

Papers Presented to Local Branches

CATAPHORESIS OR IONTOPHORESIS.*

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The separation or splitting up of a chemical substance into its elements by electricity is known as "electrolysis." The application of electrolysis to the art of healing is termed "cataphoresis." The word "cataphoresis" should apply only to medication with the basic ion or kathion, and the term "anaphoresis," which has been used for this form of treatment covers both, but is cumbersome to use. "Ionic Medication" is a simpler name, one that is easily understood. It consists in the introduction into the body of suitable medicaments in the ionic state. The substance acted upon is termed the "electrolyte." It must be fluid or semi-fluid and must necessarily be a conductor of electricity. When a substance is electrolysed the products are termed "ions," a name first coined by Faraday.

The ions are electropositive or electronegative. Electropositive ions, or kathions, have a strong affinity for and pass to the negative pole of a battery, on the well-established law that "likes repel and unlikes attract." For the same reason the electronegative ions pass to the positive pole of the battery and are termed "anions."

To take a special case, when two electrodes, a carbon plate and a zinc rod are dipped in water acidulated with sulphuric acid, and a copper wire is attached to the ends of the electrodes outside the liquid, a current of electricity is generated, and the water is split up, producing a stream of hydrogen at the negative pole and oxygen at the positive pole. In general, when substances are electrolysed in this way their metallic constituents behave in a similar manner to the hydrogen, and appear at the negative pole, while their acid products, like oxygen, are liberated at the positive pole.

In practice great care must be taken to apply the right pole for the particular purpose. It must not be thought that, because the electric current in a battery passes from the positive pole towards the negative, the medicament must be placed upon the positive pole so as to be carried by the current into the tissues. The truth is that when a substance is electrolysed by being placed on either pole of the battery, it is split up into a positive half and a negative half and these will necessarily pass to poles of opposite sign. The choice as to which should be applied depends upon which part of the medicament we wish to employ. Thus, in treating goitre by this method with potassium iodide, the drug is placed upon the negative pole of the battery. Iodine being an electronegative element it is naturally repelled by the negative pole and passes through the tissues to the positive pole,

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and is carried more or less deeply into the tissues, according to the strength of the current (amperage).

The general rule for applying drugs by cataphoresis is as follows: "Place the medicament on the positive pole to utilize the base, on the negative pole to utilize the acid." The positively charged kathions traveling to the negative pole (kathode) include hydrogen, sodium, potassium, lithium, lead, copper, iron, bismuth and the ions of alkaloidal bases. These are all set free at the positive pole and are therefore applied medically at the positive pole (anode).

The negatively charged anions traveling to the positive pole (anode) include most of the metalloids and non-metals and the following groupings: OH, NO₃, ClO₃, C₂H₃O₂, SO₃, C₂O₄, PO₄. These are introduced for medical purposes under the negative pole (kathode).

The anions travel against the current, the kathions with the current. Dr. Neiswanger, an authority on the application of electricity to therapeutics, whose work I have drawn upon in preparing this paper, has said that there is scarcely a condition of disease but that electricity may be used in some form, either as an adjunct or a remedy, and that other remedies, which may not meet the indications as well, are frequently employed because of a lack of knowledge of the therapy of electricity.

The positive and negative poles of a battery have to be used with discretion, as shown by their different behavior, according to the following table:

	Positive Pole	Negative Pole
Reaction	Acid	Alkaline
Action on tissues	(A) Hardens by coagulating albumen. (B) An acid caustic forming a hard cicatrix or scar (C) Sedative (D) Hemostatic (E) Vaso-constrictor	Softens by liquefaction and disintegration An alkaline caustic forming a soft cicatrix Increases sensitiveness Increases bleeding Vaso-dilator

The application of a negative pole by making the tissues alkaline increases inflammation, which is a condition due to excessive alkalinity. When the positive pole is applied the inflammation and pain subside. Hence we see that the negative pole must be used to remove warts and moles, as the action of the negative pole is like that of caustic soda, i. e., softening, disintegrating and liquefying.

Advantages of Ionization. Ointments act, for the most part, superficially—they do not penetrate the deeper tissues so readily as do the ions. Ionization has many advantages, of which we may mention:

1. Easy application.
2. Localization of treatment.
3. Relative painlessness.
4. Activity of the drugs employed, because in the nascent state.

Method of Application. Several thicknesses of absorbent cotton gauze or absorbent cotton are used under the pad, and a fresh solution is used for each sitting.

The quantity of drug that penetrates the tissues is proportional to the magnitude of the current and the duration of the flow.

The solution of the proper strength is applied by means of a disc covered with a thick pad of absorbent cotton or gauze, or by a glass cup electrode. The *active* electrode is covered with a piece of pig's bladder, through which the ions are able to pass. The indifferent electrode is applied in any other convenient situation, either in the hand or on the abdomen or elsewhere.

The solutions are conveniently made of 1 per cent. strength, by dissolving 4.56 grains of the drug in each fluid ounce of distilled water. Among the most useful drugs used in this way are: magnesium sulphate, potassium iodide, sodium salicylate, sodium chloride, quinine acid hydrochloride, copper sulphate and cocaine hydrochloride.

Ionic medication has been successfully employed in alopecia, chloasma (pigmentation), lupus, ringworm, scars and sycosis. A valuable summary of the therapeutic indications of different chemical substances used in cataphoresis is given in Martindale & Westcott's "Extra Pharmacopoeia," from which the following notes are taken. It should be remembered that the drug is carried through the tissues of the patient who is situated between the two poles:

Antiseptics can be introduced to whatever depth may be required.

Cocaine, using a 5 to 10 per cent. solution of the hydrochloride, abolishes sensibility of the skin in 10 minutes. Suitable for minor surgery.

Copper ions have proved effectual in ringworm.

Lithium ions have been used for gout.

Magnesium ions, using a solution of magnesium sulphate, 20 grains to the ounce, have given good effects in multiple warts on the hands.

Mercury. A 1 in 500 solution of mercuric chloride, with the addition of 1 per cent. of sodium chloride is employed.

Morphine. Toxic results can be obtained.

Quinine Acid Hydrochloride. Excellent results have been obtained in trigeminal neuralgia.

Silver. Used in infective cystitis.

Sodium Chloride has a resolving influence on sclerotic and cicatricial formations, applying the kathode to the affected part.

Sodium ions. For the removal of superfluous hairs.

Sodium Salicylate. For neuralgia, sciatica, etc.

Zinc ions. A front rank antiseptic. There is no wound that can not be disinfected by its use. Rodent ulcer has been successfully treated with zinc.