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TREATMENT

OF

ULCERS BY ELECTRICITY.

BY

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HAVING alluded incidentally to the local treatment of ulcers by electricity,* it may not be out of place to say a few words generally in regard to the mode in which it should be employed.

Before we begin the treatment, it is well to cleanse the ulcerated surface thoroughly with warm water and soap, and dry with a piece of old linen or soft sponge. We should then apply a disk of platinum, silver, or zinc connected with the positive pole of the battery, directly to the base and sides of the ulcer, closing the circuit by an electrode previously covered with clean linen and well moistened with warm water. The electrode should be applied to the edges and around the ulcer for five or six minutes. After this, we should use for a minute or two longer both poles labile around the sore, to the extent of an inch or more, in order to modify malnutrition and stimulate the enfeebled capillary circulation, as well as to electrolyze the callous and infiltrated tissues surrounding the ulcer, and to promote absorption of the exudations.

Should a case of noma pudendi, canceroid, sloughing ulcer, etc., present itself, I use occasionally as an auxiliary with electricity, a saturated solution of chlorate of potassium, dilute nitric, sulphuric, or hydrochloric acid. I prefer, however, to use the dilute mineral acids, on account of their astringent and

* Part of a paper on the Construction, Use, Mode of Application, etc., of the Galvanic Nipple-Shield.

chemical properties. I cover the bottom of the ulcer with a little lint, cotton-wool, or granulated sponge, and then wet the sponge with whatever agent the nature of the case may require, and apply the metal disk directly to the saturated material, and while I keep one electrode stationary for a few moments in the ulcer, I work the second conductor slowly around the diseased part. I maintain this mode of treatment daily for a few applications, or until the recuperative process is manifest in the ulcer.

It is unnecessary for me to give here a detailed account of the electro-chemical changes which take place at each pole when applied to ulcers, especially when using the various remedial agents mentioned. It will be sufficient for my purpose to remark, that if I wish to use a powerful diffusive agent in a nascent state, such as the chloride of zinc, chlorine, oxygen, etc., I have the immediate means at command.

By this method of treatment, and in some special cases also, the advantages of both electricity and topical medication are combined, and are in direct application to the diseased part, and thus we are furnished with reasons to expect more decided and beneficial results than could be hoped for by a single remedy.

I avoid generally, after local galvanization, all greasy applications to ulcers, and employ as a dressing a little lint, dry or wet with the solution of chlorinated soda, pure or diluted with water. Occasionally, if the ulcer is small and well filled with good, even healthy granulations, I allow nature to take her course in forming a sound cicatrix. This is done by exposing the ulcer to the oxidizing influence of the air for a short time.

When treating ulcers by the electrolytical method, speedy and better results can be obtained by applying the galvanic current as strong as can be comfortably borne, keeping the poles close to each other for five or six minutes in and around the ulcerated part, and by having a *séance* once or twice a day until there is a decided manifestation of a healing process visible, when every third or fourth day will be sufficient for a sitting.

Should an exuberant growth of granulations spring up in the ulcer, an electrode of silver or platinum connected with the negative pole should be applied directly to the spongy mass, and

the circuit closed on the adjacent parts, and then a strong battery current should be employed, but not too powerful to cause pain, until the granulations present a smooth, shrunken, and seared appearance, as if they had been slightly cauterized with a hot iron. After this effect is produced the poles should be reversed, and the *séance* finished with the positive pole in the ulcer for two or three minutes longer.

I have noticed when treating ulcers, particularly open buboes, with the negative pole by means of a metallic conductor in the sore, that the effect of the action of the pole is somewhat similar to that produced by the local use of the peroxide of hydrogen.

Fistula in ano, when free from any complication, can be successfully treated by introducing an electrode of platinum (a silver probe will answer) into the fistulous canal, and into the rectum a scoop of wood or hard rubber. The circuit should be closed by the application of a well-moistened chamois-covered disk on the neighboring parts, and moved slowly around and over the fistulous canal in a labile manner. The object of using the scoop when the fistula is complete, is to allow the free end of the metal electrode, when inserted in the sinus, to rest against it. By this means we can avoid causing unnecessary irritation or pain in the rectum during the application. The rectal scoop is not required when the fistula is incomplete, with the opening external. The advantages of this simple and bloodless method of operating are, that it does not need any preparatory treatment, or cause hemorrhage, inflammation, nor absence from business. The fistula neither requires dressing, nor is constipation of the bowels necessary after the operation. One application of galvanism is generally sufficient to close the abnormal canal in a few days.

The *séance* should not be longer than from eight to ten minutes when insensibility is rendered by ether, etc. A strong battery current should be applied, using the negative pole in the sinus for five or six minutes, and then the poles should be reversed, and the positive employed in the fistula during the remainder of the sitting; or we may use an application as strong as can be comfortably borne for twenty minutes' duration without the aid of an anæsthetic.

Plated electrodes should not be used on moist or ulcerated surfaces when attached to the positive pole, unless we specially wish to form an oxide of the metal employed. With a negative connection, however, there is no objection whatever to their use.

As a rule, I would recommend generally the use of platinum or gold, and especially when *we desire ozonization*. When the positive pole is formed of any oxidizing metal, ozone is not formed, and the electrode is quickly oxidized.

Dr. Althaus has ascertained, when experimenting on the different animal tissues and fluids of the body by electrolysis, that oxygen, acids, and albumen are accumulated at the positive pole, and hydrogen and alkalies at the negative pole. These agents give the key for further scientific research.

Ozone is supposed to be an intensified or an allotropic modification of oxygen, and is one of the most powerful oxidizing agents we possess; it has a peculiar odor, which somewhat resembles weak chlorine. *Antozone* is also an active condition of oxygen; it unites with water, and is strongly oxidizing in its action. *Oxygen* is a colorless, odorless, and tasteless gas. *Chlorine* is a yellowish-green gas of a peculiar suffocating odor.

When treating a large indolent ulcer, situated on the lower extremity, by galvanism, with the positive pole in the sore, I could easily detect the odor of ozone as evolved.

This fact induced me to subject to galvanization a piece of lean raw beef, with both poles placed about half an inch from each other. I employed plates of platinum, as this metal forms the best electrode for electrolytic purposes.

At the anode (positive pole) the ozone odor emitted was manifest in a marked degree to the sense of smell, while at the cathode a fleshy odor only was perceptible.

I did not wish to trust altogether to the sense of smell; but was anxious to ascertain its presence beyond a doubt by chemical reagents. The following are the methods I employed when experimenting for ozone. I selected a portion of perfectly fresh beef, free from fat, for each test. Meat that had been kept on ice, or with the least tainted odor, should not be used; for though we may succeed with every reagent employed to-

day, we could not perhaps with the same meat obtain a satisfactory result on the following day.

I submitted a portion of a healthy placenta to galvanization. In a few moments the odor of ozone was perceptible in every part of my office, and at the same time I noticed that there was also a large quantity of hydrogen evolved at the negative pole, with occasional mimic explosions beneath the disk, scattering a bloody froth in all directions. The free elimination of both hydrogen and ozone in this instance was to me remarkable, and was in quantity about five or six times as much as I could obtain from a piece of beef of the same size.

The large quantity of oxygen contained in the placenta is evidently intended for the special purpose of further oxygenation of the maternal blood while passing through the placenta to the infant.

When ozone is specially prepared, and in its purity, we meet with no difficulties when testing. But with the methods I have adopted a few extraneous agents are developed at the same time with ozone by the electrolytic action of the positive pole. These substances would necessarily interfere more or less with the character of the tests employed; while the small quantity of ozone sometimes evolved would not be sufficient to characterize satisfactorily a few of the tests; as, for instance, with indigo, a very weak solution should be employed.

The instrument I used when experimenting was a zinc carbon battery of thirty-two cells, manufactured by the Galvano-Faradic Company.

METHOD I.

After electrolyzation of the beef, and the removal of the metal conductors, I laid a piece of white bibulous paper, previously impregnated with a solution of iodide of potassium, and then pressed the paper gently with porcelain buttons against the electrolyzed portions of the meat for a few moments, when a brown stain was produced on the paper, oxidizing the potassium and setting the iodine free. By this method of testing

I found a few agents satisfactory, while others gave only a faint indication of ozone.

METHOD II.

Upon a glass plate I placed a piece of bibulous paper saturated with a reagent, and over the paper a thin slice or shaving of raw beef, lastly the platinum plates. I then employed a strong galvanic current for a few minutes. I expected by this method that as soon as the ozone was evolved, and from its diffusive character, a sufficient portion would at least penetrate the meat, and come in contact with the prepared test-paper. Most of the tests employed by this mode of experimenting gave satisfactory results.

METHOD III.

On a piece of raw beef I applied a strip of thick white blotting-paper (about one-third the width of the conductor), and over it the metal disks. I had my tests, etc., at hand, and as soon as the ozone odor was developed I removed the conductors and immediately brushed the surface of the paper, which had been allowed to remain on the meat, with a test solution. By this proceeding the blotting-paper was impregnated with ozone sufficient to characterize satisfactorily whatever test I chose to employ.

In treating ulcers I have also applied the above method of testing.

METHOD IV.

I placed a piece of beef on the bottom of a small glass jar, and over it the metal disks, and securely covering the vessel, allowed only the wires of the conductors to be exposed outside, to form the connections with the battery. The test-papers were suspended from the inside of the cover, directly over the electrodes. This method gave very unsatisfactory results.

“Necessity is the mother of invention.” I may not have employed the most scientific method of ascertaining the presence of this odoriferous agent; however, such as it is, I am convinced of one fact, that I have discovered that ozone is evolved by the electrolytic action of the positive pole when applied directly to ulcers. I feel assured in saying of this discovery that it will have a very important and practical bearing, and aid us also to

arrive at a more definite and scientific basis, as to which pole we should employ directly in the treatment of diseases by electrolysis. I find no reference whatever regarding its use or mode of application in any work on electro-therapeutics which I have consulted. I am aware that ozone is derived by the action of the ordinary electrical machine, and evolved when we strike together the metal conductors of a galvanic battery in operation, by chemical action, etc.

OZONE.

<i>Tests:</i>	<i>Positive pole.</i>	<i>Negative pole.</i>
1. Odor.....	{ Sensibly manifest to the sense of smell.	{ Fleshy odor.
2. Iodide of potassium and starch..	{ Purplish shade of deep blue.	{ No visible change.
3. Iodide of potassium.....	{ Brown color.	{ No change.
4. Tincture of guaiacum.....	{ A beautiful shade of light greenish blue.	{ Orange yellow.
5. Ferrocyanide of potassium.....	{ Yellow, soon changes to a bright greenish blue.	{ No change.
6. Litmus paper, slightly reddened.	{ Bright red.	{ Blue.
7. Blue litmus.....	{ Reddened.	{ No change.
8. Indigo.....	{ Decolorized.	{ No change.
9. Silver leaf.....	{ Oxidized.	{ No change.

Galvanism, when employed in the treatment of ulcers, possesses many important and decided advantages which are wanting in the usual local remedies daily in use. It is easily applied, and by no means a painful remedy. Its action is various, that is to say, it is electrolytic, catalytic, and thermal.

The elements evolved by the decomposing power of the positive pole, especially when the conductor is formed of an unoxidizable metal, and applied directly to the ulcer, possess the following properties: stimulant, antiseptic, disinfectant, deodorizing, oxidizing, besides possessing the power of coagulating blood and albumen, as well as promoting absorption of the abnormal secretions.

It matters little in the surgical treatment of ulcers what the nature of the agent or agents may be, their action when developed by electrolysis, or whether its beneficial effect are due more to the primary or secondary chemical results which occur in the ulcer during the application; it is sufficient for our purpose when we have the practical fact, that ulcers heal rapidly after its application, generally in about one-sixth the time ordinarily consumed by the usual methods of treatment.

The flabby livid-colored granulations which are usually found in indolent ulcers, after one or two applications of galvanism, are soon changed to a healthy flesh or rose color.

To this method of treatment I would give the name *Galvano-ozonization*, a term which fully characterizes its nature.

I am sanguine enough to believe that we have no single remedy or mode of treatment with which I am acquainted during the thirty years I have been engaged in practice, which can be compared to the *galvano-ozonic method* when properly applied to ulcers. The latter usually heal in one, two, or three weeks, when by other methods they frequently take as many months or more to accomplish.

This form of application does not interfere with any other kind of treatment, local or constitutional, but, on the contrary, allows us to use whatever means the case may require.

Of the electrolytical treatment of malignant ulcers I cannot say as much as regards galvanization alone. My experience of this class of diseases is too limited to give a decided opinion. Of one fact, however, I am certain, it will have a soothing effect, so as to relieve acute pain, and aid considerably whatever local or constitutional treatment may be employed. But this is effected through the direct application of the positive pole. The negative pole in some special cases will occasionally cause the ulcerated surface to slough or spread. Nevertheless, we may use both poles in the ulcer at the same time, or the negative first and the positive pole the last.

The thermal effect of galvanism can be easily ascertained by submitting a piece of cooked fresh beef for a few minutes to a tolerably strong galvanic current, and after the removal of the metal conductors, the portions of the meat which had been electrolyzed will be found heated to such a degree as to be almost impossible to hold in the hand, even for a few moments. The heat developed on raw beef is not so manifest, owing to the large quantity of moisture in the tissues.

Localized faradization, when employed in the treatment of ulcers, affords very unsatisfactory results. This is no doubt due to the feeble electrolytic action of the induced current.