NOTE ON THE USE OF IONIZATION IN THE TREATMENT OF CERTAIN TYPES OF FACIAL SCARS.

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As a therapeutic measure in the treatment of facial scarring with its unpleasant consequences, ionization has hitherto received scant attention. The only reference in current literature which we have been able to find on the subject is a book by Hollande¹ in which the author claims good results by the ionization of these scars with potassium iodide as his electrolyte.

We propose in this paper to demonstrate the results that we have obtained by ionic treatment of facial cicatrices consequent upon war injuries to the facial tissues, and especially where damage has been done to the masticatory muscles.

Perhaps the commonest disability arising from this type of injury is the condition of "false" trismus, manifested by deficient mandibular movement and inability to open the mouth properly. Hitherto such conditions have been treated by intermittent intra-oral gagging, and by massage of the scar area, with transient good results but a strong liability to recurrence. We have already noted elsewhere² that this clinical condition is due commonly to one of three causes:

1. Fracture of the ascending ramus of the mandible, with actual damage to contiguous tissues.
2. In the absence of fracture, injuries of such a nature as to involve some fibres of the masseter, temporal, or pterygoid muscles, the scar tissue limiting movement.
3. Reflex spasm of all the masticatory muscles consequent upon organic injury of remoter parts.

In the more marked cases, as will be seen from the list recorded below, the degree of separation possible between the upper and lower incisor teeth may be as small as three millimetres.

We have found that the treatment of the scars by ionization results in a progressive decrease in their densities and an increased flexibility, both subjective and objective, with marked permanent improvement in ability to open the mouth and masticate. This has definitely occurred even when ionization has been unaccompanied by the use of intra-oral gagging or facial massage. Adherence of the scar to osseous tissue offers greater resistance, and the treatment has to be prolonged in these cases, often for a period of three months or more.

Method of Ionization.

We have used the alternating current from the city mains, which is run through a motor transformer so as to give a constant current of 100 volts E.M.F. This is conveyed to the patient through a distributing board, fitted with a wire resistance rheostat for the purpose of varying the strength of the current, and with a milliammeter for registering the amount of current used. The electrodes consist of small zinc plates about two inches square, between which and the skin we place from sixteen to twenty-four layers of folded lint. These coverings are about half an inch larger all round than the metallic electrodes, in order to prevent possible burns by contact of the metal with the skin. The pad of the negative or active electrode is soaked in the therapeutic agent (in our cases NaCl, KI, or sodium salicylate) in 1 or 2 per cent. solution in hot distilled water. The pad of the positive pole is soaked in hot water to which a trace of sodium chloride has been added to ensure easy passage of the current. The negative electrode is placed over the cicatricial area, whilst the positive electrode is placed under the chin (most often) or over the deltoid or on the nape of the neck. These are made secure by bandages which also ensure efficient contact with the skin area to be treated.

The current is turned on very slowly, and we start with a current of 2 to 3 milliamperes, gradually working up, according to the patient's tolerance, to 15 or 20 milliamperes. The maximum current which each patient can support comfortably varies, and is usually not reached until the third or fourth treatment.

By this gradual method we have been able to obviate the unpleasant after-effects of headache, vertigo, and nystagmus, which are liable to occur from the passage of an electric current so near to the semicircular canals and their endolymph system. The duration of each treatment is from thirty to fifty minutes, daily when the condition of the skin permits and on alternate days when the skin is sensitive. It is useless to attempt ionization when oral sepsis is present, or, at any rate, until it is under control; also it should not be used while metallic foreign bodies exist in the tissues, otherwise burns are liable to occur, with the formation of slowly healing ulcers.

In the event of an abraded surface happening to be in the area under treatment, it is sealed with a drop of collodion which is allowed to dry before proceeding. If a small indolent sinus persists, it is plugged with gauze soaked in the electrolyte used and usually heals early in the treatment.

At the end of each treatment the current is always gradually reduced before withdrawal to avoid unpleasant subjective shock to the patient. It should be remembered that the ionic effect is directly proportional to the intensity of the current and the time of application, so that as large a current as can be comfortably borne should be used, and the treatment should be of a long rather than short duration.

Mode of Action.

Ionization with sodium chloride as an electrolyte has given us the best results; ionization with iodides is more apt to cause irritation of the skin, but is useful, as is ionization with sodium salicylate, in the alleviation of painful conditions. As far as softening the scar is concerned, the latter two drugs are less effective, in our opinion, than sodium chloride (chlorine ions).

It is said that the liberation by secondary reaction at the cathode of the hydroxyl ion, which like the hydrogen ion is one of high velocity, may contribute to the resultant effects, and we can confirm that the results obtained with the negative pole as the active electrode are greater than those obtained with the positive. There seems to be no doubt, however, that a considerable portion of the resultant good effects, is due to the condition of induced hyperaemia which persists for an hour or two after the cessation of treatment. It would seem highly improbable that the ions penetrating the tissues, or formed in the tissues by the passage of the current, retain their ionic or active state locally for more than a fraction of time, but that they immediately enter the general circulation in combination as inert substances. It has been stated that ions are introduced into the endocellular plasma and not into the general circulation, but we fail to see why such a permeable membrane as the cell wall should act as a confining barrier to the highly active ion, or why the cell plasma, which is isotonic with the surrounding exocellular plasma, should exercise any chemiotactic effect upon the ion. Hence any benefit due to introduction of ions or to ionic dissociation in the tissues, must be limited to the time of passage of the current and to the period of active bombardment during the actual treatment.

The following list summarizes the nature of 24 cases with the results of treatment. Chlorine ions were used where there is no statement to the contrary. Supplementary treatment is indicated where any was employed.

1. Pte. O.C. Dense scar, masseter; limitation of opening. Fourteen treatments; current up to 20 milliamperes. *Result:* Scar very soft and pliable; complete restoration of ability to open mouth.
2. Sgt.-Maj. E. Small dense scar, right masseter; limitation of opening. Twenty-five treatments; current up to 26 milliamperes. *Result:* Scar much softer; mouth opening increased from 7 to 15 millimetres.
3. Cpl. P. Two dense scars (adherent to underlying bone) in right masseter region; limitation of opening 3 millimetres. Fifteen treatments; current up to 20 milliamperes; gag used. *Result:* Improvement; scar softer; mouth opening increased 3 to 7 millimetres.
4. Pte. S. Dense radiating scar of left cheek. Eighteen treatments; current up to 22 milliamperes; iodine ions. *Result:* Scar decreased considerably in size and density.

5. Pte. W. Extensive radiating scar, right cheek and right submaxillary region; limitation of opening. Fifteen treatments; current up to 22 milliampères. Result: Scar decreased in density (scar adherent to bone).

6. Lce.-Cpl. P. Long dense scar in right temporal region; limitation of opening. Fifteen treatments; current up to 24 milliampères. Result: Scar considerably softer; opening increased from 5 to 20 millimetres.

7. Driver W. Dense scar, left temporal region; limitation of opening. Twenty-five treatments; current up to 20 milliampères; gag used. Result: Improvement very slight.

8. 2nd Lieutenant J. Small dense scar, left masseter and left internal pterygoid region (adherent to bone). Fifteen treatments; current up to 10 milliampères. Result: Scar softer; ability to open mouth increased 10 to 25 millimetres.

9. Sgt. C. Dense radiating scars from angle of mouth to angle of mandible on same side; limitation of opening. Twelve treatments; current up to 14 milliampères; iodine ions. Massage employed. Result: Mouth opening increased from 4 to 12 millimetres; scar softened and loosened considerably.

10. Pte. H. Small depressed scar, left temporal region; painful; limitation of opening. Fourteen treatments; current up to 15 milliampères; iodine ions. Result: Pain decreased; otherwise improvement slight.

11. Pte. M. Dense depressed scar, right masseter region; limitation of opening. Twelve treatments; current up to 20 milliampères. Result: Scar considerably softer, but development of an abscess interferes with continuation of treatment.

12. Pte. F. Dense scar, right masseter region; limitation of opening. Eighteen treatments; current up to 20 milliampères; gag used. Result: Mouth opening increased from 3 to 10 millimetres; scar much more flexible.

13. Pte. K. Extensive cicatrization in left angle of mandible region; painful. Twenty-four treatments; current up to 20 milliampères; salicyl ions. Result: Scar considerably softer and more pliable; total absence of pain.

14. Pte. J. Extensive dense depressed scar, right masseter region; limitation of opening. Twenty treatments; current up to 20 milliampères. Result: Improvement slight.

15. Pte. P. Large depressed scar, right masseter region; limitation of opening. Twelve treatments; current up to 24 milliampères. Result: Mouth opening improved; scar less dense.

16. Pte. L. Dense scar, left masseter region (adherent to bone); limitation of opening. Eight treatments; current up to 9 milliampères. Result: Scar softer; mouth opening increased from 5 to 10 millimetres.

17. Cpl. W. Depressed scar, left masseter region; limitation of opening. Sixteen treatments; current 9 to 14 milliampères; gag used. Result: Mouth opening 3 to 8 millimetres; improving slowly.

18. Sgt. O'H. Long depressed scar, left temporal region; limitation of opening. Twelve treatments; current 7 to 11 milliampères; gag used. Result: Considerable improvement; mouth opening increased 5 to 10 millimetres.

19. Pte. W. Injury pterygoid region; passage of bullet from supraorbital region to lower border of mandible of same side; limitation of opening; complete closure. Eighteen treatments; current up to 20 milliampères; iodine ions; gag used. Result: Mouth opening increased from almost complete closure to 2 centimetres.

20. Lce.-Cpl. R. Dense depressed scar, right temporal region; limitation of opening. Fifteen treatments; current up to 10 milliampères; iodine ions; gag and massage employed. Result: Improvement slight.

21. Pte. B. Small scar, right angle of mandible; limitation of opening. Fifteen treatments; current up to 10 milliampères. Result: Mouth opening increased from 4 to 9 millimetres.

22. Pte. T. Dense scar, right temporal region; Six treatments; current up to 6 milliampères. Result: Improvement so far very slight.

23. Pte. W. Small depressed scar, masseter region; limitation of opening. Ten treatments; current up to 10 milliampères; massage employed. Result: Improvement marked; mouth opening increased 8 to 14 millimetres.

24. 2nd Lieutenant M. Long dense depressed scar, left temporo-mandibular region; limitation of opening; incomplete facial palsy. Eighteen treatments; current up to 20 milliampères; massage employed. Result: Marked improvement; mouth opening increased from 2 to 12 millimetres.

From the above notes we may conclude that ionization in the treatment of facial cicatrices is of undoubted value. The circulation through the scar tends to become re-established; there is loss of stiffness and adherence, permitting the play of underlying muscles and reduction of the limiting effect of the scar upon the masticatory muscles. It is a therapeutic measure which we think may be with advantage combined with the mechanical procedures of intermittent intra-oral gagging and massage. We find the results best when the gag is applied for

an hour immediately before treatment. In cold weather it is a good thing to thoroughly warm the area to be treated with hot water, or by the use of radiant heat by means of a small cup reflector for fifteen minutes before commencing ionization.

In cases also where the edges of the flaps, after facial plastic operations, are rolled and thickened, causing retraction of surrounding normal tissue, we have found ionization of use in increasing the softness and flexibility, and so in diminishing the deformative effects of such scars.

In conclusion, we should like to thank Lieut.-Colonel Littlewood, C.M.G., the administrator of this hospital, for the encouragement and facilities he has afforded us; Captain J. le F. Burrow, R.A.M.C.(T.), officer in charge of the Neurological Department, for much help and criticism, and Captain W. Maxwell Munby, R.A.M.C.(T.), and Captain J. E. Mawer, R.A.M.C.(attd.), for their courtesy in sending us additional cases.

REFERENCES.

- ¹ Hollande; *La Restauration Maxillo-Faciale*, Paris, February, 1918.
- ² *British Journal of Surgery*, No. 21, 1918.

Memoranda:

MEDICAL, SURGICAL, OBSTETRICAL.

SHELL WOUND OF THE HEAD WITH LARGE
FRAGMENT LODGED IN CEREBRUM:
AFTER-HISTORY OF PATIENT.

As a rule the medical officer serving with the forces abroad is unable to follow cases of gunshot wound of the head and to hear what eventually happens to them, though probably those who are on pension boards see a number of old cases. It would be interesting to determine what proportion of these cases recover and how many later on develop cerebral abscess or mental symptoms, and when these dangers may be considered past. In the following case—of which I regret that, owing to the great pressure of work, I was unable to keep better notes—I had the opportunity of observing the condition nearly three years after the wound.

Pte. F. was admitted to my ward in a base hospital towards the end of September, 1915. He was quite unconscious, with flaccid paralysis of all limbs and symptoms of cerebral compression. There was a wound $4\frac{1}{2}$ in. above and $\frac{1}{2}$ in. anterior to the left external auditory meatus. A skiagram showed a large shell fragment lying in the right cerebral hemisphere. I trephined without delay (he had been wounded two or three days previously) at the site of the wound, enlarging the trephine hole with nibbling forceps. A large intracranial clot was evacuated and a few fragments of bone were removed from the superficial part of the track in the cerebral tissue. No attempt was made to remove the shell fragment.

The patient made an uneventful recovery, except for the fact that a few days after the operation he developed a small cerebral hernia, which soon subsided. He was then evacuated to England.

After-History:—About six months after receiving his wound he had his first fit. For a time he had a fit about every fortnight, and then about every six weeks. Eleven months ago he married, and had no fit till six months later. This fit was succeeded by an interval of three months without a fit, after which he had two fits on the same day. When seen in August, 1918, he had had no fit for two months. He had been working as a labourer for ten months, and for the last six months had been in a china warehouse earning 35s. a week. His wife stated that mentally he was quite normal. He stated that he gets practically no warning that a fit is coming on, and his chief anxiety is that he may get one while crossing a road in traffic. The fit involves the whole of the right side, including the face, arm, and leg, the head being turned strongly to the right. The twitching lasts about a minute, after which he remains unconscious for about another minute. For half an hour after he feels dazed.

When he was examined in August, 1918 (nearly three years after the receipt of the wound), no abnormality in reflexes, etc., was found. He did not suffer from headache. All the cranial nerves appear to function well.

A skiagram taken for me by Dr. R. T. Cooke showed a large oblong foreign body. Dr. Cooke calculated that the shell fragment is $3\frac{1}{2}$ in. deep (from left side), and that it is lying slightly to the right of the middle line.

Personally I do not consider any further operation advisable, as I think it might well leave him in a worse condition than he is in at present.

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