OBSERVATIONS RELATING TO THE SYMPTOMS AND EFFECTS OF OXYGEN INHALATION.

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General effects.—Patients inhaling oxygen for lengthened periods experience various sensations, some patients feeling very easy and comfortable during the inhalation; others, on the contrary, feeling great discomfort, so much so that the use of the gas has to be temporarily suspended. Many patients state that they breathe much more freely under oxygen, and experience a great sense of freedom about the chest, especially beneath the sternum. Others complain of very severe supra-orbital headache with a feeling of fulness in the head and throbbing. Some complain of light-headedness, which may go on to vertigo. This was very pronounced in one of the cases cited, and, fearing some unpleasant complications, the use of the gas was stopped for three or four days.

Hypnotic action.—Many patients become very drowsy on taking the gas, and yawn repeatedly, some sleeping during the greater part of the day, and seem to be especially sleepy when they are not taking food; the gas seems to exert its full hypnotic influence in these cases.

Action on the circulatory system.—Oxygen acts as a cardiac stimulant causing increased action of the heart at first; this soon, however, comes back to its normal state. The pulse is sometimes accelerated, but more frequently remains unchanged; in cases of debility it is often reduced in frequency.

Action on the respiratory system.—Oxygen inhalation does not seem to have any marked effects on the respiratory system; as I have already stated, the breathing seems to be rather freer, giving rise to a feeling of warmth and comfort in the chest. The respirations are quite regular and normal. Its action is very beneficial in cases of insufficient entrance of air into the lungs, as in dyspnoea and orthopnoea, in which the patients are usually very cyanosed.

Action on the digestive system.—Many patients complain of a feeling of dryness of the mucosa of the mouth and pharynx during the inhalation; this is soon relieved by a drink of acidulated water. Oxygen has a marked effect on the appetite, stimulating it to a remarkable degree; one patient, who always had a very small appetite, told me that since taking the gas she feels as if she could eat almost anything. The gain in weight in this particular case attests the fact that an increased amount of food is assimilated, during the taking of oxygen.

Action on the temperature.—I trust that I shall be able in this paper to fully substantiate the claims of oxygen gas as an antipyretic agent in cases of high temperature. The temperatures of
all the patients directly inhaling the gas at the Hospital are carefully recorded—these being taken in the morning at 7 o'clock before they take the gas, and recorded; then taken again, and recorded, at 7 P.M., before they have the oxygen inhalation stopped for the night. During my observations on the temperature, I have noticed that oxygen acts by reducing the temperature considerably, this being especially marked in cases of high temperature. This was very beautifully brought out in one of the pneumonia cases, where the patient had a temperature of 103°5 F., and after inhaling 3 cubic ft. of oxygen it fell to 99° F. It very often brings a normal temperature slightly to the subnormal, this antipyretic use of the gas being especially marked in cases of pneumonia, or in cases of feverish headaches.

**Action on micro-organisms.**—Oxygen exercises a selective power in reference to micro-organisms, wounds, ulcers, lupus, etc., causing some to grow larger and flourish, and causing others to grow smaller and in some cases to disappear altogether. In cases where healing is progressing favourably, it has been found that the staphylococci especially (*Staphylococcus pyogenes albus* and *citreus*) are in great abundance, and flourish. The greater the number of staphylococci present, the more favourable the prognosis as to the ultimate cure of the diseased condition, their presence in healing wounds having led me to regard them as "beneficent" or favourable micro-organisms. In badly healing ulcers, etc., it has been found that streptococci in erysipelas conditions, and a series of rod bacilli and diplococci in others, predominate over the staphylococci—these are regarded as "malignant organisms." Oxygen causes the beneficent organisms to grow larger, and also causes them to be more easily stained by various staining reagents. The *Staphylococcus aureus* and *albus* probably act in the ulcer or wound by absorbing the poisonous matters on which they live, their excreta again poisoning the wound; but not being sufficiently virulent are more readily oxidised and purified by the oxygen, and the process of healing thus precipitated.

**Action on unhealthy tissues.**—Oxygen exerts a stimulating action on unhealthy tissues, causing the pale unhealthy granulations to sprout and flourish, and allowing the newly formed epidermis to grow in rapidly from the sides. At the same time it does not produce irritation of the denuded surface, as dressings immediately applied to the part would, especially if the dressing be saturated with carbolic or corrosive sublimate, which, however, diluted exerts a certain amount of irritation. Oxygen keeps the parts beautifully clean and sweet-smelling, thus acting as a very powerful disinfectant and deodoriser. Its latter action was very well brought out in some cases of atrophic rhinitis, treated by oxygen, the ozsena with its heavy, pungent, foul-smelling odour entirely disappearing after a few applications.
TREATMENT OF LUPUS BY OXYGEN.—I have been fortunate in seeing upwards of twenty cases of lupus most successfully treated during the past year at Dr. George Stoker's Private Hospital. As this mode of treatment has only within recent years come to the knowledge of the profession, and as cases of very chronic ulcers, wounds, eczema, lupus, and also very bad cases of pneumonia, have been very successfully treated by this means, I devoted upwards of a year in carrying on research work on this interesting subject, as well as a series of experiments on dogs, under the direction of Professor Vaughan Harley.

I wish, in this paper, to submit the results obtained in my experiments, and also to fully report some of the cases under my observation. Before describing the cases, I shall just briefly give the outline of the routine treatment which was adopted. The patient on admission has the lupoid areas on the face carefully scrubbed with sterilised water and soft soap; then a sterilised water dressing is put on for the night, and the following day the patient is operated on under an anaesthetic, when the parts are most thoroughly scraped. Then a sterilised water dressing is again applied to the parts, and kept on for the rest of the day and night. The following day the patient is ready for the oxygen treatment. The gas is applied to the parts by a specially made mask which closely fits the parts on the face which it is intended to treat. The gas is at first applied considerably diluted (\( \frac{1}{2} \) of oxygen to \( \frac{1}{6} \) of sterilised air), and, as the patient is able to bear it, it is from time to time increased in strength.

Each patient receives a bag full of oxygen in the morning, which is connected by a tube with the mask on the face, and in this way the gas is allowed to play on the unhealthy tissues all day, and removed at night, when the sterilised water dressing is again applied. The gas used at the hospital is that prepared by Messrs. Brin, and is, in my experience, the best. A very ingenious apparatus for charging the bags with the desired proportions of sterilised air and oxygen has been devised.

The following description will make it easily understood:—

Oxygen is let in from the cylinder, till the movable part of the gasometer registers \( \frac{1}{2} \) on the graduated scale painted alongside of it, then tap of cylinder closed. Next, air is pumped in, passing through a wash-bottle, so that by the time it reaches the gasometer it is very thoroughly sterilised. The gasometer is then filled with the sterilised air, so that at the end of operation it contains \( \frac{1}{4} \) oxygen and \( \frac{3}{4} \) sterilised air. The bag is next filled, and so replenished from time to time for bedside use. The gas bag holds 1 cubic ft., and is sufficient for ten hours. The parts to which the gas is applied are enclosed in specially constructed apparatus. For example, in a case of ulcer or wound of the leg, the part is enclosed in a wooden box, with a window of glass at the top, through which
the progress of the ulcer may be watched without unnecessarily disturbing the patient.

The temperature in the enclosure is kept at between 80° and 90° F., and is regulated by placing hot-water bottles in the enclosures. It is found that oxygen acts best in a warm moist atmosphere.

In cases of lupus of the face, the patient wears a specially constructed mask, similar to that used for administering ether. In affections or injuries to the scalp the patient wears an india-rubber cap, and the oxygen is conveyed into the cap by a tube.

RÉSUMÉ OF THE VARIOUS MODES OF APPLYING THE GAS TO DIFFERENT PARTS OF THE BODY.—1. In cases of head injury or disease of the scalp, such as favus or ringworm, the gas is applied by a tightly fitting cap, connected with the bag by a tube. The patient is able to go about, and if he feels well enough generally, is able to engage in manual work.

2. In cases of abrasions or diseased conditions of the face, such as lupus, the gas is applied to the part by specially constructed masks, in the same way as above. In disease on parts around the eye, a window of glass is let into the mask, through which the patient can see. In application to the ear, an inlet tube projects about three-quarters of an inch inside the mask, and thus the current of oxygen is directed into the external auditory meatus. This is useful in cases of eczema of these parts.

3. In wounds or ulcers on the thorax, the gas is applied in the same way, the mask being secured to the part by a strap around the body.

4. In cases of ozena, the patient receives the gas through one nostril, the other being plugged with cotton-wool, breathing through the mouth, to avoid inhaling the gas—the unhealthy crusts being previously removed by syringing with alkaline lotions. In cases of pneumonia, the pure gas can be similarly applied, but in this case the patient inhales the gas. In cases where masks are used on the face or any part of the body, it is not desirable or necessary that they should be air-tight, as ventilation is highly necessary. This is easily managed by the apparatus not fitting too closely to the skin surface, which allows the passage of oxygen and sterilised air from within out; and, being at a greater pressure, prevents entrance of impure air from without in.

Before entering on a description of the various cases, it will be of interest to briefly allude to how this very satisfactory form of treatment came into existence, and how the idea was suggested to Dr. Stoker, its originator.

It was while serving in the Russo-Turkish and Zulu wars that he had an opportunity afforded him of attending several bad wounds. It was especially during the Zulu wars that he was greatly im-
pressed. He noticed that the Zulus, being averse to surgical operations, usually retired to the uplands with their wounded, where the air was pure and the sun warm and scorching. The wounds healed in a really marvellous manner. He attributed this partly to the warm dry air, which retards the progress in the growth of streptococci, staphylococci, and rod bacilli, and thus largely helps to hinder the progress of pus formation and ulceration, and partly to the ozone in the air, which is usually most plentiful just after a thunderstorm. To the rapid cure and progress of ulcers in the natives of South Africa I can fully testify, having lived amongst them for upwards of twenty years, and seen wonderful cures of some really bad wounds and ulcers.

I shall now proceed to describe some of the cases of lupus treated by oxygen which have come under my notice during the past year.

**Case I.**—K. C., Dublin, st. 19; single; admitted March 6, 1899; discharged April 20, 1900.

**History.**—

(a) **Family history.**—Father died of heart disease after influenza. Mother alive and well. One brother alive. Patient has comfortable home, good surroundings, and plenty of good food. Takes no stimulants.

(b) **History of disease.**—Patient has always been healthy and never had any ailment. About ten years ago she noticed a small red spot just under the chin. At first nothing was thought of it; but after a while another spot appeared close to this one, the two amalgamated, and the condition gradually became worse.

(c) **Previous treatment.**—She then became anxious, and consulted a doctor, who treated her with sulphur ointment externally and an iron tonic internally. She remained under this treatment some months, but it gradually got worse, and then broke out in one spot on the point of the nose, the spot under the chin gradually spreading to each cheek. She next went to Richmond Hospital for some time, where she was scraped and cauterised by Sir Thornley Stoker several times. She improved considerably, went out, and attended as an out-patient for some time. Unfortunately the condition again started; she was again taken into hospital, and this time inoculated between the shoulder-blades with Koch's tuberculin. She felt very ill after the first few inoculations. Her temperature going up, the inoculations were stopped for two days. Thereafter she had them daily for some weeks. This had a very beneficial effect, the lupoid areas drying up and disappearing. She went home, thinking she was completely cured; but after two months it again started, so she went back to Richmond, and attended there off and on for eight years.

(d) **Present treatment.**—On the 6th of March she came to Dr. Stoker's Hospital. When I saw her early in May, the lupus had completely removed the soft tissues of the nose, involved both cheeks, and spread down the neck. The two months oxygen application had completely dried up the unhealthy tissues around the mouth and chin and upper part of the neck. She was then receiving applications of oxygen...
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to the cheeks. She made marked progress, and by the end of July the right cheek healed, and then the left cheek was treated and left lower eyelid. By end of November this had greatly improved, and by the end of December was nearly completely healed, except for a small spot on the centre of the left cheek. This has been a very chronic case; but the patient is progressing very satisfactorily, and will shortly be discharged.

TREATMENT OF PNEUMONIA BY OXYGEN INHALATION.—Oxygen gas has during the last few years come to play such an important and extensive part in the treatment of pneumonia, that it is at the present time considered to be one of the chief therapeutic applications in this common and oftentimes fatal disease. It has, up to very recently, been used only in that stage of the disease where there is marked difficulty of breathing and cyanosis, and it acts most beneficially by relieving the dyspnœa.

It has been my experience that the earlier in the course of the disease oxygen is administered, the better the prognosis is for ultimate cure of the patient. It certainly does no harm; on the contrary, it acts most beneficially, by reducing high temperature, and greatly eases embarrassed respirations.

At the hospital the routine of treatment adopted in cases of pneumonia is the giving of oxygen at the very beginning of the disease, just immediately after the initial rigor and rise of the temperature. Poultices are of course applied, and drugs given when indicated for cough or cardiac weakness. The gas is given to the patients by means of a tube attached to a gas bag, and ending in a soft bulb, which is inserted into the nostril. It is, I think, advisable that the oxygen should not be used direct from the cylinder, but should be decanted into a gas bag before being inhaled, because—(1) The oxygen in the cylinders and issuing from them is at far too low a temperature to be used with safety for inhalation. (2) By the use of a bag containing a certain amount of the gas, you can accurately estimate the amount used per hour, and better regulate the pressure under which the gas is inhaled. In the twelve cases which have come under my notice very excellent results were obtained by the early administration of the gas. The effect on the temperature was very marked indeed.

Case 2.—Miss F., Dublin, aet. 23; single; admitted May 2, 1899. Patient complained of a feeling of chilliness, with pain in the back and left side; headache and vomiting.

History.—(a) Family history.—Father died of congestion of the lungs. Mother alive and well. One brother died of scarlatina. One sister of consumption. Four sisters alive and well.

(b) General history.—Patient previous to the time she was taken ill had a most comfortable home with good surroundings, plenty of fresh air, and good food. She takes no stimulants.
(c) Previous illnesses.—As a child, patient had measles and scarlet fever, and had congestion of the lungs when about 18 years of age.

(d) Present illness.—About the end of April patient caught a very severe chill, in crossing over from Ireland. She felt very poorly for two or three days, and on May 2 she developed pneumonia in the left lung. On the above date she got up as usual to attend to her duties, but was shortly afterwards obliged to return to bed. She had a very severe headache, her face was flushed and cough troublesome. She complained of pain above the left breast, running backwards below the left shoulder-blade. At 10 a.m. the temperature was 103° F., the pulse 95, and the respirations 30. In the afternoon she began to bring up glutinous expectoration, with the characteristic “prune juice” colour.

(e) Physical signs.—On inspection, marked impairment of movement on the left side; dulness on percussion over the left base. On auscultation, the vocal resonance was found to be markedly increased, tubular breathing elicited, and fine crepitations heard all over the base and back of the left lung.

(f) Treatment.—In the early morning 10 grs. of phenacetin were given to relieve the headache. At 4 p.m. the inhalation of oxygen was begun, and linseed poultices were applied to the side and back of the left chest. At 10 p.m. the temperature had fallen to 101°. On May 3 (the second day), at 2 a.m., the temperature was again 101°·6; at 6 p.m. it was 99°. There was very little cough, and no pain; and the expectoration, which had much diminished, was only slightly discoloured. At 6 p.m. the temperature was 102°·2, the pulse 92, and the respirations 20. She passed a quiet night, and at 10 p.m. the temperature fell to 100°. On the 6th, at 2 a.m., the temperature was normal; at 6 a.m., and also at 10 a.m., it was 98°·2. The pulse was 72, and the respirations were 20. There was very little expectoration, and it was untinged. The poultices were discontinued. Up to this the oxygen inhalation was continuous, the amount used being 1 cubic ft. in two hours. On the 7th the patient slept well all night. There was no cough, pain, or expectoration. On this day only 2 or 3 cubic ft. of oxygen were inhaled at intervals. The temperature was 97°·4 at 2 a.m., and 97°·6 at 6 p.m. On the 8th the patient’s temperature was 97°·4 at 2 a.m., and 97°·8 at 6 p.m. As she was feeling well, she was allowed up for a couple of hours. She must have got a chill, for on the next day, May 9, she had a severe rigor at 7 a.m. At 10 a.m. her temperature had risen to 102°, and the cough and rusty expectoration—in fact, all the original symptoms—reappeared. In the early morning she had 10 grs. of phenacetin to relieve the headache. The poultices were renewed, and oxygen inhalation resorted to. At 10 p.m. the temperature was 103°.

On the 10th, at 6 a.m., the temperature was 100°, the pulse 92, and the respirations 32.

On the 11th the temperature went up to 103°, pulse 100, respirations 28.

On the 12th, 6 a.m., temperature had fallen to 101°, and in the evening at 7 p.m. it had reached the normal.

On the 13th, 14th, and 15th there was no change in the condition of the patient, the temperature fluctuating between 97°·2 and 97°·8.
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There was no pain, cough, dyspnœa, or expectoration. The oxygen was discontinued.

On the 16th, 17th, and 18th, patient continued to improve, and was up for a short time during each of those days. She took her ordinary diet, and slept well at night.

On the 24th she left for the "Nurses' Convalescent Home" at Brighton, where she spent three weeks. She returned looking very well, having regained her usual good health, and being once again able to resume her ordinary duties.

(g) Sputum.—A cover-glass preparation of the expectoration was made which showed the Diplococcus pneumoniae, and tubes inoculated from the sputum showed the same micro-organisms, also epithelial cells, and débris composed of epithelial cells undergoing degeneration, and blood corpuscles.

The Oxygen Treatment of Ulcers.—Historical.—I do not intend entering into any elaborate details, but wish briefly to summarise the treatment of ulcers from the earliest time to the present-day treatment.

The treatment of wounds, ulcers, and other abrasions of the skin surface has occupied the minds of men from the earliest times. Hippocrates, Galen, Celsus, Fallopius, and many of the older writers, make mention in their works of various forms of ulceration and their treatment. The surgeons of the seventeenth century held the theory that all diseases, including ulcers, were caused by the presence of certain humours in the body, and that by getting rid of these they hoped to cure the local condition of ulceration. In order to do this efficiently, they gave their patients either very drastic internal remedies, or resorted to extreme blood-letting, measures which certainly did not effect the cure it was intended, but, on the contrary, made them considerably worse.

Later on, certain applications began to be used, such as oily infusions, animal fats, emollient cataplasms, and dusting powders such as barley flour, and resinous substances such as pitch and tar. Still later, agents began to be applied with a view to stimulating the process of healing in the ulcer, such as blue stone (copper sulphate), lunar caustic (silver nitrate), lead lotion, and many other preparations.

Then the germ theory of disease came into vogue, by which it was demonstrated that certain micro-organisms were responsible for the inflammatory condition and attendant pus formation met with in the process of ulceration. Various theories were then propounded as to where these organisms came from. Some maintained that they originally existed in the blood, and made their presence felt when from any cause the vitality or tonicity of the tissues locally was lost; or the vitality of the individual as a whole was below par, as, for example, after certain debilitating diseases. Others maintained that these organisms were present in
the lymphatics primarily, and got into the blood streams indirectly. Another party favoured the view that these minute organisms got into the system through the pores of the skin and sebaceous ducts, directly.

Whatever view might be favoured, the fact remained that all forms of inflammation and ulceration were associated with the presence of micro-organisms. The next step was to find the means of getting rid of these intruders. It was found that a great many of the acute inflammatory and ulcerative conditions were markedly improved by keeping the inflamed surfaces clean, and resting the part, and toning up the tissues by giving tonics internally.

Then certain antiseptic agents came to be locally applied, such as boracic lotion, carbolic lotion, corrosive sublimate; and dusting powders, such as iodoform powder and boracic powder; ointments, such as iodoform, boracic, mercuric, etc. Good results have also been obtained by massage, and by skin grafting in extensive ulcerations. These various remedies certainly proved themselves very effective in most cases; but, unfortunately, in some cases of chronic ulcers they have done little good—in fact, have more often done just the reverse. This may be due to the too great anxiety on the part of the medical attendant to cure the condition too quickly, and applying these agents in too strong solutions, which are undoubtedly detrimental to the process of healing.

John Hunter, in his treatise on the blood, says: "In reference to lead lotions, I am certain I have seen lead increase such inflammations, particularly in many inflammations of the eyes and eyelids, and I believe it is a bad application in all scrofulous cases and processes of ulceration."¹ Benjamin Bell states that he has derived great benefit by applying pressure in cases of not very acutely inflamed ulcers; he does this by applying stockings and bandages, which support the part and prevent oedema. He further goes on to say that "whatever tends to keep up any considerable inflammation in sores has a certain effect in putting a total stop to the production of granulations. Hence the necessity of removing from the wounds and ulcers every extraneous body, or whatever tends to produce irritation; and from the same circumstances is accounted for the great advantage of dressing seldom, with mild simple applications, instead of the practice which formerly prevailed (and often still prevails) of dressing much more frequently, and that, too, with very complex irritating ointments and washes; the careful removal of all irritating pus by keeping the surface of ulcer clean, and promoting the formation of laudable pus."²

Watson Cheyne says that in order to treat cases of ulceration properly, you should remove the various causes of irritation, which

¹ "Treatise on Blood," p. 350.
² "On the Theory and Treatment of Ulcers," pp. 155, 159, 164.
he classes as—(a) mechanical (bandages and dressings); (b) chemical (chiefly in form of sepsis); (c) presence of decomposing discharge on the surface. I could quote several more authorities to show the baneful results arising from the application of dressings or too strong antiseptics to ulcerated or wounded surfaces, but it would only take up unnecessary space and time.

Various methods have been applied within recent years to obviate the direct application of antiseptic dressings and agents to the affected parts. These are as follows:

(a) **Finsen’s phototherapy.**—Finsen found that certain chemical rays (blue-violet, ultra-violet) caused an inflammation (erythema solare) of the healthy skin, and he assumed that they would be capable of aggravating pre-existing inflammation. If, therefore, the skin was protected against the injurious action of the chemical rays of light, it would be possible to diminish the intensity of the inflammation. The object is therefore to exclude the rays of light which are injurious to the skin. This new mode of treatment is now used by Finsen with great success in the treatment of superficial bacterial skin diseases.

(b) **New method of applying antiseptic dressings.**—Reid, in his article on the treatment of burns and other surface wounds, says: "The surgical dressings are not placed on the wound, but on a light wire cage or support, which thus, while permitting them to afford protection, prevents them from acting as foreign bodies. The apparatus, when properly adjusted, may be covered by any dressings the surgeon may choose, and it is retained in its place by strapping or bandages."

The surface of the wound is sponged thrice daily with some mild antiseptic fluid, such as boracic acid or weak (1-40) carbolic lotion, otherwise the discharges from the wound, coagulating, form a cake under which pus is retained, which acts as a foreign body to the wound. The advantages claimed for the above method are briefly—(1) Using foreign bodies (i.e. dressings and antiseptics), not as applications directly to the wound, but retaining them for the purpose of protection. (2) The wound is quickly, easily, and painlessly dressed. (3) It prevents superabundant granulations forming, and it gives rise to a smooth cicatrix, and not to the thick cicatrices which are often puckered, owing to the contraction of the excessive fibrous tissue formation, in wounds or ulcers treated by direct antiseptic dressings.

(c) **Holländer’s hot air treatment.**—This method of treatment was first suggested to Holländer by Sneguirew, who successfully utilised steam, at his gynaecological clinique at Moscow. Holländer first tried steam applications to the diseased parts, but did not meet with very marked success. An idea then struck

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1 "Treatment of Wounds, Ulcers, and Abscesses," p. 119.
2 *Brit. Med. Journ.*, London, 1899, vol. ii. pp. 1187–1188.
3 *Ibid.*, 1899, vol. ii. pp. 825–830 and 1378.
him that heated air might be more efficacious, and in order to apply this he devised a very ingenious apparatus—a coiled tube in connection with a cylinder containing air under pressure, the air passing through the coiled tube, which was kept at a red glow by a Bunsen burner. The air was heated to a temperature of about 300° C. The heated air can be concentrated on the diseased tissues, like the Paquelin cautery, without damaging the surrounding healthy tissues. He applied the air to the parts under an anaesthetic, and states that the patients do not feel any painful after-effects: this, he thinks, is due to the fact that the nerve endings of the sensory cutaneous nerves had been destroyed by the heated air. The parts subjected to the hot air become very white and bleached, but after a few days, when the circulation is re-established, assume their normal colour again; the parts soon healed again, the unhealthy tissues sloughing off, and a new skin growing over the parts from the centre of a mass of granulation tissue. After the hot air is applied, a boracic lanoline ointment is applied to the parts on a dressing.

Holländer had some excellent results with this mode of treatment, especially in cases of lupus. He describes some very good cures of the latter, especially one case of a boy who had the disease upwards of fifteen years, and presented a leprous appearance, so much so that he was debarred from all society, and became a burden to himself. This is a result which compares very favourably with one chronic lupus case, K. C., which I have already detailed.

Holländer\(^1\) also reports another interesting use to which he has put this hot air. After a very extensive operation for total extirpation of the gall bladder and cystic duct for carcinoma, there was extensive haemorrhage, and this was successfully checked by the application of heated air.

We now come to the treatment of wounds and ulcers by oxygen gas. As I have, during the past year, used and seen it used with very great success in cases of chronic ulcers, that have withstood all other forms of treatment, I think I am justified in claiming for oxygen gas a place among the numerous therapeutic agents that have been brought forward in the treatment of ulcers and abrasions of the skin.

The effect of oxygen on micro-organisms has already been referred to in an earlier part of the paper. In a series of experiments I made along with Dr. Stoker, we got some very interesting results. We took a scraping from a very chronic ulcer on the leg of one of our female patients who had come into the hospital, and made a culture on agar-agar jelly, inoculated this at body heat.

\(^1\) Holländer, "Ueber die Heisluft Cauterisation im Speziellen bei Lupus Vulgaris," *Deutsche med. Wochenschr.*, Leipzig, Bd. xxiii. S. 688, 690; "Total Extirpation der Gallenblase und des Ductus Cysticus wegen Carcinoma, Blutstillung mit Luftcauterisation," *ibid.*, Bd. xxiv. S. 413.
(37° C., or 98°-6 F.) in an incubator, having a self-regulating gas jet, and, after forty-eight hours, prepared a slide, stained and examined microscopically. We found a great number of rod bacteria, micrococci, and diplococci. We then transferred the rest of the culture to a glass flask exhausted of air, removed the cotton-wool stopper covering the opening of tube, and filled the flask with oxygen, thus allowing it to play directly on the culture. After a few days we examined it again, and found that the staphylococci had increased in amount and size, and that the diplococci and rod bacteria had grown much smaller.

In conclusion, I shall briefly state the effects I have observed by the application of oxygen to the ulcerated surface, and give a short account of the routine treatment adopted.

(a) The effect on the ulcer.—(1) It acts very beneficially in alleviating the unpleasant sensations of pain, burning, throbbing, and heat in the part. (2) It dissipates the heavy, unpleasant, sickly odour of the ulcer. (3) It acts as a powerful stimulating agent, without causing irritation of the tissues. It thus practically embodies all the most important uses of any of the antiseptic agents, with the additional benefit that it is non-irritant.

(b) Routine treatment in hospital.—The patients, on admission, have the parts thoroughly cleaned; the ulcer and surrounding tissues are thoroughly washed with soft soap and water; next, a sterilised water dressing is applied. The oxygen is then applied to the part, the limb being enclosed in a box, and the gas allowed to play on the ulcer. The gas is applied in varying strengths, 1 in 8 of sterilised air being usually employed, i.e. $\frac{1}{8}$ of oxygen, or 12 per cent.; or sometimes 1 in 4, i.e. $\frac{1}{4}$, or 25 per cent. This is gradually raised to $\frac{1}{3}$, or 50 per cent.

The patients have the gas applied at 9 o'clock every morning, after having had a sterilised water dressing on all night. At 6:30 in the evening the oxygen is removed and water dressings again applied. The oxygen forms a fine parchment-like film round the margins of the ulcer over the newly-growing skin, and this is from time to time removed by forceps so as to allow the oxygen to reach the underlying tissues.

Sometimes the skin around the ulcer becomes very dry, and, to prevent the skin cracking, lanoline is rubbed in. The patients are not kept in the recumbent position all day, but are allowed up for two hours in the morning and three hours in the evening.

The following case, which is very briefly described, gives the salient points bearing on the treatment, and demonstrates the beneficial results obtained.

Case 3.—Mrs. E., at 30; admitted June 30, 1899.

(a) Family history.—Good. Personal history of contracted syphilis from her husband, who is a sailor.

(b) History and description of ulcers.—About two years ago the patient noticed a small ulcer on the outer side of the right ankle, which
appeared after a fall she had. This gradually became larger and extended in various directions, going on to front of lower end of leg. Six months later a similar ulcer appeared on the outer side of the left leg, commencing just a little above the external malleolus, and gradually involving the whole of the outer and lower one-third of left leg. She was attended at home by a doctor, who gave her some medicine internally, and applied various lotions and ointments locally; she was laid up for upwards of a year. On the 30th June she came to hospital. The ulcers, on admission, were pretty extensive. In parts they resembled syphilitic ulcers, in being very punched-out looking, but the general appearance of the ulcers was not that of a typical syphilitic ulcer. She had oxygen applied on July 1, and at first very slight, almost imperceptible, improvement was noted; but after a month of the treatment the improvement was very marked. She had the oxygen applied in various strengths, and was discharged cured on the 4th November.

NOTES ON THE SURGERY OF JOINTS.

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During the past ten years, 1890–1899 inclusive, 540 joint operations have been performed by us. A study of the cases brings out some interesting facts which may be worth the attention of hospital surgeons in England. The relative infrequency of amputations is noticeable. There were only twenty-eight amputations for disease of large joints, as compared with 201 conservative operations, the latter including incisions into and drainage of joints, as well as arthrectomy and excision.

During the decade 1876–85 inclusive, at St. Thomas's Hospital, McCormac states that there were 338 amputations for disease with thirty-six deaths, and 338 excisions of joints with thirty-nine deaths. This was in the transitional period of antiseptic surgery.

At the Edinburgh Royal Infirmary, during the three years 1894–6 inclusive, there were 127 amputations for disease of joints, with eight deaths, against 352 conservative operations, arthrectomy, etc., with seven deaths. Here we see the influence of aseptic surgery, reducing the death-rate to a very low figure, and at the same time saving scores of limbs which would have come to amputation a decade earlier.

The Kashmir ratio of amputation is still lower; had it been the same as at Edinburgh, sixty limbs would have been amputated instead of twenty-eight. And, from personal knowledge of the class of cases in both instances, I venture to think that the Kashmir cases are of a worse kind, or in a more advanced stage.

We regard amputation as a dernier ressort, and even when we considered it desirable, as in perhaps ten or fifteen other cases,