been made on skin areas from which the horny layer has been removed by blistering. They leave no doubt that "capillary pulsation" is contributed to by the venules, and that often the part played by the venules is no small one; especially in areas where capillaries are relatively scanty, as in the cheek and forearm. I have seen no evidence that the arterio-venule anastomoses described in the deeper layers of the skin by Sucquet play any part in inducing clinical capillary pulsation. The evidence as it now stands seems to warrant us in concluding that in all instances of clinical capillary pulsation the capillaries are directly involved, and that the rhythmical change of colour, seen macroscopically, is due to pulsatile flow in the minute vessels of the skin, involving always the capillaries, and, perhaps, always involving through these the collecting venules and the venules of the subpapillary plexus.

SUMMARY AND CONCLUSIONS.

1. When the human skin is soaked in water at temperatures of 45° to 47° C., the capillaries and venules on the one hand, and the arterioles on the other, independently dilate. These reactions are both local reactions. When higher temperatures are used, a reflex dilatation of the arterioles is observed in addition, and this spreads beyond the heated area.

2. Capillary pulsation is a physiological phenomenon, occurring in the skin or mucous membrane whenever the arterioles are sufficiently dilated, providing that the pulse pressure is normal and capillary and venule tone is not increased. A sufficient dilatation to produce pulsation is usual in the arterioles of the face of young people at room temperatures of 17° to 20° C. Pulsation is brought about in the hand by immersing it in water at 45° C., providing that the arterioles are capable of dilating; it is usual in association with the vaso-dilatation of local inflammatory lesions, however small these may be; it occurs in the facial flush of amyl nitrite, and in other forms of bright erythemas of the skin.

3. If, in the presence of normal or heightened pulse pressures, capillary pulsation in the hand is not produced by soaking the hand in water for three minutes at 45° to 47° C., the arterioles are probably incapable of dilating.

4. In aortic regurgitation, capillary pulsation is often independent of high pulse pressure, though the last increases pulsation when this is present. In patients suffering from the named valvular defect, sufficient dilatation of the arterioles is again the chief determining cause of capillary pulsation. The state of the arterioles not only chiefly determines its presence or absence, but *a fortiori* it determines its varying prominence in different skin areas.

5. The colour of the facial skin in uncomplicated aortic regurgitation is mistakenly described as pale. On the contrary, the facial skin is, if anything, more flushed and warm than normal. In aortic disease in which the mean blood pressure is at or below normal, the arterioles of the face can usually be shown to be wider than normal; this arteriolar dilatation is often associated with arterial dilatation; sometimes, though not usually, the flushing of the face with arterial blood is so excessive that the patient is conscious of heat and throb in the face. The skin of the hands is affected like the face, but in lesser degree.

6. Arteriolar dilatation is opposed to cyanosis.

7. It is more accurate to associate capillary pulsation with dilated arterioles than it is to associate it exclusively with any other causative factor; and this statement is independent of the clinical diagnosis of the case.

8. It is probable that in all cases of macroscopic "capillary pulsation" the phenomenon is due to the pulse passing from the arteries into and through the capillaries, to involve in greater or lesser degree the minute skin venules. The visible pulsation is shown to be due mainly, as Boas has suggested, to pulsation of the venules, at all events in the skin of the face, trunk, and upper parts of the limbs. Pulsation of the capillaries themselves contributes little in these areas; it probably contributes more in the skin of the palm and sole and in the mucous membrane of the lip.

9. There is no evidence that pulsation is conveyed from arterioles to venules through the arterio-venule anastomoses originally described by Sucquet.

A British Medical Association Lecture ON THE TREATMENT OF FRACTURES.*

BY

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Few cases in practice cause so much care and worry as fractures. The difference between the good and the bad result may mean so much to the patient. Mal-union is so permanent and so aggressively apparent that any sure and simple methods of avoiding the bad results are worthy of consideration. Of late years we have begun to recognize that the standard of result which it was our custom to demand of ourselves in the treatment of fractures must be raised. When, some years before the war, as the result of an inquiry by the British Medical Association, it was realized that even in the larger teaching hospitals the late results obtained in the treatment of fractures of the lower limb, and particularly those of the femur, were far short of the ideal, an endeavour was made to revise our methods of treatment and to set as our goal full functional restoration of the injured limb. The stimulating examples of Sir Arbuthnot Lane on the one hand and Sir Robert Jones on the other in the operative and bloodless methods of treatment demonstrated that an almost complete restoration to full functional activity was possible in the vast majority of cases of fracture of bones of the extremities. The development of orthopaedic surgery in America, with a more intensive study of fractures and their treatment, brought fresh light to bear on this subject, whilst the systematic control of treatment by x-ray examinations had a chastening effect on all who submitted their results to this acid and heartless test of surgical efficiency. Finally, the experience of the war demonstrated that by systematic and concentrated effort a standard of cure never previously obtained was possible even in gross forms of injury. How, then, are we to apply the accumulated experience of the last two decades to our treatment of fractures to-day? I propose to confine myself to fractures of the extremities, and particularly to the commoner varieties which one may be called on any day to treat.

Treatment of Compound Fractures.

No problem calls for more care or gives more anxiety than this. The name of Lister must ever be associated with the treatment of the open fracture. The principles which he propounded and the methods which he practised have been, and doubtless will be still further, improved; they can never be entirely superseded. Whilst Lister directed attention to the primary factor in infection—the contamination of the wound by bacteria—and demonstrated how by means of chemical antiseptics the organisms which had gained entrance might be killed and further infection prevented, he was not unaware of the other important factor—the soil on which the bacteria might grow and multiply. It was not until the later years of the war, however, that we began to realize the great importance of endeavouring to remove not only the bacteria but the damaged and devitalized tissues on which they may grow and feed and in which they multiply. The resistance to infection of undamaged tissues is considerable, and the brilliant results which attended the primary excision of wounds during the latter half of the war demonstrated for all time the importance of removing the damaged tissue in dealing with all accidental wounds. The method of wound excision is one which we should strive to apply to all cases of compound fractures in civil practice.

From personal experience I can say that nothing in surgery has given me greater satisfaction than the result of bold and painstaking excision of the tissues exposed in the wound, followed by an immediate and complete closure. Where the wound is large and ragged, as in so many cases of motor accident, etc., a complete excision may

* Abstract of a lecture delivered before the Northern Counties of Scotland Branch. The lecture was illustrated by lantern slides.

be impossible. Careful excision of all obviously damaged and devitalized tissue, and particularly the lacerated or bruised skin margins, will, however, often permit of a primary closure. So vitally important is it to convert the compound fracture into a simple one, that I would be prepared to sacrifice the position of the bony fragments for a week or ten days to secure a primary union and a whole skin. This attained, the problem is that of a simple fracture, and the delay in adjusting the position of the fragments will be more than compensated for by the absence of suppuration and necrosis. In a great many cases primary closure is impossible, but here again a careful excision of all damaged tissue, combined with an antiseptic cleansing of the wound and of a wide area of surrounding skin, is of the greatest importance. The use of a Thomas's splint will greatly facilitate the after-treatment, and the frequent instillation of eusol into the deeper parts of the wound by means of Carrel's tubes will maintain the antiseptics and dispense with frequent dressings.

Treatment of Simple Fractures.

This problem is for many medical men a very difficult one to decide. Knowing full well the teaching of the two extreme schools—the one insisting on as perfect reposition of the fragments as possible and the fixation of the limb until union has taken place, the other caring less for the bony alignment, but all for the functional activity of the surrounding muscles and adjoining joints—what is the practitioner to do in the individual case? Common sense dictates that, other things being equal, the nearer the fractured ends are brought to their original position the better will be the ultimate result. Our ideal, therefore, will be to get the most complete restoration of the alignment of the bone with the least disability of muscular and articular function. At once we recognize that there is an essential difference in the primary functions of the upper and lower limbs. In the upper limb mobility, free both in range and character, is the essential for the vast majority of individuals. In the lower limb painless stability takes first place. In the upper limb, therefore, anything which will tend to interfere with the free movement of muscles and joints, be it adhesions, contracture, or excessive bone formation, must be prevented, and measures to avoid such crippling processes must have first claim in our scheme of treatment. In the case of the lower limb restoration of the correct length and axis of the limb are the essentials for stability, and no consideration for muscle or joint function, important though these be, must be allowed to compromise our efforts to restore correct length and axis.

A consideration of the factors which produce the displacement of the fractured ends of a bone or bones will give us a clear indication for our line of treatment in the individual case. In certain fractures the displacement is the direct result of the violence producing the break in the bone—for example, in Colles's fracture, fracture of the lower end of the humerus, in Pott's fracture, and in fractures of the bones of the leg produced by direct violence. It is obvious, therefore, that as considerable force was required to produce the displacement, an almost equal and opposite force will be required to reduce it. In such cases *immediate forcible reduction under a general anaesthetic* must be the first essential of our treatment. The neglect of this simple rule is, I think, the most fertile source of mal-union. No amount of massage or movement will ever remedy the disability of an unreduced Colles's or still less a Pott's fracture. In the other type of fracture, of which that of the shaft of the femur is the best example, the displacement is due to the tonic contraction of the muscles which pass parallel to the bone and are attached to the adjacent bones above and below. In such cases some form of extension which will tire out and stretch the offending muscles is required. If the muscular pull is suitably counteracted and correct length restored, the only other factor of moment in maintaining displacement will be gravity, and this can be countered without difficulty.

Open Operation.—The method of treating simple fractures by open operation with the application of some form of internal splint has been strongly advocated by Lane, and, in his hands, still gives results of a uniformly high standard. It is, however, not the method for general use,

and equally good results can be obtained by bloodless and more conservative measures in all but a limited number of cases. Operation should, in my opinion, be reserved for the following classes of cases:

1. Those in which, owing to the interposition of soft parts, the fragments cannot be brought into close apposition.
2. Those in which repeated redisplacement occurs after reduction.
3. Certain fractures into joints in which a fragment cannot be controlled and interferes with joint function.
4. Cases of non-union of more than six months' duration.

No open operation on a fracture should ever be attempted unless by one who has complete confidence in his aseptic operative technique. A bad result may be made a disaster by an injudicious operation under imperfect conditions.

Plaster-of-Paris.—The sphere of usefulness of the plaster bandage in the treatment of fractures is not sufficiently realized by most practitioners. There is a widespread idea that the application of plaster contravenes all our modern ideas of massage and movement as an essential part of treatment. This, however, is by no means the case, and by the application of plaster we can, in many cases, attain as by no other method that primary immobilization in the corrected position which is the secret of the relief of pain; and, later, by splitting the plaster case on either side, we have more accurately fitting splints than can otherwise be obtained. In place of an assortment of special splints or hastily improvised ones which can seldom be retained in good position without constant attention, we have in plaster the raw material for almost any splint we may desire, and when applied we have the assurance that fixation, and with it comfort, has been secured. The fracture *par excellence* for plaster fixation is that common and troublesome one, the Pott's fracture with lateral or backward dislocation at the ankle-joint. Immediate reduction under a general anaesthetic is the first essential; fixation in plaster in the corrected position the second. The criticism that dangerous pressure and ischaemia may result from subsequent swelling of the tissues round the ankle is not a valid one if the plaster is applied judiciously with ample cotton-wool padding round the ankle-joint. I have never yet had cause to regret an immediate plaster fixation of this fracture, and all of us are aware of the deplorable result which failure to maintain perfect reduction entails. So important is the maintenance of the astragalus in its correct anatomical position that I would not hesitate to leave the plaster undisturbed for three to four weeks if adequate supervision was not feasible. At the end of this time the plaster case is split down both sides and retained as a splint, and daily massage and passive movements at the ankle-joint instituted, care being taken that no outward or backward displacement of the foot occurs.

Splints.—As a general rule it may be stated that whilst in the treatment of fractures of the lower limb some form of splint is an advantage, if not an essential, in that of fractures of the upper limb splints may be dispensed with, except perhaps during the first few days after the injury. For the lower limb Thomas's knee splint is the most useful. For simple fractures it is an advantage; for compound ones a necessity. The extraordinary diversity of injuries to the lower limb encountered during the war for which Thomas's splint was used with such success demonstrated the value of this simple piece of apparatus. For both the transport and extended treatment and nursing of the fracture case it has still no superior, used by itself or slung to a Balkan frame; with the addition of the Sinclair skate or of pressure pads it fulfils all the demands of treatment—namely, fixation, extension, simple access, and easy nursing. Two large-sized Thomas's splints with footpieces should be in every practitioner's house throughout the country.

Fractures of the Upper Parts of the Humerus.

For fractures involving any part of the upper two-thirds of the shaft of the humerus no special apparatus is required. When this fracture is the sole injury and the patient is able to go about, a bandage holding the upper arm to the trunk and a sling supporting the forearm, with the elbow

at an angle of 60 degrees, are all that is required. If shortening persists after the first few days, a light weight (1 lb.) dependent from strapping applied to the sides of the upper arm can be applied with advantage. After the first week the body bandage should be dispensed with and active movements of the whole upper limb encouraged. Massage should be employed from the very outset of treatment, but it is no substitute for active voluntary movement, which is the surest guarantee of a good functional result. The profession owes a debt of gratitude to Mr. J. W. Dowden for his complete demonstration of the value of early active movement in fractures of the upper limb. When a fracture of the shaft of the humerus is one of several injuries which necessitate the patient lying in bed, we have found that extension with a Thomas's arm splint gives the best results. As soon as the patient can sit up, however, this should be discarded in favour of a simple sling.

Fracture of the Lower End of the Humerus.

This, one of the commonest of fractures, illustrates another principle in treatment. It is usually met with in children, and is frequently diagnosed, wrongly, as a posterior dislocation of the elbow or a separation of the lower epiphysis of the humerus. (Incidentally, may I note here the rarity of the injury of separation of an epiphysis? For every one occasion on which this lesion occurs the bone will fracture on the diaphyseal side on nine.) In the treatment of this fracture there are two pitfalls to be avoided—namely, (1) the backward displacement of the lower fragment may not be completely reduced; (2) an excess of new bone may form, and this may compromise the range of movement of the elbow-joint. Complete reduction under an anaesthetic is the first requirement, the forearm being first forcibly hyperextended and then flexed at the elbow. Rest in the position of full flexion is the second essential. Too early or vigorous movement and massage may lead to excessive callus or ossifying myositis with some permanent disability. It is better to leave the elbow uncovered whilst fixing it in acute flexion. This may be done by a broad band of adhesive strapping applied round the forearm and upper arm, the limb being supported in a sling; the danger of a figure-of-eight bandage, which is so often used, is that the swelling which invariably follows this fracture may render the bandage a tourniquet and lead to an ischaemic paralysis. This complication, I regret to say, has occurred in my own practice.

Colles's Fracture.

Reference has already been made to the essential of the treatment of this injury—forcible reduction under an anaesthetic, preferably by Jones's method. Exception to this rule may be made in the old and feeble patient where the deformity is not excessive and the impaction firm. In the vast majority of cases, however, reduction must be attempted. For the first few days the patient's comfort will be increased by the wearing of a splint which permits of free movement of the fingers; thereafter a light bandage and a sling are all that is necessary, and from the first day massage and both active and passive movements should be practised.

Fracture involving the Carpus.

The chief disability liable to follow such fractures is a defective grasp owing to restricted dorsiflexion at the wrist. Whether the fracture be an oblique one of the lower end of the radius or one of the scaphoid bone, the wrist should be put up with the hand dorsiflexed; this can be most conveniently done with a light plaster case which is later split down either side and used as a splint. Where the scaphoid is fractured—and the injury is by no means a rare one—the anterior aspect of the wrist should be examined to make sure that there is not an associated dislocation of the semilunar, as unless a lateral x-ray photograph of the part has been taken this injury may be overlooked.

The prognosis in these carpal injuries should be guarded and the patient warned that prolonged disability may result. Not only is pain on certain movements liable to persist, but a curious rapid absorption of lime salts, with rarefaction of all the bones in the vicinity of the wrist, may occur with an associated weakness in the fingers and hand. The rarefaction may be a striking feature of the x-ray

picture within a week of the injury. It is too rapid to be the atrophy of disuse, and most probably depends on some disturbance of the trophic nerve control of bone nutrition.

Fracture of the Femur.

No more difficult problem confronts the practitioner than this. Can he hope to give, in the cramped conditions of the cottage dwelling, either the treatment or supervision which is necessary to attain the standard of result which we now rightly demand? In the case of the young adult with the fractured shaft, I would say, No. This class of case is one which requires institutional treatment if transport facilities are at all available. Another problem is the elderly patient with fracture of the neck of the femur. There is a somewhat widespread opinion that in this type of case bony union is unlikely to occur, and that, apart from rest in bed with sandbags to steady the limb, no special fracture treatment is indicated. We owe chiefly to Whitman the demonstration that bony union with good function is possible in the great majority of these cases, provided certain definite principles of treatment are followed.

If the patient be over 75 years of age and the fracture definitely impacted, it is probably wiser to leave it alone. In almost all other cases, however, it is advisable to give an anaesthetic, disimpact if necessary, and put the limb up in a position of full abduction. In this position the fragments will almost certainly be in apposition, and the trochanter resting against the pelvis will ensure immobility. The limb and pelvis may then be put up in plaster, or a Thomas's knee splint applied and slung in the abducted position. To maintain the abduction it may be necessary to apply a similar splint in the abducted position to the sound limb. At the end of three months the patient may be allowed to get up with a walking calliper, which is worn for six to eight weeks. If plaster-of-Paris is employed it is well to split the case and use the posterior shell, thus allowing of access to the skin and massage of the muscles. The results of such treatment are most gratifying, and firm bony union is the rule.

Fracture of the Shaft of the Femur.

Some form of extension is essential, and various means of applying extension are available, each with its own advantages and limitations. I would rather lay emphasis on certain points of importance common to all methods. First, it is desirable that both the hip and the knee joints should be in a position of slight flexion. Secondly, the normal anterior curve of the femur must be maintained; it is better to err on the side of anterior curvature rather than posterior. Thirdly, the foot must be maintained in a vertical axis, and at right angles to the leg.

During the period since the war we have treated fractures through the shaft of the femur by means of direct extension by ice-tong callipers, the limb being suspended in a Thomas's splint with movable kneepiece. The Morrison frame makes adjustment of splint and extension and moving of patient easy, and the suspension of the foot to the vertical footpiece by lint glued to the sole obviates all pointing of the toes and pressure sores above the heel. Repeated x-ray photographs with a portable apparatus control the progress of the case. The apparatus must be left on for from eight to twelve weeks, massage of the muscles being given throughout this time. After two weeks in bed without any splints the patient is allowed up with a walking calliper, which he wears for four or even six weeks. Thereafter ordinary walking exercise may be undertaken. By this method firm union without any shortening should be attained, and whilst some stiffness of the knee usually remains for a few months, it ultimately goes, and a practically normal limb is restored.

Other and perhaps simpler methods, such as that recently described by Hamilton Russell of Melbourne, may give equally good results provided none of the essential principles are traversed. The mistakes most frequently made are allowing of backward bending at the seat of fracture and either some rotation or pointing of the foot. Only constant supervision will prevent such errors, hence the necessity for institutional treatment in all but exceptional cases.

One of the best learnt lessons of the war was the painless transport of the case of fractured femur. We appear

to be in some danger of letting slip knowledge and experience so hardly won. The Thomas splint with fixed extension from the boot—best obtained by driving a long nail or pin through transversely between sole and upper, attaching cords or tapes to its ends and tying them round the end of the splint—should be the standard method for transport.

Fractures of Bones of Leg.

The oblique fracture through one or other of the tuberosities of the tibia into the knee-joint is one of those for which I think operation with nailing is indicated. The fracture of both bones in the lower third of the leg is one requiring considerable care, both in deciding the line and watching the course of treatment. We all know the tendency both to mal-union and non-union in this situation. So much is this the case that many surgeons now treat all these cases by operation, with or without the application of some internal splint. In this fracture reduction under an anaesthetic with temporary fixation in plaster has much to commend it. If treated by splints—as, for example, by the widely used box splint—elevation of the limb *without* flexion of the knee will be found a useful aid in preventing the forward projection of the lower end of the upper fragment of the tibia which is often so troublesome. Where there is considerable comminution of the tibia an accurate reposition of fragments is seldom possible. Union with good function will usually be secured, however, if the true alignment of the limb is preserved. At all costs a posterior sagging at the seat of fracture must be prevented.

CONCLUSION.

I desire to lay emphasis on the following points:

1. In the case of most fractures it is necessary to *reduce* the fracture under a general anaesthetic.
2. In upper limb fractures early active movement is desirable. (Fractures in the immediate vicinity of the elbow form an exception to this rule.)
3. In fracture of the lower limb restoration of the correct alignment and length of the limb take precedence over all other considerations.
4. In certain fractures, notably Pott's fracture with partial dislocation, immediate fixation in plaster gives the safest assurance of a good result.
5. In compound fractures excision of the wound with primary suture should be attempted whenever possible.

THE EARLY TREATMENT OF FRACTURES.*

BY

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THE fracture of any bone results in damage to many small blood vessels and lymphatics, frequently to muscle fibres, muscle sheaths and tendons, not seldom to joint capsules; also many small nervules and end-organs are involved, either directly from the original trauma, or indirectly from pressure.

The bruising of the muscles and tearing of the blood vessels and lymphatics result in painful muscular spasm and rapid infiltration of the tissues with blood and lymph. This is usually so extensive that the normal circulation of the limb, below the injured part, is more or less affected, with consequent swelling and oedema; and it is undoubtedly the tension in the tissues that causes much of the pain. Indeed, when a fracture has occurred a vicious circle is set up in which one can see the injury giving rise to effusion, effusion causing pain and spasm of all contractile tissues voluntary or involuntary; spasm of blood vessels, etc., preventing adequate drainage; engorgement causing further irritation, and this again in its turn causing further muscular spasm.

It is here that the teaching and results of physiology are

invaluable, as they show that certain electrical currents should help (1) to accelerate the removal of the excess of fluid accumulated; (2) to secure more rapid reduction of the hypersensitivity of the nerve endings; (3) to bring about abolition of spasm, whether in muscles, blood vessels, or lymphatics.

Physiological Considerations.

With the passage of a direct current through the body, certain effects take place known technically as cataphoresis, anelectrotonus, catelectrotonus, polarization, etc., and a brief consideration of these effects is necessary in order to realize the rationale of the treatment I am about to describe. It will also be necessary to consider the changes that occur in the normal electrical condition of muscle when this is injured. I will endeavour to do this as non-technically as possible.

Cataphoresis.—When a current passes through a conducting medium which is fluid or semi-fluid, a movement of the fluid takes place from the positive towards the negative pole. Experimentally this can be easily demonstrated by placing a porous partition in an electrolytic cell; then after the passage of a current, the fluid will be seen to be higher on the side of the cathode, thus indicating a definite transportation of fluid. In this well known phenomenon we have, then, an electrical means of assisting in the removal of the accumulated excess of fluid present in any injury; and, on this ground alone, it would be justifiable to employ the direct current in the treatment of fractures or other injuries.

Anelectrotonus and Catelectrotonus.—It will be remembered from physiological days that if a constant current is passed through a portion of the nerve of a muscle nerve preparation, and then a second exciting current is applied as a stimulus to the nerve, there is a considerable reduction of muscular response when the stimulus is applied in the neighbourhood of the anode, and a considerable increase in the response when near the cathode. The reduction of response when the stimulus is applied in the neighbourhood of the anode is due to a lowering of the excitability of the nerve below the normal, and is maintained the whole time the current is running. Here, then, we have a well known effect which can be made of use in reducing the hyperexcitability of injured nerve endings, provided we take pains to prevent sudden increase or fall of the strength of the current, provided also the current used is small and made to enter over a wide area. Without these precautions, false cathodes will be formed, and undesirable ionic concentrations take place. With the reduction of excitability of nerve endings, and the transportation of fluid away from the injury, we shall have successfully taken the first steps in breaking the vicious circle referred to above.

Demarcation Currents of Injury.—Hermann has shown that when a muscle is injured the injured portion is electro-positive to the uninjured parts—that is, there is a current *within* the muscle from the injured area to the uninjured area. If now we consider a muscle such as the biceps, injured near its insertion, say, as the result of a fracture of the lower third of the humerus, this portion of the muscle—namely, the injured or excited portion—is electro-positive to parts of the muscle nearer the origin. Now it must be remembered that this condition is the exact electrical condition that takes place when a normal muscle commences to contract, and from such a condition the wave of contraction proceeds. It is therefore easy to understand why in fractures muscular spasm is such a prominent feature. If we apply the positive pole of a direct current over, or just below, such an injury, we should tend to increase this electro-positivity, and thereby increase, or at any rate not diminish, the muscular spasm present as the result of the original injury. If, on the other hand, the area of application of the current includes the whole of the muscle, we shall tend to *make* the condition in the muscle iso-electric; and, with this, not unreasonably expect diminution of excitability and a tendency to the disappearance of spasm. This is, I believe, what actually occurs during the treatment I am about to describe to you.

Polarization, Temperature, and other Effects.—When strong currents are employed, polarization occurs between the sheath and the conducting fibre in a medullated nerve, resulting in hyperexcitability instead of the desired hypoexcitability, and it should be guarded against by the use of very weak currents. The passage of any electrical current through a conducting medium results in the production of heat. Now Gotch has shown that, within physiological limits, both in skeletal muscle and nerve, excitability is diminished by raising the temperature and increased by lowering it. Any increase, therefore, of temperature occasioned by the passage of the direct current is likely to act in a direction which is useful and certainly not prejudicial. It is doubtless due in part, at any rate, to this

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