The oxygen treatment for wounds, ulcers, burns, scalds, lupus, and diseases of the nose, eye, and ear / by George Stoker.

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Stoker, George.

Publication/Creation

London : Bailliere, Tindall & Cox, 1897 (London : W. & F. Heal.)

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THE

OXYGEN TREATMENT

FOR

WOUNDS, ULCERS, BURNS,

SCALDS, LUPUS,

AND

DISEASES OF THE NOSE, EYE, AND EAR.

BY

GEORGE STOKER,

M.R.C.P.I., M.R.C.S., L.R.C.S.I., ETC.

Physician to the London Throat Hospital; Medical Officer to the Oxygen Home; Hon. Physician Actors' Benevolent Fund, &c.

Late Chef à l'Ambulance au Croissant Rouge, Turco-Russian War; late Stafford House Commissioner, Zulu War.

LONDON:
BAILLIÈRE, TINDALL & COX,
20, 21, KING WILLIAM STREET, STRAND. W.C.

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PREFACE.

9.9.98.

It is a hopeful sign of the growing interest in and importance of the Oxygen Treatment that within the last few months I have received a large number of inquiries as to where the details for carrying out the treatment may be found. These details, together with many points of collateral interest and scientific importance, are at present scattered through various journals that have been published during the last three years.

At the request and on the suggestion of many persons interested in the matter, I have collected in this pamphlet all the papers that are of most importance as bearing on the Oxygen Treatment, and I now offer these for the consideration of my professional brethren in collective form.

I have, however, a second object, and that is to show how the system has developed; and how, month by month, matters of the highest scientific interest have been discovered.

The Oxygen Home, 2 Fitzroy Square, has been established for the purposes of teaching and investigation, and those who wish to see the system at work are welcome to visit the Home any afternoon at 4.30.

GEORGE STOKER.

14 Hertford Street,
Mayfair.

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Local Treatment of Wounds and Ulcers by Oxygen.

A LECTURE AND DEMONSTRATION GIVEN AT THE RICHMOND HOSPITAL, DUBLIN, FEB. 16, 1895, BEFORE THE PRESIDENTS OF THE ROYAL COLLEGE OF PHYSICIANS AND SURGEONS, IRELAND, AND A LARGE BODY OF THE PROFESSION,

BY

GEORGE STOKER, M.R.C.P.I., M.R.C.S.Eng., J.P.

Reprinted from the Medical Press and Circular, *April 17th, 1895.*

Dr. Stoker said :—

Mr. Thomson, Ladies, and Gentlemen—Having made what I believe to be a discovery in reference to certain surgical treatment, and having proved it in a private way to be an entire success, I now desire to bring it before your notice. After I shall have described shortly the apparatus and the method of procedure, I am perfectly certain that the first question which will suggest itself to everybody here is, "What on earth put this into your head"? I shall, therefore, anticipate that question by stating that the idea was first suggested to me by continuous observation of wounds which healed without any further treatment than washing with water twice a day, and which were exposed to pure air. These wounds came under my notice during and after the Russo-Turkish and the Zulu wars, especially during the Zulu wars. The Zulus are not in favour of surgical progress from one point of view. Their practice was to go to the uplands, where the air is extremely pure, and to use no dressings, and the result was that their wounds healed in an extraordinary way. That first attracted my notice to this matter many years ago, and I am ashamed of not having developed the idea long ago, but the exigencies of life constantly prevent us from doing many things that we wish to do. First of all,

the definition of this treatment is simply "exposure of the wounds or ulcers to the action of oxygen." The oxygen may be either pure or diluted with pure air, according to the requirements of each case. I had conceived the idea that these results would be produced by the stimulating vitalising effects of the oxygen, but above and beyond that it has been unquestionably forced on my mind that some profound chemical change takes place in the surface of the wound in the nature of a process of oxydisation. In order that the wound may be exposed thoroughly, and if possible continuously—I do not say that the exposure must always be continuous, but it is better to expose it continuously, because the case will then be treated without any interruption to the action of oxygen, pure or diluted—it became necessary to design some apparatus which would effect that object. And the first which I designed and made with my own hands were boxes such as you see. These are not absolutely necessary, as a simple india-rubber bag would do, but as they stand they are satisfactory for the purposes of treatment *plus* clinical observation. It is not in any way necessary for this treatment that you should bring about an absolute vacuum. If that were so the treatment would be practically useless, because an absolute vacuum is an extremely difficult thing to attain. When we have to apply the treatment to the extremities of the body it is only necessary to have india-rubber bags of the simplest construction. If you want to apply the treatment to a knee-joint, what is required is an oval india-rubber receptacle, open at both ends, larger at one end than at the other. The lower or smaller end of the bag embraces the limb below the knee, and the upper or larger end embraces the limb above the knee. In the cases in which boxes have to be used there is always a certain amount of leakage, and, therefore, it is more or less necessary to have a continuous stream of oxygen. But in cases where the limb is enclosed in an india-rubber receptacle, it is not necessary to have a continuous stream, it is only requisite to fill the bag and turn off the tap, and after five or six hours to fill it again. The cap on the head of this boy was filled last night with pure oxygen, and he slept comfortably with it on. You have to apply a suitable apparatus to any other part of the body that it may

be necessary to treat. Here (No. 2) is a bag enclosing a foot, and here (No. 3) is another enclosing an arm and hand. You will presently see apparatus for applying oxygen to the eye or ear. I conceive that the treatment might be very useful in ulceration or chronic diseases of the os uteri, but I have not yet had an opportunity of trying that. For such a purpose a ball pessary might be constructed, with a tube through the centre of it for the injection of the oxygen to the part, an exit tube being provided through which the used-up gas could escape. I hope I may be able to make arrangements for applying oxygen to the bladder, which might prove a very effectual mode of treatment in cases of chronic cystitis. I think the treatment can be applied to the vagina and the uterus, as well as to the head or the eyes. The method of proceeding to treat an extremity is as follows: First the wound is washed, then the india-rubber cap is passed along the arm so as to embrace the limb. The larger end of the bag is passed round the edge of the box and tied with tape, and through the india-rubber tube is passed the oxygen diluted with air. Only a few cases can stand pure oxygen, as it causes a great deal of pain when used in its pure state, but there are cases that will stand it. But suppose a case in which we use diluted oxygen—that is a fifty per cent. solution of it. First, in order to purify the dilutant air, it is passed through two wash bottles before entering the gas-bag, the first containing lime-water, and the second a strong solution of Condy's fluid. Then the oxygen is passed into it out of a cylinder supplied by Messrs. Brin. When the bag is filled it is connected with the receptacle by a small tube, the tap is turned partially on, and your treatment starts. It goes on according to the length of time that the bag is supposed to last. Of course, in cases where a very large box or receptacle is used, and where there is great waste, the emptying process takes place quicker than in ordinary cases where only a box for a hand is employed, in which latter case one filling lasts twelve hours. The caps I now show you are used for treatment of the eye and ear, and superficial ulcers on the surface of the body, including the breast. The edges of the cap are fitted with adhesive plaster, to attach the cap to the skin, and the oxygen is passed in through the

tube. Supposing the treatment to be started, there are a few points which I wish to mention in the order of their importance. First, as regards pain; there is relief from pain at once. Some of these cases were extremely painful before this treatment, but the patients have one and all stated to me that the treatment gave them immediate relief from the pain they suffered, the only discomfort they experienced being a kind of little pricking pain, which lasted only from the first half-hour to the first hour of the treatment. Of course, if the oxygen is too strong the pain is very severe. Here is a photograph of a woman who had an ulcer of the leg for eight years, for which she had been continuously treated in hospital, both as an outdoor and indoor patient. At the end of twenty-four hours after the first application of the oxygen treatment, I asked her how she felt, and she said it was the first night for eight years that she had been free from pain. With regard to the discharge, you know that many of these chronic ulcers are very dry and hard, but in the very worst of them, after twelve hours of the oxygen treatment, the discharge has been greatly increased, and also considerably altered in character. During that time microscopic examination does not show any difference in the number or character of the micro-organisms present in the pus, but after twelve or fourteen hours' treatment the discharge begins to diminish, and then remarkable alterations are seen in the character of the micro-organisms. With regard to the healing process, several very interesting points are to be observed. First, the new tissue is not cicatricial, but is similar and continuous with that of the surrounding parts. Another very important point as to the healing is this. We know that in many ulcers there is a tendency to redundancy of granulation; that has never been observed in any of the thirteen or fourteen cases I have treated. In some of the cases, which were deeply excavated, the ulcer has come rapidly to the surface, and then stopped and waited patiently until the skin grew over it. Of course, we are now only at the beginning of this business. We are just taking the first step. I think there is a great possibility in front of it, and I look to you, gentlemen, who have general surgical hospitals behind you, to try to develope this treatment. I

think it is one which might be very successfully carried out with rodent ulcers and lupus. We have a case of lupus in this hospital which we only began to treat to-day; and I hope that we shall also be able to do something with epithelioma. I am now trying ozone also. We know that it is a very much more powerful oxydiser than oxygen itself. But there are difficulties attendant upon its use. It is so powerful an oxydiser that it destroys any fabric with which it comes in contact except such as are covered with pure paraffin. I have been so informed by Professor Dewar, of the Royal Institution, who is the greatest authority on the subject, and who has experimented largely with ozone; he states that paraffin is the only thing that will stand it. At present we are trying to make something covered with paraffin which will answer the purpose.

I propose now to say a few words about the cases you see here.

The first is that of a little girl. She has tuberculous disease in several parts of her body. Both ankles are affected, the right elbow-joint and the right wrist. She is now nine days under treatment. When we began she had an ulcer (tuberculous) on the back of her right hand, which extended from the line of the fold between the thumb and first finger to the base of the little finger, and engaged nearly all the dorsal surface of the hand. You can see it is now about the size of a threepenny piece. This case has been several months in the hospital, and has resisted all the usual surgical methods of treatment. She was treated with a 50% of oxygen, and suffered no pain whatever. The photograph shows the original size of the ulcer.

The second case is that of a tuberculous boy, with extensive disease of the tibia. He has been five months in hospital, several operations have been performed, and sequestræ removed. It has been found impossible to get the large cavity to granulate up; 80% of oxygen was applied. The measurements when the treatment was commenced were:—length, 10 c c.; breadth, $4\frac{1}{2}$ c.c.; depth, 4 c.c. The measurements now are:—length, 9 c.c.; breadth, $3\frac{1}{4}$ c.c.; depth, 2 c.c. This is the result of nine days' treatment.

The third case is that of a girl with tuberculous sygnovitis attacking the tendons on the back of the wrists; she has been seven

months under treatment. Several plastic operations have been performed with a view of getting the ulcer covered; they have all failed, and the usual methods of treatment did not promote granulation. The ulcer measured when we began—2 c.c. long by 1 c.c. broad; now, after *three days' treatment* by oxygen, the measurements are—1 c.c. long by ½ c.c. broad.

The fourth case is that of a young man with tertiary syphilis. He has been eighteen months in hospital. He is an extremely bad case; he has lost his hard and soft palate. His head was covered with suppurating sores, and resisted the usual treatment. Now the cap is removed you can see that most of these sores are healed, and those that are not are now granulating in a perfectly healthy manner. He is treated with an india-rubber night-cap, which is filled with pure oxygen twice daily.

I do not propose to occupy your time any longer, but it is right and proper and entirely in accordance with my feelings that I should express my thanks to the staff of this hospital; first, for their goodness in allowing me to introduce these cases here, and giving me an opportunity of testing the treatment. I assure you that I feel highly honoured by your presence here to-day, and I deem it a great privilege that here in this hospital, where I passed many of my student days—and very happy days they were—I should be allowed, after the lapse of a good many years, to bring under your notice a system which I am sure, under your fostering care, will extend far beyond the limits of this city. I believe also that it will reflect credit, not only on the medical schools which we represent, but on the country to which we have the honour to belong.

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The Economy of the Treatment of Wounds and Ulcers by Oxygen Gas.

BY

GEORGE STOKER, M.R.C.P.I., ETC.,

Physician to the London Throat Hospital.

Reprinted from the BRITISH MEDICAL JOURNAL.

The above treatment has proved so successful that now, after more than a year's experience of it, it is thought desirable in this present paper to bring one aspect of it before the medical public. Let us lay aside for the present its humanitarian aspect; the relief of suffering that it gives; the cessation of foul smells and discharges that it causes; the rapid healing it promotes, of what had hitherto been considered incurable sores, and which had resisted all other forms of treatment; and let us shortly consider its manifest economical advantages, its money-saving power, both to individuals and to institutions, infirmaries, hospitals, homes, etc., where such cases are treated.

We can best appreciate these points by the consideration of two cases, which are samples of many others, though perhaps in a more marked degree.

The first is one in which the oxygen treatment was carried out in a metropolitan infirmary, by the permission of the medical superintendent. The patient, S. E., aged 58, had suffered for thirty years from a chronic ulcer of the leg. The ulcer was most painful, and prevented him from working, which he was otherwise able and quite willing to do—in fact, the ulcer was the sole cause of his being idle, and costing the rates about fifteen shillings a week. He had been in the infirmary for eighteen months at the time the oxygen treatment was commenced, and after six months under the treatment he left with the ulcer completely healed.

Now, it is fair to expect that if the oxygen treatment could have been applied when he first entered the infirmary the ulcer would have been healed in six months, and the rates thus saved his expenses for eighteen months, *minus* the cost of the treatment—that is, about £50.

The second case is as follows:—The patient, a man, received a wound on his leg fifteen years ago, and an ulcer gradually formed. For ten years the ulcer prevented him from working, and was a source of constant pain. For many years he had been an inmate of the British Home for Incurables at West Norwood, and it was there, under the care of Dr. Rugg (whose permission I have to publish the case), that the treatment was carried out. The ulcerated surface extended from a little below the knee nearly to the middle of the instep, and in some places right round the leg, the extreme measurements being 13 inches by 7 inches. There was a profuse discharge, and so foul-smelling was the leg, that the patient hand to be kept in a separate room with carbolised sheets hung over the door. The patient suffered constant and acute pain. Under the oxygen treatment the foul smell disappeared in two weeks' time, and the leg was completely healed in six weeks. Only a little tenderness remained over the inner ankle. The dressing of this leg with antiseptic dressings (and it was most carefully attended to) did not cost less than 1s. a day, and now the institution is saved at the rate of 7s. per week, equal to £17 per annum, for the rest of the patient's life, and he may live ten or fifteen years to come.

These cases speak for themselves, and many such cases could be quoted, but it would seem to any unprejudiced person that the above are sufficient to encourage all Boards of Guardians, and committees, etc., to start the treatment in their hospitals, infirmaries, or homes, or wherever such cases are received.

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The Treatment of Ulcers, Wounds, and other Surgical Cases by Oxygen.

By GEORGE STOKER, M.R.C.P.I.,
Physician to the London Throat Hospital.

Reprinted from The Hospital *of July 4th*, 1896.

This treatment has advanced far beyond the limits that were at first anticipated. Like all good and useful discoveries, it has not stood still, but has proved itself capable of development in several directions. The treatment consists in the exposure of the affected part to oxygen gas; this exposure may be either continuous or intermittent. The system in its simplest form is seen in the treatment of a hand or arm, or foot and leg below the knee. For any of these the apparatus is practically the same.

I always use Brin's oxygen, which can be obtained in cylinders holding from ten feet upwards. I recommend anyone using these cylinders to get a "fine adjustment valve," to be attached to the cylinder, as it much facilitates decanting the oxygen into the bag and avoids waste. Having enclosed the limb in the box and filled the bag, the next step is to attach the bag to the box and turn on the taps, and the treatment is commenced. One bag is sufficient under ordinary circumstances for twelve hours. The amount of pure oxygen used varies according to the case. In recent cases of wounds, burns, &c., it is sufficient to use a quarter of a bag of pure oxygen and three-quarters of purified air, but in chronic cases, equal parts of air and oxygen is best. To measure the oxygen accurately it is necessary to have a bag containing one quarter of a cubic foot; in the Oxygen Home we have a gasometer, but this is manifestly impossible except in institutions, and a quarter of a foot bag will be found sufficient and convenient.

Beyond what I have stated, there are at present no data for exactly determining the best strength of oxygen to use in any

particular case. My present belief is that such exact data may possibly be found in the state of the micro-organisms in the wound, and I am making careful investigations in this direction, and will publish the results later on.

The wounds should be cleansed twice daily with warm water. The oxygen causes the formation of a parchment-like film round the margins of the wound over the newly-growing skin, and unless this film is removed it prevents the oxygen getting at the parts underlying it, and delays healing; its removal is best effected with fine dissecting forceps.

It rarely occurs that after some time, and when only a very small part of the wound or ulcer remains unhealed, the oxygen seems to lose its effect and the wound remains stationary. Under these circumstances it is best to leave off the oxygen, and apply a little simple water dressing. This result is not by any means common, and I am at present unable to offer any reason for its occurrence.

I have found the treatment most successful in cases of ozœna and suppurative middle-ear disease. There the application is very simple. Only the bag, tube, and taps, and the wash-bottles are required. The bag is half filled with oxygen, and filled up in the usual way with purified air. A small ear or nose piece is fitted in on the end of the tube. If the ear is to be treated the ear-piece is passed into the external auditory meatus and the tap turned on. The oxygen should be applied about three to four hours daily for periods of half an hour at a time. The ears should be syringed with warm water before each application of oxygen.

For ozœna the same strength of oxygen should be used as in ear cases. The nose piece should be passed into one nostril and the other plugged with cotton wool. This compels the patient to breathe through the mouth, and leaves the oxygen more or less in undisturbed contact with the nose or naso-pharynx and prevents the patient inhaling too much oxygen, which induces headache.

In ozœna cases the oxygen should be continued for half to one hour four or five times daily, the nose being cleansed and thoroughly freed from scabs and crusts before each application of oxygen.

The oxygen treatment is further being applied to diseases of the antrum, eye, uterus, &c., and is, indeed, applicable wherever there is an ulcerated or suppurating surface. Its advantages may be thus summarised. It heals cases that have resisted other forms of treatment; it heals in far less time than any other system (this is especially marked in recent cases); it relieves pain, stops foul discharges, and bad smells; it forms a healthy and vascular cicatrix, which in cases healed many months ago has shown no tendency to break down.

I have made many careful cultivations from wounds and ulcers rapidly healing under oxygen treatment, and have in all found micro-organisms staphylococci aureus and albus in abundance. I am inclined to believe that these bodies absorb poisonous matters from the wounds, &c., on which they live, and in turn their excreta poisons the same wound; but that oxygen oxidises and purifies these excreta and thus assists healing. It is also plain that oxygen acts as a stimulant, and induces a flow of blood to the part, and that this blood is directly oxygenated.

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The Surgical Uses of Oxygen Gas.

By GEORGE STOKER, M.R.C.P.I.,
Physician, London Throat Hospital.

A PAPER READ AT THE SIXTY-FOURTH ANNUAL MEETING OF THE BRITISH MEDICAL ASSOCIATION, HELD AT CARLISLE IN JULY, 1896.

Reprinted from the BRITISH MEDICAL JOURNAL, *October 24th, 1896.*

The oxygen treatment consists essentially in the exposure of the affected parts to the action of oxygen gas, either pure or diluted with purified air. The exposure may be either continuous or intermittent, both of these particulars depending on the character and necessities of each individual case. The treatment is applicable to wounds, ulcers, or, in fact, to any ulcerated or suppurating surface, or any mucous surface with vitiated or unhealthy secretions.

The apparatus necessary for carrying out the treatment may be considered under two heads :—

1. The apparatus for enclosing the affected parts, called "the enclosure."

2. The apparatus for supplying oxygen, called "the supply"; and inasmuch as this is practically the same in all cases, I will describe it first. It consists of a wedge-shaped macintosh gas bag, of one cubic foot capacity, fitted with taps and tubes. There is a large tap on the bag for the purpose of filling it, and there is as well a tap in the tube leading from the bag for regulating the flow of oxygen. There are two wash-bottles for purifying the dilutant air, the first containing lime-water, and the second Condy's fluid.

I will now describe the apparatus for enclosing the affected part; and here I would point out that it is not necessary, or even desirable, that the enclosure should be air-tight. On the contrary, it is necessary to have ventilation. All that is requisite is that it should be managed in such a way as to secure the passage of air from within out, and prevent the passage of impure air from without inwards, and the current of air from the bag secures this ventilation. Holes, if, any should be loosely plugged with cotton wool.

The temperature in the enclosure varies between 80° and 90° F., and a high temperature indicates the necessity of further ventilation. A box apparatus for the treatment of any of the extremities below the knee and elbow consists of a simple wooden box with a glass lid and an india-rubber funnel. The instructions for applying it are as follows :—

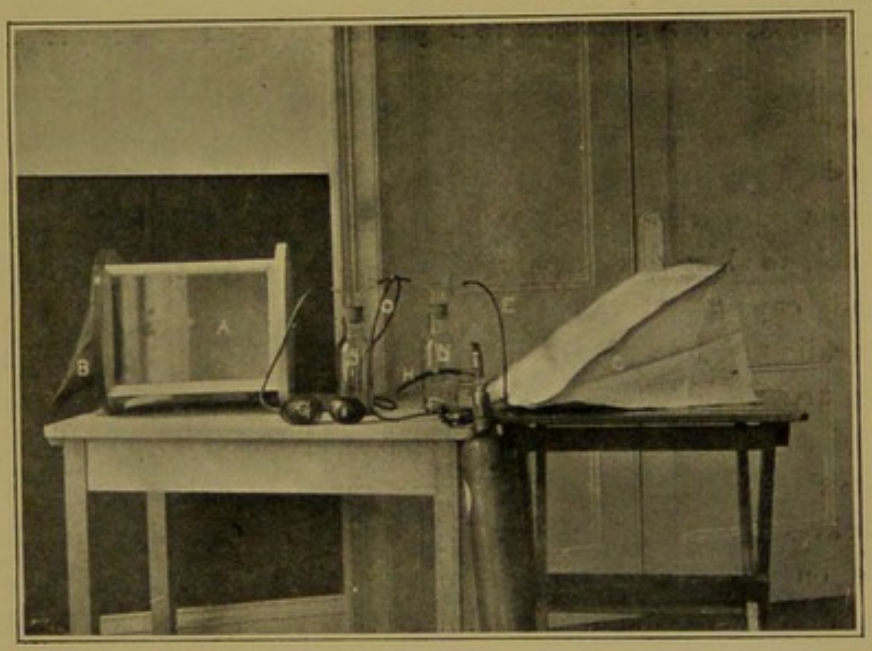

Fig. 1.—A. Box ; B. Funnel ; C. Gas bag, tubes, and taps; D. Washbottles.

To apply the Box.—Draw the small end of the funnel (B) up to the limb above the affected part, pass the limb into the open end of box (A), and stretch the large end of funnel round the edge of the open end of the box.

To fill the Bag.—(1) Half fill wash bottles, one with lime water, and the other with solution permangate of potash, eight grains to the ounce ; (2) attach tube (E) from wash-bottle to the tap (F) on the gas bag ; (3) by means of the hand ball (G) pump air into the gas bag to the required amount (this amount will depend on the amount of pure oxygen that is necessary for the case) ; (4) turn off tap (F) and detach the tube (E) ; attach the oxygen cylinder by means of the short india-rubber tube (H) to tap (F), which must be turned full on. Fill up the bag with oxygen (Brin's is the best) ; (5) turn off tap (F) and detach bag from cylinder ; attach tube (O) from end of box to tap (F) and turn both taps half on. The gas bag holds one cubic foot, and is sufficient for ten hours.

In the thigh and arm above the elbow it is found more convenient to use a glass cylinder with two funnels, one above, and one below the cylinder. The oxygen can be passed in either above or below the cylinder. In these cases it is necessary to have ventilation, which can be arranged by seeing that the funnel furthest from the

inlet fits loosely round the limb; the oxygen must thus pass over the wound before it can escape.

For the purpose of applying oxygen treatment, two kinds of caps are used—that is, (*a*) head caps, and (*b*) body caps, The head caps are uses principally for treating cases of baldness from any cause, but may, of course, be used for scalp wounds, etc. The cap, in shape like a knitted nightcap, is stretched round the prominence of the occiput and just above the eyebrows, and is secured by a bandage bound round the margin of the cap. The oxygen is supplied by a tube passing from the top of the cap. If used during the night, this tube is attached to a supply bag placed between pressure boards. I find that after a night or two patients are able to sleep quite comfortably with the cap on.

Body caps may be any shape. I show a square one. They are for healing small wounds, etc., on the surface of the body or limbs. They are made of guttapercha, and have a pneumatic ring round the edge. Bandages or straps are passed round to keep the cap in position.

Jackets are used for applying oxygen to extensive wounds or sores on the trunk. They are made quite loose, and only fit accurately round the arms and neck; they are gathered in pleats round the waist, and secured with a bandage or belt. A tube is fixed round the jacket below the armpits, through which a strong wire is passed for the purpose of preventing the jacket from touching the surface of the wound or ulcer. Drawers are used for wounds, etc., of the buttocks or lower part of the body. They are arranged in much the same way as the jacket, but fit closely round the waist and round the thighs; they have also a tube and wire like the jacket.

The *Eye Piece*, or shield, as shewn, is made of gutta-percha, and being dipped in hot water is softened, and can then be moulded to the face. It is then fitted with a pneumatic ring round the margin. The eye piece is retained in position by an india-rubber strap passing round the back of the head.

Nose.—For the purpose of carrying out the treatment in cases of diseases of the nose, a nose piece is attached to the end of the tube

leading from the end of the supply bag. It is shaped like the teat of a feeding-bottle. It should be passed into one nostril, and the other plugged with cotton wool. This compels the patient to breathe through the mouth, and thus leaves the oxygen in a more or less undisturbed contact with the nose and naso-pharynx, and prevents the patient from swallowing too much oxygen, which induces headache. In nose cases the oxygen should be used at intervals of not more than an hour for four or five hours daily.

Ear.—To apply oxygen to the ear a cap or ear piece is used. It is made of gutta-percha, and consists of a box of oval shape, about an inch-and-a-half deep, and with a pneumatic ring round the edge. The inlet tube projects about three-quarters of an inch inside the box, and directs the current of oxygen into the ear. The box is kept in its place by straps or elastic bands. For ear cases the treatment should be as far as possible continuous.

Dressing and Cleaning.

In reference to these points it must be understood that no applications have been used to promote healing further than oxygen. The wounds, etc., are simply washed with warm water twice or thrice daily. One result of oxygen is to form a fine parchment-like film round the margins of the wound or ulcer over the newly-growing skin, and unless this film be removed it prevents the oxygen getting at the parts underlying it. If the wound be steeped in warm water for half-an-hour it is then easily removed with dissecting forceps.

The strength of the oxygen used will depend on the nature of the affection for which it is employed. It is best to use at first pure oxygen, and after a while a solution varying from 25 to 75 per cent. This point will receive full consideration in the bacteriological part of this paper, as the data are to be found in the condition and behaviour of the micro-organisms.

One of the most gratifying effects of oxygen is the power it has of relieving pain, whether in chronic cases or in recent ones, such

as burns, but this point will be mentioned in the notes of the cases, the pictures of which will be thrown upon the screen.

Scarcely less satisfactory is the power oxygen has in dissipating all unpleasant smell, and this will also be alluded to in the notes of cases.

The first effect of oxygen, especially when used strong, is to largely increase the amount of discharge, and this I believe is very beneficial, as it carries with it the unfavourable micro-organisms that have found a resting place in the deeper part of the wounds, etc., or if it does not absolutely wash them away, it brings them to the surface and under the influence of oxygen gas.

The most satisfactory point in wounds and ulcers that are healed by oxygen gas is the nature of the cicatrices. You will see on the cases I have brought here for your inspection some remarkable instances of this, and you will also see the same results pictured in the photographs on the screen. They are:—(1) the cicatrices closely resemble the normal skin surrounding them in colour; (2) they are vascular; (3) they are not contracted or puckered.

I would draw your attention to the fact that the temperature in the enclosures of various kinds varies from 80° to 90° F., the variation depending principally on the temperature of the surrounding atmosphere.

The conclusions that I have drawn from a long and varied experience of the oxygen treatment are:—(1) it heals where every other form of treatment has failed; (2) it heals in far less time than any other form of treatment; (3) it allays pain; (4) it stops foul discharges and smells; (5) it forms a healthy new skin, vascular; (6) the more chronic the affection, the longer pure oxygen must be used; (7) it is far more economical and less expensive than any other form of treatment, both as regards suffering and money; (8) if it were always used at first, there would be few chronic ulcers.

At the demonstration given before the Surgical Section, the notes of twenty-two cases were read, and photographs shown illustrating their progress. Micro-photographs of the bacteriological conditions were also shown. It is impossible to publish all

the cases and illustrations here. Five typical cases have been selected as follows.

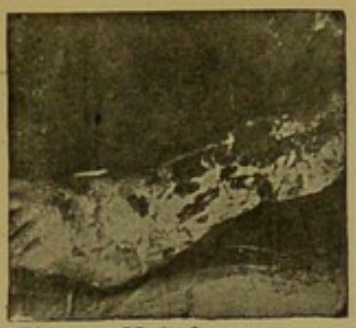

Fig. 2.—H. before oxygen treatment.

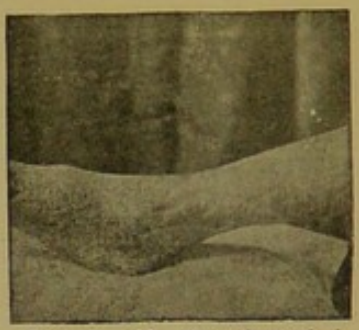

Fig. 3.—H. after 6 weeks' oxygen treatment.

Case 1 —This patient suffered from chronic eczematous ulceration of the leg for thirty years. She is an inmate of the Home for Incurables at West Norwood, and was treated there with oxygen by my friend Dr. Rugg. She was completely healed with six weeks' treatment, and the cicatrix presents all the appearances of natural skin. For years she suffered pain and extreme irritation in the ulcer, but this was relieved by the oxygen.

Fig 4.—Mrs. S., May 30th, 1896.

Fig 5.—Mrs. S., June 24th, 1896.

Fig. 6.—Mrs. S., May 30th, 1896.

Fig. 7.—Mrs. S., June 1st, 1896.

Case 2.—The patient has had two ulcers, one on the inner and the other on the outer ankle. She has been bad for two years. The ulcer on the outer side measured 2½ inches by 1¾ inches, and has healed completely in three weeks and four days. I show this patient here to-day. The ulcer on the inner side, which is much smaller, a little larger than a shilling, healed in forty-eight hours. I may mention that these ulcers smelt most foully before the oxygen treatment was

commenced, but under oxygen the smell disappeared in a very few days. This patient suffered much pain, which disappeared when the ulcers were exposed to oxygen. On May 30th a cultivation was taken upon nutrient agar-agar at the end of forty-eight hours' incubation at 37° C. It smelt badly, there were small

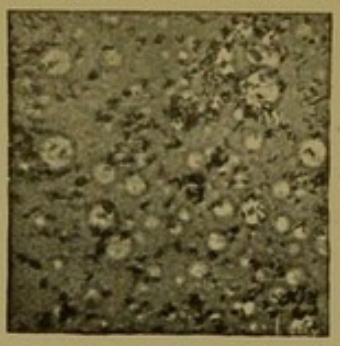

Fig. 8.—Mrs. S., May 30th, 1896

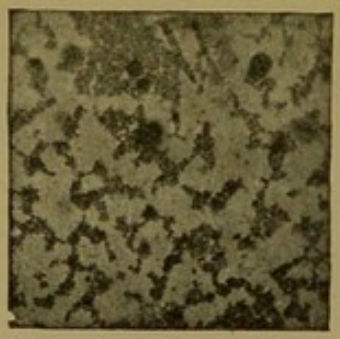

Fig 9.—Mrs. S., June 6th, 1896.

whitish colonies and dirty whitish growth over the whole of the face of the agar. Upon examination with $\frac{1}{12}$ it was found to consist of large quantities of rod bacteria and a few micrococci. On June 6th another cultivation was taken upon nutrient agar-agar which had no smell, and upon examination was found to have extensive colonies of staphylococcus pyogenes aureus. This case was healing so rapidly that no further cultivations were taken.

Fig. 10.—D. W., May 9th. 1896.

Fig. 11.—D. W., August 29th, 1896.

Case 3.—D. W. *The Hand.* The second burn, which was received on April 10th, extended from the ulnar side of the first finger of the right hand all across

Fig. 12.—D. W., May 23rd, 1896.

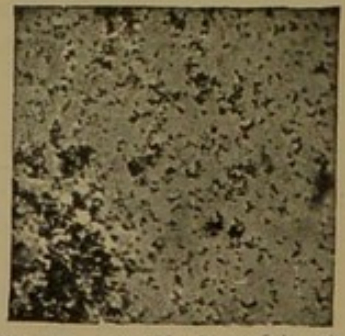

Fig. 13.—D. W., June 6th, 1896.

the back of the hand, and to the ulnar side of the little finger into the palm. Like the thigh the wound smelt badly, looked very unhealthy, and had a profuse

discharge. She was in St. Bartholomew's, and received the usual treatment that one would expect in an institution of the kind, but there was no sign of healing. I may say that the metacarpal bone of the little finger was exposed, and that now all the ulcerated or burnt surface has healed. The metacarpo-phalangeal joint was opened, but has since healed and is now closed up. On July 26th, the piece of exposed bone exfoliated and came away, leaving a granulated surface exposed. On May 23rd a cultivation was taken upon nutrient gelatine; after about forty-eight hours' incubation at 16° C. there was found to be an extensive growth of small whitish colonies, with a slightly unpleasant smell. Upon examination with $\frac{1}{12}$ they were found to consist of exceedingly small cocci, very difficult to stain, and a few large cocci easily stained; from the way in which they were grouped we concluded they were a very poor growth of staphylococcus pyogenes albus. On May 30th another cultivation was taken upon nutrient agar-agar; after twenty-four hours' incubation at 37° C. a vigorous growth of button-shaped colonies of white and brown colour had appeared. Upon examination they were found to be staphylococcus pyogenes albus, and staphylococcus pyogenes aureus of a much larger growth than in the previous cultivation, with a few rod bacteria; the cultivation had a strong smell of fish. On June 6th another cultivation was taken upon nutrient agar-agar; after forty-eight hours' incubation at 37° C. there had developed large quantities of whitish button-shaped colonies, which upon examination were found to be staphylococcus pyogenes albus of a large size, very easy to stain, and which had no smell.

Fig. 14.—J. S., May 16th, 1896.

Fig. 15.—J. S., June 6th, 1896.

Case 4.—This patient, J. S., had a wound on the shin. As a child he had received a severe burn which left a large cicatrix, extending on the front of the leg from below the knee to the middle of the instep, and it was on this cicatrix that the wound was received. The wound measured $2\frac{1}{2}$ inches by $1\frac{3}{4}$ inches.

Fig. 16.—J. S., May 16th, 1890.

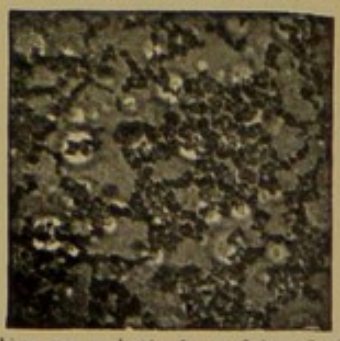

Fig. 17.—J. S., June 6th, 1896.

The patient was a military recruit, and had been treated in the Hounslow Military Hospital for two months, all forms of treatment being tried, but without

success, the ulcer becoming larger. He was sent up to us, and the wound had been carefully strapped and every attention paid to it. He was treated with oxygen for six weeks, and the result was a complete cure. I think this a specially important case, being, as it is, quite a recent one, and the wound being situated in a position which everyone is aware is perhaps the most difficult to heal. This wound was very painful, but, as in nearly every case, the pain was relieved when put in oxygen. On May 16th, a cultivation was taken on nutrient gelatine. By the 19th, a thick whitish coat had grown upon the surface and smelt badly ; upon examination with $\frac{1}{12}$ immersion it was found to consist of a few staphylococcus pyogenes albus and a large quantity of short rod bacteria. On May 23rd, another cultivation was taken upon nutrient gelatine ; it had the whitish growth, but not so thick as in the previous cultivation, and upon examination it was found to be staphylococcus pyogenes albus and a few rod bacteria. On June 6th, a cultivation was taken upon nutrient agar-agar ; the growth consisted of small button-shaped masses, which, upon examination with $\frac{1}{12}$, were found to be staphylococcus pyogenes albus only. As the cases was healing so rapidly, no further cultivations were taken.

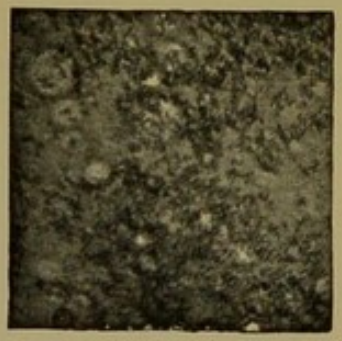

Fig. 18.—J. S., June 6th, 1896.

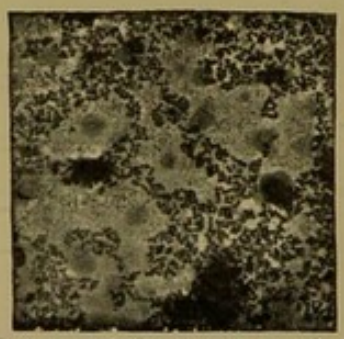

Fig. 19.—J. S., June 13th, 1896.

Case 5.—*Chronic Suppurative Middle Ear Disease and Mastoid Disease.* This patient, J. S., a boy aged eight years, had suffered from his birth from chronic discharge from his left ear. The discharge was profuse and foul-smelling He was treated for two months with oxygen gas, which after a few days' interval entirely destroyed the smell, and he left cured as far as the discharge was concerned. I believe, however, that he has disease of the mastoid, which I propose to trephine and scrape at another time. A cultivation was taken on June 6th upon nutrient agar-agar, and cultivated at 37° C. for forty-eight hours. A whitish growth had formed upon the surface of the agar, which had a very bad smell ; upon examination with $\frac{1}{12}$ immersion, it was found to consist of short rods with rounded ends, and were believed to be bacillus pyogenes fœtidus. On June 13th another cultivation was taken upon nutrient agar-agar, and cultivated at 37° C. ; at the end of 48 hours an extensive growth of small button-shaped colonies had taken place down the needle track, and upon examination they were found to consist wholly of staphylococcus pyogenes albus.

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Bacteriological Report by George Stoker, M.R.C.P.I., and George Dineen.

It must be thoroughly understood that in the following report the authors confine their remarks to the bacteriological conditions found in cases treated by oxygen, and their methods, deductions, and conclusions have reference to cases treated in this way only.

As attention was first drawn to the bacteriological aspect of the oxygen treatment by the results of the examination of the discharges from one case, it will perhaps simplify matters to give a short account of it.

Miss S., aged 41. Patient has double talipes equino-varus and infantile paralysis of both legs. Fifteen years ago a chronic ulcer (following a blow) formed on the right leg, and ten years later an ulcer formed on the left leg. She has had many forms of treatment, including all kinds of applications, three months in hospital, and rest at home for eight months, but the ulcers did not heal. In 1895 she came under my care. It was thought a good case to compare the relative merits of oxygen and antiseptic treatment. The ulcer on the left leg (four years old) was accordingly dressed with black wash, whilst that on the right leg (fourteen years old) was treated with oxygen. The right leg began to improve at once, but the left leg showed no signs of progress.

Cultivations were taken from both ulcers and sent to the Clinical Research Association for incubation and examination. The following is the report: "Three culture tubes were inoculated in this case in the presence of Mr. Stoker. From the left leg on glycerine agar:—no growth has appeared in this tube, incubated at 37° C. From the right leg on agar:—a mixed growth, consisting of yellow and white colonies, appeared in forty-eight hours after inoculation. On microscopic examination the colonies consisted of micrococci, and no doubt are due to the multiplication of staphylococcus pyogenes aureus and staphylococcus pyogenes albus respectively. From the right leg on gelatine:—during transport to the laboratory this tube had melted."

The right leg still continued to improve, and looked far healthier and healed far more rapidly than the left. On July 22nd, 1895, cultivations were again taken from both ulcers, and the report was as follows:—"Right leg: A considerable number of colonies has appeared on this tube, practically all white in colour, and consisting of staphylococcus albus. Left leg: On this tube, under the same conditions as the other two, practically no growth has appeared on

the surface of the medium. There is, however, one doubtful white colony which will be watched and reported on if it appears of interest."

This is a brief history of the case that led one to form certain conclusions, which have been amply borne out by subsequent investigation.

Our method is as follows:—The wound or ulcer, etc., is photographed, and a cultivation taken for and examined before the oxygen treatment was begun. At intervals cultivations were taken and examined, and once a month the cases were again photographed. The results of our observations were carefully tabulated on the sheets we produce, and microscopic slides were also prepared (produced) from the tube cultivations taken (produced). The cultivations are all taken on agar-agar, as it occurred to us that our observations and conclusions would be more exact if the cultivations were incubated at about the temperature of the wounds from which they were taken, and, as I stated, the heat in the boxes out of hundreds of observations varied from 80° to 90° F. As will be seen, we have taken upwards of eighty observations, and almost without a single exception our results may thus be stated:—

Conclusions.

1. That oxygen has a selective power in reference to micro-organisms on the wounds, destroying some and encouraging others.

2. That in all healthy and rapidly healing wounds, etc., under oxygen treatment, staphylococcus albus, staphylococcus aureus, and occasionally staphylococcus citreus are found; and these we call favourable micro-organisms.

3. That on the wounds exposed to oxygen the growth of streptococci, bacillus fluorescens, bacillus fœtidus, rod bacteria, and others, is retarded and destroyed; and these we call unfavourable micro-organisms.

4. That when in a wound treated by oxygen healing is arrested or retarded, there is always a corresponding decrease of the favourable and increase of the unfavourable micro-organisms.

5. That when this condition arises, if the strength of the oxygen solution be increased, then the favourable micro-organisms are increased and the unfavourable diminished.

6. That oxygen destroys the foul smells due to unfavourable micro organisms when they are exposed to its influence on the wounds.

7. That oxygen encourages the growth of favourable micro-organisms, that under its influence they grow larger, increase in number, and are more easily stained.

8. That when this condition pertains in reference to favourable micro-organisms, the wounds from which they are taken rapidly heal.

We have also striven to find some simple bacteriological data for regulating the strength of the oxygen used, and beg to offer the following as a useful guide:—(*a*) Take a cultivation on agar, incubate for twenty-four hours, 37° C.; if tube smells foul increase the oxygen; (*b*) If there is no foul smell reduce the oxygen, using half-a-foot of pure oxygen, and half-a-foot of purified air, this being what we call our "standard strength."

This is, of course, a rough and ready way, but in accurate work much experience in examining microscopically the bacteria will be necessary. If anyone wants examinations made they can have them done at the Oxygen Home, 35 St. George's Square, Pimlico, London, S.W. [*Now removed to 2 Fitzroy Square, W.*]

We have gone some two steps further still. We have cultivated what we call favourable micro-organisms in pure air, pure oxygen, and varying strengths of oxygen, and find that the favourable micro-organisms grow best and stain easiest after cultivation in from 25 to 50 per cent. of pure oxygen mixed with purified air. It is found in practice that a solution as strong as 75 per cent. of pure oxygen, mixed with pure air, is too stimulating for any ordinary cases, and that with a weaker solution wounds heal better. There are thus two elements to be taken into consideration in regulating the quantity of oxygen to be used:—

1. The condition and behaviour of the micro-organisms, favourable and unfavourable, when cultivated on agar.

2. The condition and behaviour of the micro-organisms, favourable or unfavourable, when growing on a wounded or ulcerated surface.

Secondly, we have taken the case of W. Here the hand was healing with great rapidity and the leg slowly. We took some of the pure staphylococcus albus and aureus from the hand and inoculated the leg. This produced the best results, and the leg improved rapidly. We repeated this treatment in three other cases with the most satisfactory results, but as we cannot, owing to want of space, give the detailed account of them, we only mention the fact.

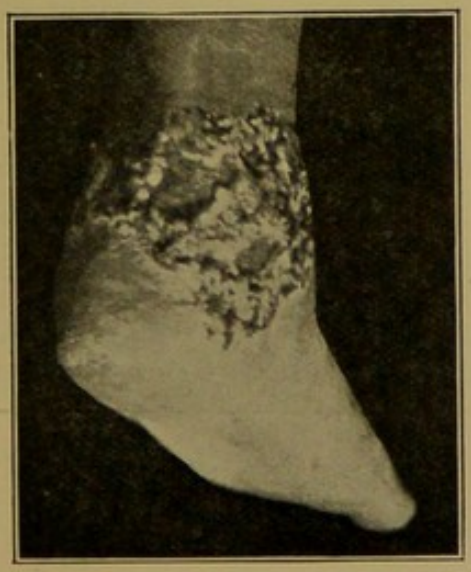
We have further cultivated the unfavourable micro-organisms in atmospheres varying from air to pure oxygen, and we have found that in air they flourish, but in oxygen their vitality and size diminish as the amount of the oxygen in the mixture is increased, and when 50 per cent. of pure oxygen is used with 50 per cent. of purified air (that is, O=60 and N=40) they begin to die off.

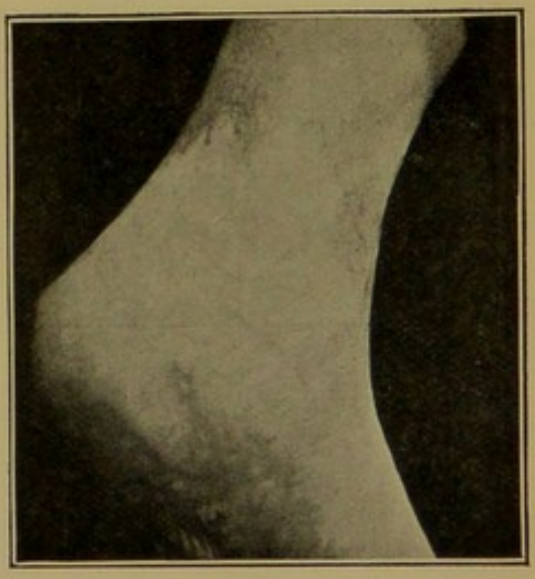
Cases

Exhibited at a Meeting of the Clinical Society, January 22nd, 1897.

Case I.—J. D.; occupation, commercial traveller.

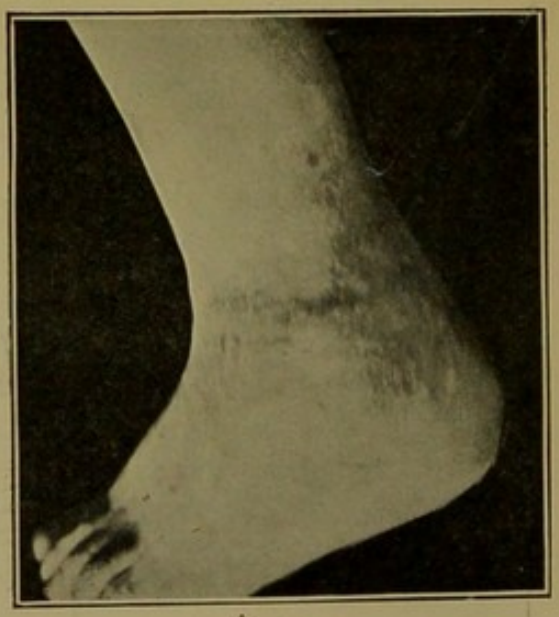
This patient was admitted to the Oxygen Home on October 23rd, 1896. His leg had been bad for twenty years. Ten years ago a wart appeared over the inner ankle, and an ulcer formed.





The ulcer increased rapidly in size and was continuously painful, both night and day. Seven years ago he was obliged to give up travelling, and laid up at home for some weeks; but no improvement to the ulcer resulted from rest. It was very much smaller then than it is now. Many applications of ointments, lotions, etc., were tried, and he took medicine internally—I believe of an anti-specific character. None of these treatments had any effect; the ulcer continued to increase in size and became more and more painful. On admittance it presented the appearance shewn in the photograph. It was deeply excavated, with irregular, rough thickened margins, a considerable discharge, very offensive

smell, and was most painful. He was treated with equal quantities of pure oxygen and purified air. In a few days the pain and smell quite disappeared, and on November 14th (in less than four weeks) the ulcer on the inner side was healed, and that on the outer side is now in an advanced state towards recovery; the progress during the last two weeks has been nothing short of marvellous.



Bacteriological Report.

On admission a cultivation was taken on agar-agar. After forty-eight hours incubation, it was examined, and found to contain :—

1. Bacillus flourescens.
2. Bacillus subtilis.
3. Torula.

November 23rd, second cultivation :—

1. Staphylococcus pyogenes aureus and albus.
2. Micrococci.
3. Diplococci.

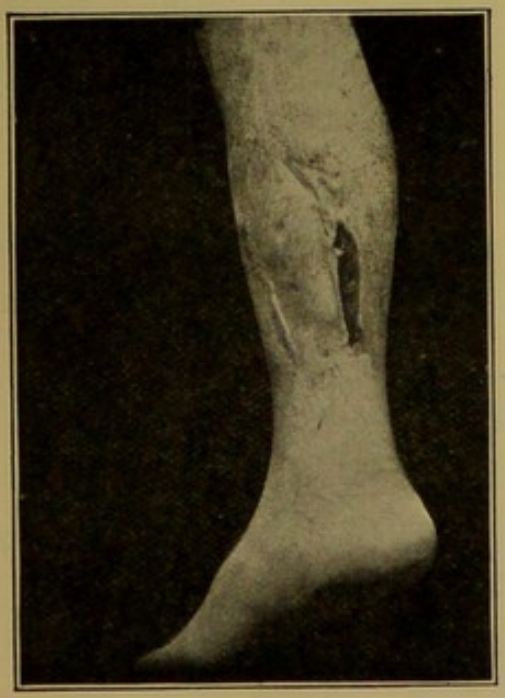
January 11th, 1897 :—

A practically pure growth of Staphylococcus pyogenes citreus.

Case II.—M. W., aged 36.

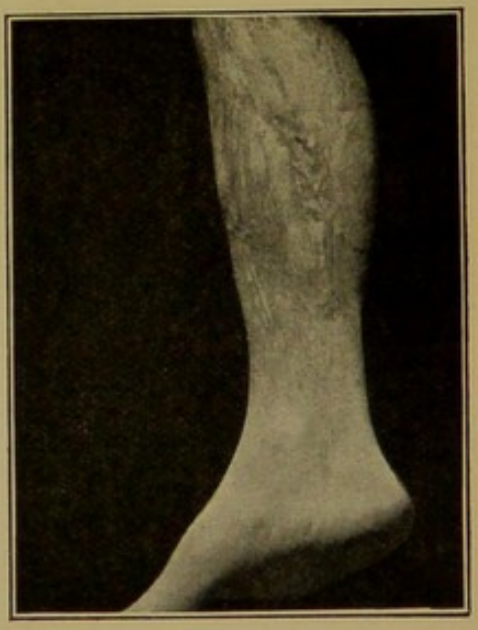
The patient is a signalman on a railway. On April 10th, 1896, he was run over by a van and his leg crushed. He was taken to a general hospital, and was there treated for two months in bed, and, as the wounds shewn in the photograph would not heal, he was sent to a convalescent home for one month. This also failed to effect any improvement, and the surgeon under whose care he was

1



M. W., 18th July, 1896.

3



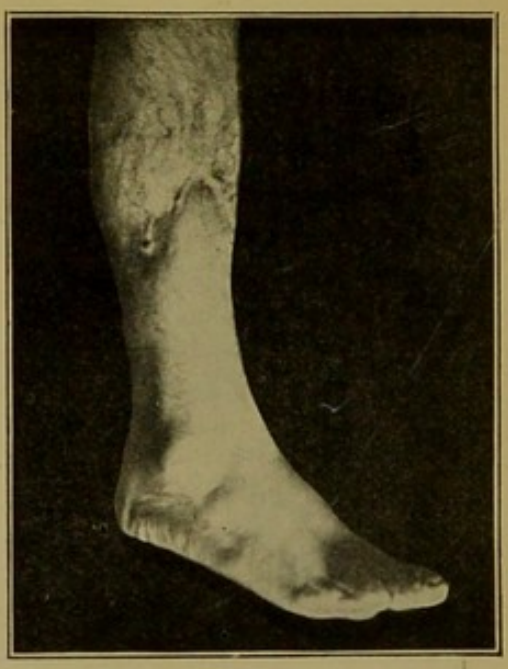
M. W., 29th August, 1896.

advised him to come into the Oxygen Home, and this he did on July 17th, 1896. He then informed me that, so far from healing, the wounds were increasing in size, and that there was constant pain and much discharge. On admission, his leg presented the appearance shewn in photographs 1 and 2. In two or three days, under the oxygen treatment, the pain disappeared, and he was discharged cured on September 4th, after six weeks' treatment (*vide* photographs 3 and 4). This patient has been in active work since for four months, and there is no sign of his ulcer breaking down.

2

M. W., 18th July, 1896.

4



M. W., 29th August, 1896.

Bacteriological Report.

On admission, cultivation contained :—

1. Staphylococcus.
2. Streptococci.
3. Rod bacteria.

August 1st, cultivation contained :—

A pure growth of Staphylococcus aureus and albus.

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A Note on the Bacteriological Conditions present in Ulcers treated by Oxygen Gas.

By D. SEMPLE, M.D.

(Surgeon-Major, Army Medical Staff; Assistant Professor of Bacteriology, Army Medical School, Netley).

Reprinted from The Hospital, *May 8th, 1897.*

In a very interesting paper read before the British Medical Association at Carlisle, in July last, and reported in the *British Medical Journal* of October 24th, Dr. George Stoker described in detail his method of the Surgical Uses of Oxygen Gas, and gives a series of cases of chronic ulcers and burns successfully treated by this method. In the same paper he also gives, in conjunction with Mr. George Dineen, a short bacteriological account of the cases so treated, and a summary of conclusions. With a view to testing the accuracy of these conclusions, advantage was taken of the opportunity of making cultivations from a series of cases of chronic ulcers undergoing the oxygen treatment at the Royal Victoria Hospital, Netley.

The methods pursued were in the main the same as described by Dr. Stoker in his paper, viz., cultivations were made from the ulcers before the application of oxygen and at intervals during the treatment. In all cases the cultivations were made on agar-agar tubes, and incubated at 37° C. for periods varying from twenty-four to forty-eight hours. Special notice was taken as to whether the favourable progress of healing corresponded with the disappearance of "rod bacteria" in cases where they were present at the outset, and a plentiful growth of staphylococci.

It is to be noted that Dr. Stoker in his paper mentions that staphylococci are favourable, and "rod bacteria" unfavourable micro-organisms when present in a wound undergoing oxygen

treatment. He also mentions that soon after the application of oxygen, and when healing sets in, that it is accompanied with a disappearance of the "rods," and a continued growth or increase in growth of the staphylococci.

No attempt was made to classify these "rod bacteria." The majority were short motile rods with rounded ends, growing well on any ordinary medium, and producing liquefaction in gelatine. Between February 19th and April 3rd, seven cases of chronic ulcers, all specific except one, were put under the oxygen treatment. The surfaces of the ulcers were attended to in the manner described by Dr. Stoker in his paper. All the patients were men under the age of thirty, and most of them were in a feeble state of health, emaciated and broken down from the effects of constitutional disease and service in India, and were not good subjects to respond to any treatment. Notwithstanding the inferiority of the material to work upon, marked improvement took place in all at an early stage, pain was diminished, the discharge became less, "rod bacteria" disappeared, and staphylococci flourished all the time.

Case 1.—A specific ulcer on the leg of four months' standing. February 19th, half oxygen and half air applied. Improvement was noted on the third day, and continued until March 13th, when the ulcer had quite healed. In this case all the cultivations showed staphylococcus pyogenes citreus only.

Case 2.—Rupial ulcerations on arms and legs of five months' standing. February 19th, half oxygen and half air applied to left arm only (the legs and right arm having other treatment). Improvement was noticed on the second day, and on February 27th all the ulcers on the left arm had healed, while for the most part those on the right arm and legs remained open. First cultivation consisted of staphylococcus pyogenes citreus and short "rods." Second cultivation, taken four days after the first, showed staphylococcus pyogenes citreus only.

Case 3.—A specific ulcer on the scalp of thirteen months' duration. February 20th, pure oxygen applied. February 25th, half oxygen and half air applied. The first cultivation showed staphylococci only. Healing progressed satisfactorily for the first

week, when it came to a standstill. After this it was noticed that a new gummatous ulcer had formed close to the old one, a circumstance which interfered considerable with its healing. On March 5th, the cultivation showed a copious growth of short "rods," and only a few staphylococci. The ulcer was then sown with a pure culture of staphylococci pyogenes citreus. On March 14th, owing to the predominance of short "rods" in the cultivations, the ulcer was again sown with a pure culture of staphylococci pyogenes citreus. On March 20th the improvement began, and the cultivations at this time showed a plentiful growth of staphylococci and a few "rods" only. On March 28th improvement was again at a standstill, and the cultivations showed "rods" only. On April 1st improvement again set in, and has continued up to date (April 18th). All the cultivations after April 1st showed staphylococci only. In this case delay in healing was accompanied with the presence of "rods" in the cultivations, and when progress set in, these diminished and at last disappeared.

Case 4.—Several syphilitic ulcers on arms, legs, and face of ten months' duration; those on the legs being the worst. Patient is in a very feeble state of health, and greatly emaciated. February 28th, half oxygen and half air applied to a large ulcer on right instep. Cultivations showed a mixture of short "rods," and staphylococci. Cultivations from another ulcer on right knee, which is being treated in the ordinary way, show a mixture of short "rods" and staphylococci, March 6th, both sides improved. Cultivations from the instep ulcer show staphylococci only, and from the knee ulcer a mixture of "rods" and staphylococci. March 13th, oxygen applied to the knee ulcer. March 18th, both ulcers improving and the cultivations from both show staphylococci only. Oxygen left off on account of the patient being so weak and irritable that he cannot bear the necessary restraint for the continuous application of the treatment.

Case 5.—Three ulcers on shin of four weeks' standing, over a large cicatrix, and caused by a fall. March 13th, half oxygen and half air applied. Cultivations show a plentiful growth of "rods" and a few staphylococci. March 16th, ulcers healed. Cultivations

made on the 15th show a plentiful growth of staphylococci and a few "rods" only.

Case 6.—Gummatous ulcerations on right shin and instep of four months' duration. March 1st, half oxygen and half air applied. No cultivations made before oxygen. Improvement set in after two days' oxygen, and now (April 18th) the ulcers are almost healed. Cultivations all showed staphylococci only (all were taken after oxygen).

Case 7.—Lupus of nose and face of nearly three years' standing. Seraping done two days before oxygen. March 28th, half oxygen and half air applied. No cultivation made before oxygen. April 3rd, marked improvement in ulcers. Cultivations show a plentiful growth of staphylococci only. April 5th, all ulcers closed.

All the foregoing ulcers, with the exception of Case 5, were of a very chronic character, and had shewn great resistance to other methods of treatment. In all improvement was noticed in from two to four days after the application of oxygen gas, and, with the exception of Case 3, the improvement was uninterrupted.

A complete explanation as to how this improvement is brought about is at present difficult to give. Possibly the oxygen acts in one or more of the following ways: (*a*) Diminution of irritation. Any dressing you choose to apply to an open sore causes more irritation than a mixture of oxygen and pure air. (*b*) Direct stimulation without irritation. (*c*) The oxygen may oxidise the toxins produced by micro-organisms in the surface of the ulcer. This may apply more especially to the toxins produced by bacilli when present. (*d*) As stated by Dr. Stoker, the oxygen has possibly a selective power in its action on micro-organisms present in the ulcer, encouraging staphylococci, which then outgrow the bacilli. Some of the forgoing points are at present under investigation. Here, as yet, we have only the practical results of a few cases to go by, all of which are in favour of the oxygen treatment.

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Oxygen Cicatrices.

In any system of treating wounds, ulcers, etc., the most important point is the exact nature of the new tissue formed, as on this depends the permancy of the results achieved. It is common experience that, as a rule, the cicatrices formed by ordinary methods, especially in the healing of ulcers, do not last, and when a strain is put on them when the patient gets about again, they break down.

Those who have observed the process of healing by the Oxygen Treatment have been impressed with the nature of the cicatrices formed, and the opinion has often been expressed that they were like new skin. This view has been borne out by the fact that nearly all the cases so healed have maintained this condition and have not broken down again.

It has been observed that under this treatment the granulations on the healing surfaces are on a slightly higher level than the surrounding skin, and that as healing progresses the epidermis gradually creeps over these granulations.

The theory one had formulated was that the epidermis coalesced with the granulations, and that the latter ultimately formed a deep true and vascular layer of skin.

This theory was suggested by the following observations.

The patient in question had a severe burn which had just skinned over when she received a blow on the centre of the cicatrix (during an epileptic fit) and a blood blister formed; on opening the blister granulations were seen to a limited extent, but when one endeavoured to turn back the epidermis, a point was reached where the epidermis and the granulations were firmly joined together.

There was only one way to absolutely ascertain the exact nature of the newly formed tissue, and it was not until a few weeks ago that an opportunity of doing this presented itself.

In this case the patient had had a large ulcer of nineteen years' duration; it measured $8\frac{1}{2}$ by $6\frac{1}{2}$ inches and was deeply excavated. It healed very well till it measured $3\frac{1}{2}$ by $2\frac{1}{2}$ inches and then, from some cause, healing came to a standstill, and I determined to scrape it, and in doing so I removed a small portion of the cicatrix (under an anæsthetic). I kept half the portion removed for examination, and sent the other half to the Clinical Research Association for examination and report. The specimen proved to be true skin, nearly but not quite physiologically perfect. The following is the report of the Clinical Research Association:—

THE CLINICAL RESEARCH ASSOCIATION, LIMITED.

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1 SOUTHWARK STREET,
LONDON BRIDGE, S W.

June 2nd, 1897.

LABORATORY REPORT.

To DR. GEORGE STOKER.

The specimen marked "M. C." received here on May 27th has been duly examined, and I have been instructed to forward the following report thereon:—

The sections of the tissue examined show that the specimen consists of epidermis and true skin.

The epidermis is thick and possesses a specially thick layer of horny epithelium. This epithelium is of normal character, the stratum granulosum being well developed.

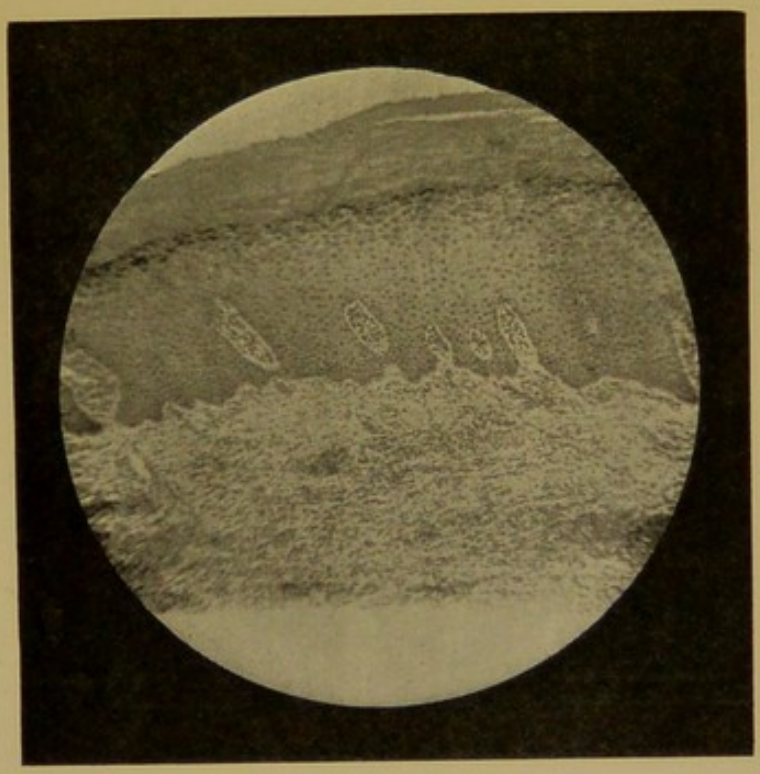
The cutis is infiltrated to a considerable extent throughout with an exudation consisting of round and oval cells. The arrangement of these cells is in groups, probably round blood-vessels, and in lines corresponding to the lymphatic vessels of the skin, it is also found in the papillæ. 'Mast cells' are present in considerable numbers in the neighbourhood of this exudation.

The arrangement and character of the round cell exudation suggests some form of new growth of mesoblastic origin rather than the exudation of inflammation or that of any of the specific granulomata.

N.B.—Probably a more definite opinion could be obtained if some points in the history of the case were communicated.

C. H. WELLS.
J. H., *Secretary.*

One Prepared Slide enclosed as requested.



It will be seen by the foregoing and by examination of the micro-photograph that the new tissue is almost true skin, it lacks only sweat glands and hairs to be so. The absence of these two structures proves its genuineness, and are conclusive negative arguments showing the new tissue produced by the Oxygen Treatment in this case is a great deal more than an ordinary cicatrix, and little less than true skin. I am told by a competent authority that some of the cells mentioned in the report are probably of an embryonic nature, and that future developments may be expected in reference to them.

9.9.98

Printed by W. & F. Heal, 126 High Road, Willesden Green.

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