
10. Technique.
11. Illustrative cases from my hospital and private practice, with photograph reproductions illustrating effect of X ray treatment in the above diseases.
12. Dangers of X rays: how obviated.

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