

ARTICLE IV.—*Painless Dental Surgery.* By J. SMITH, M.D., Edinburgh, Dentist and Surgeon; Lecturer on Dental Surgery, Medical School, Surgeons' Hall, Surgeon Dentist to the Royal Dispensary, etc.

“In coming home from St Cassien, we encountered a thing which I could not exactly make out . . . It resembled a long low bathing machine, with no visible door, and with one small window in front. . . . On the side of the machine was a large card nailed, and upon this card was the lively representation of a very large tooth. . . . Also, there was an announcement that the invisible tenant of the machine was a travelling dentist, who had the happy faculty of being able to draw teeth without the least ‘douleur.’”—(*Letters from Cannes, by MISS BREWSTER, p. 95.*)

CONSIDERABLE attention has of late been directed towards discovering or elucidating those methods by which pain, during the performance of the little operations required in dental surgery, might best be diminished or altogether avoided; many of the experiments, with such a view, have been conducted with much assiduity and not a little expense; and there is no doubt that some credit is due to those who have, even by the failure of their proposed methods, contributed to our knowledge on the matter. The means adopted have generally been of two kinds, namely, 1st, The induction of a state of general anæsthesia; and, 2d, The induction of insensibility at that part only where pain is to be inflicted. With reference merely to the last of these methods I would here offer a very few remarks.

Perhaps in no other operations have the circumstances of the case to be more taken into account in the induction of anæsthesia, whether local or general, than in those performed within the cavity of the mouth. The locality itself, the severity of the pain inflicted, and, at the same time, its short duration in dental operations and the complications attendant on the interference, here sometimes unavoidable, with the function of respiration or even deglutition—are circumstances which present themselves for consideration, as specially attaching to this department of surgery, and sometimes entailing extra risks to what are inherent to the employment of anæsthetic agents in other cases, where the operations are in a different and more accessible quarter; and it is mainly owing to these facts that so much difficulty, and so much variety of opinion exists with reference to the employment of such obtunding agents in the practice of dental surgery.

For some time back it has been an object with dental practitioners to discover, if possible, some mode by which *local* insensibility to pain during tooth extraction might be attained; no generally applicable or effective means of this kind having as yet been realised, although the investigations and experiments made with this object have been numerous and, in many instances, well conducted. For how long a time the idea has been entertained that tooth extraction

might be performed without pain, it is difficult precisely to determine; nor is it easier to enumerate all the different modes which have been adopted with such an intention in view; but we know that for similar operations *local anæsthesia* was mentioned by the ancients, as by Dioscorides, and described as a possible if not an ordinary mode of practice among surgeons and others; and it has long been popularly asserted, too, that the Chinese have for some unknown period been, and are now, the possessors of a secret method of extracting teeth without pain or suffering of any kind. Various statements exist in reference to what their method consists in; it has been described as a process by which insensibility of the part results from the application to it of some substance of a benumbing or powerfully anodyne nature—but what this substance is appears to be involved in mystery. According to one account, it consists of a particular bone taken from the head of some fish; this bone being reduced to powder, forming the substance employed. Another receipt, alleged to be used in the composition of this agent, represents it to be the root of the “Bringall,” powdered and treated with the urine of a pure white mare. This information, so far as it goes, I have on good authority; but if anæsthetic means are really employed in this way with success in China, it is almost evident we have no approach to the secret of their composition in either of the above receipts. Dr Ivor Murray, whose lengthened residence in China enables him to speak with some confidence on such matters, tells me that the effects attributed to the use of such preliminary steps in tooth extraction are considerably exaggerated; that the notion of the existence of an anæsthetic agent for tooth extraction is prevalent in China; but, so far as his knowledge leads him to believe, that it is a preparation of arsenic which is employed, and which, being from time to time applied to a tooth, acts on it in such a detrimental manner as to loosen it in its socket, and thus, of course, lead to its easier removal in the end. And we can easily, in this manner, conceive exaggerated accounts, if not false reports, being originated in the use of such a substance among the Chinese, or any nation so little accessible to inquiry—a substance which might, no doubt, ultimately lead to the easier extraction of a tooth, but which, owing to its otherwise detrimental and dangerous qualities, could not be employed with impunity among a people where danger to life is regarded in a more serious light. On the Continent, too, and sometimes in England, every one is aware of the manner in which the well known mountebank practitioner puffs his wares, and sets off the painless nature of his operations—especially tooth-drawing; and how implicitly his “Clientelle” seem to embrace his confident assertions rather than give way even to the testimony of their own sensations.

Without, however, going back to any remote period, or attending to problematical examples of local anæsthesia being employed for painless tooth extraction, we find the same thing attempted of late

years in our own and other countries, although by no means with so much apparent success. A great variety of expedients have been thought of for the accomplishment of this purpose; the application of various narcotic or anæsthetic substances to the part; the benumbing influence of extremes of temperature; the application of electricity and galvanism; the injection of different preparations into the part where the suspension of sensibility was desired; all these may be mentioned as methods which have of late, from time to time, been tested as means for preventing or mitigating the pain of tooth extraction, and regarding which, I would merely state, very briefly, the results of my own experience, so far as it goes, in what has recently and somewhat prematurely, I fear, so far as the extraction of any average, tolerably fresh tooth, and not mere extinguished stumps, is concerned, been denominated "painless dental surgery."

First, Regarding the local application of Anæsthetic Substances more properly so called. Little need be said of the attempts to induce local insensibility by mere external application of these agents, since, as yet, it has failed to produce effects anything like sufficient to enable a tooth to be extracted without pain. Chloroform, ether, opium, aconite, amylene, bi-sulphuret of carbon, cyanide of potassium, hydrocyanic acid, etc., have all been tried in this way by myself, and these and several additional substances have been tested by others also; and the result has been to prove them, when merely applied to the unbroken surface, as entirely ineffectual for such purposes.

Instead of applying these substances superficially, however, if I may allude to an experiment of my own, it occurred to me that they might possibly act with greater efficacy were they injected into the tissues by means of the syringe and perforated needle. I accordingly made a number of experiments of this nature with many of the substances already enumerated, with somewhat better result; but, so far as I have been able to form an opinion, the solution of the muriate of morphia—four times the ordinary strength—acted as satisfactorily as any of them. Aconite I have employed in this way with apparent diminution of pain in cases where stumps, etc., had to be removed; but the disagreeable and persistent tingling it produces at the part, and apparently, in some instances, the increase of the ordinary hemorrhage after extraction, renders the employment of this agent less desirable. Used even in this manner, however, these substances did not appear capable of producing by any means such a degree of local insensibility as would be sufficient for rendering tooth extraction painless.

Secondly, The application of Extreme Cold, so as to produce insensibility by congelation of the part, is another method which has been, with some noise, set forth as possessed of considerable advantages in dental surgery. This mode of inducing local anæsthesia, although by no means new, has been revived by Dr Arnott of London and others, and some ingenious enough contrivances have been brought

forward with the view of facilitating the employment of this agency, and rendering it serviceable in dental operations;¹ as yet its application, however, has been by no means easily managed, nor at all certain in its effects, even if it could be said to be without danger in those cases where insensibility might happen to be produced. There is no doubt that where a part is frozen hard, insensibility is lost. But to produce this effect satisfactorily, is much easier in theory than when it comes to be put into practice. Within the cavity of the mouth, as has been already observed, several difficulties have here to be contended with: first, there is the difficulty of effectually applying cold at all in this manner, except in some easily accessible quarter of that cavity: second, there is the uncertainty of pain being avoided after all, no matter what apparatus be used—as even supposing the part has been fully frozen, the slightest delay or accident during the operation entirely frustrates our object here: and, thirdly, there is no doubt that unpleasant results may at any time be the consequence of such an injury being inflicted on a part which is frozen, as that entailed in the extraction of a tooth.²

Some years ago, I commenced a few experiments with the view of facilitating the applicability of congelation, as a means of preventing pain during dental operations. This I have attempted in several ways: one, which I found capable of reducing the temperature lowest and most rapidly of all others, was the use of a large body of metal—a large brass ball, in fact, having a properly adapted projecting extremity to be applied within the mouth to the spot in the dental arch intended to be frozen. This apparatus being inserted in a freezing mixture of ice and muriate of ammonia, soon became reduced to a temperature far below freezing, and almost instantaneously froze the finger or any part applied to it; and so long and persistently did it retain its low temperature, that the point of its projecting extremity might be kept some seconds in boiling water, and yet be still quite capable of freezing upon its withdrawal. This apparatus, however, I found to be applicable only in certain cases, and even then, as I have already said, of freezing applications in general, I found it apt to disappoint the expectations of relief from pain.

¹ Three or four years ago, Mr Walter Blundell of London, brought out an apparatus by which a flow of freezing mixture could be passed over the tooth and gum, by means of a thin membranous bag, having tubes attached for the inlet and outlet of the freezing mixture; the temperature being also capable of gradual regulation, according to circumstances.—(*Mechanics' Magazine*, 1855, p. 211.) Other appliances of a similar kind were proposed by M. M. George, Putnam, etc.—(*L'Art dentaire*, Paris, April, 1857.) And, in *certain cases*, they were, no doubt, capable of employment with success; but this could never, in any uniform or general manner, be relied on; sometimes, indeed, the suffering was increased.

² "Sloughing and Hemorrhage after Freezing in Dental Surgery."—*Edinburgh Medical Journal*, January 1858.

A second method I found tolerably convenient, was that of using a wide glass tube covered with caoutchouc, and bent at a right angle about four inches from its lower extremity, where it opened into an exceedingly thin caoutchouc bag, partly enclosed in a wire framework, which enabled it to be adjusted in such a manner as to be kept in apposition with any part of the teeth and gums of either the upper or lower jaw. Upon the tube being held upright, and then being filled with a freezing mixture,—say the one of muriate of ammonia and ice,—this bag became also filled, and retained its low temperature in close contact with the alveolar border, as long as did the freezing mixture in the tube with which it communicated. Many modifications of such contrivances were in common use among those attempting thus to alleviate the pain of extraction, none of them, however, being more simple in their construction, or more easily applied, than either of these methods, and certainly none better adapted to test the efficiency of cold applications for such purposes. Yet success with either was very uncertain, and in some cases they could not be applied at all; as, for instance, to some wisdom teeth, or in children, or those who, either from excessive sensibility or impatience, would not submit to their use, as well as in numerous other cases of constant occurrence. Further, such apparatus involved much trouble and loss of time, not to speak of additional expense,—matters, however, which even would not be objectionable if only the certainty of success could with any degree of probability be looked for. Similar unsatisfactory results have been experienced by all who have fully tested this process; and the consequence has been, that it has gradually come to be laid aside.

Thirdly, Another method attempted for the production of local anæsthesia has been the application of Galvanism or Electricity. Partly, it would appear, owing to some misconception of the results observed in certain physiological experiments made on the nervous system with these agents,¹ and partly, it may be, owing to an erroneous notion entertained in reference to the feeling experienced in a part through which the electric current is passed, the conclusion seems to have been jumped at by some dentists, that electricity could be easily employed as a local anæsthetic. But the mistake here committed seems to have arisen from confounding mere *altered* with *arrested* nervous sensation, as the pain of an operation, in fact, becomes under this agent not less in amount, but different in kind—the electric thrill not supplanting, but being superadded to such pain.

In this way, however, advantage has in some instances been taken of the distraction of the attention thus occasioned, together with the effect of imagination, influenced by suggestion, to make patients believe that the pain of tooth extraction actually was materially

¹ Such as the experiments of E. Du Bois-Reymond, *Untersuchungen über tierische Elektrizität*, Berlin, 1849; Ludwig, *Physiologie*; Eckhard, *Physiologie der nerven system*, 1844; etc.

diminished. And the difficulty of at once arriving at anything like satisfactory evidence, either one way or other in the matter, when the sole foundation for such assumption consists in the mere conjecture of a patient, that less pain was perceived than would otherwise have been done; and the assertion of a dentist, that the patient was led to such an opinion in consequence of the locally anæsthetic powers of some plausible measures adopted, affords a most favourable opportunity for exercising all the unscrupulous and high sounding pretensions of quackery. But the shallowness and untenable nature of any such hypothesis as that of pain in tooth drawing, being capable of prevention by merely making the forceps, or other instrument, when applied to the tooth and gums, a means of completing the electric circuit, becomes at once apparent, when we find that precisely the same principle is utterly ineffectual when applied in a far more simple manner, namely, by retaining exactly the same arrangement, but only substituting a common needle for the forceps; the pain on pricking the finger with such needle being thus not in the least diminished, but rather increased. And especially does the equivocal nature of such a theory manifest itself, when it is recollected that this identical experiment completely controverts the deliberate statement set forth in some instances, to the effect that the complete success of electricity as an anæsthetic, in exactly similar circumstances, positively suggested its use in dental surgery.

In short, when we find it distinctly stated, that a most painful operation, such as tooth extraction, is rendered literally painless by a local anæsthetic which does not render any other, even the simplest operation, painless, the inference is, that such statements are the result of either most egregious misapprehension, or else of downright misrepresentation of facts. As for any combinations, etc., of freezing and electricity, the former may possibly benumb the part—the latter, even if it were available, is consequently not required.

I do not thus speak of the inefficacy of electricity in dental surgery, without having put it to the test of experience; about two years ago I tried the effects of this agency in a variety of ways, both with the continuous and interrupted currents, and found it unsuccessful. The interrupted current can be easily obtained of sufficient strength to produce the ordinary appreciable effects of electricity, but the continuous galvanic current of a strength sufficient for such purposes is not so readily obtained. Through the kindness of Dr T. S. Wright, however, I was last winter informed of a convenient mode of producing such a continuous stream, and was thus enabled to carry on experiments in both ways.¹ I have passed such currents directly across the alveoli; along the ramus of the jaw; through the jaw, in the tooth's long axis; with one pole applied to the tooth, while the other was grasped in the hand; or the modification of this last

¹ Of course, the mere difference in construction of the apparatus employed signifies nothing so long as the influence obtained is the same.

method, viz., having one pole attached to the forceps, or other instrument, while the opposite pole was held in the hand; but in all these cases I found the application of this agent to be most unsatisfactory, and by no means capable of enabling a tooth to be extracted anything like painlessly; on the contrary, many declared the suffering attendant upon such a mode of operation to be much increased rather than diminished. How such success, therefore, as has been asserted to have accompanied the use of this agent in other hands has been attained, I am at a loss to understand; but I am strongly inclined to impute it to the mere preconceived prejudice of opinion; the implicit *belief* that any agency can alleviate pain being very apt to lead to self-deception—the result being, that the patient is shuffled into the conviction that the suffering has really in this manner been lessened.

I must not overlook one great difficulty experienced in these, as in all other such local anæsthetic experiments, viz., to arrive at any reliable conclusions as to the effects really produced; because, as I have said, patients with a preconceived notion that the operation will be less painful, actually seem to believe it to be so when it is performed;¹ and I doubt that many cases brought forward as evidence of success in this way are founded upon the mere assertion of patients in such anomalous circumstances. Indeed, I may say, that I have only met with one or two cases where the testimony thus afforded seemed in the least satisfactory, or less equivocal, as in these patients the means were used without their knowledge of my intention, and sometimes, no doubt, so little was suffered at the subsequent removal of the tooth as even to lead to incredulity of its having been extracted at all. Unfortunately, however, so few and exceptional cases afford no warrantable grounds for concluding that the diminution of pain was owing to, and not merely coincident with, the employment of such measures. We know that a source of fallacy often exists in the different degrees of susceptibility to pain found among patients: to one, the extraction of a tooth is horrible to anticipate, and scarcely endurable; while, to another, it is a matter of very little moment, and seems to entail but a very slight degree of suffering indeed. The same thing has been known to occur in some diseases; and even capital operations have been undergone apparently without pain. M. Beau, in the Archives General de Médecine, for January 1848—as alluded to by Professor Simpson in his publication on “Anæsthesia,” p. 225—relates some cases of this kind, and among them that of one patient who even had a leg amputated without suffering pain to any degree from the operation; but whenever such patients—naturally insensible to pain—are subjected to any anæsthetic process previous to an operation, this, and not the defective

¹ Thus, a few drops of simple water, given in a formal manner, with the sole object of inducing in the mind of a patient an *expectation* of sleep, answers the purpose of a sedative and hypnotic.—(Professor LAYCOCK on “Delirium Tremens,” *Edinburgh Medical Journal*, October 1858.)

sensibility, is too apt to get all the credit of the operation having been easily borne. In reference to the production of local insensibility within the mouth, however, by means of anæsthetic agencies applied to the part, there would, perhaps, even be a greater chance of success, from the fact of the integument here being mucous membrane instead of skin, as generally exists where local anæsthetics are more usually tested. As it is, however, no agent of this nature, capable of producing such an effect to a sufficient degree, is as yet known to us.

I am unwilling to enter at any further length upon these matters; nor would I feel warranted to occupy space by introducing some other modes suggested as possibly applicable for locally anæsthetic purposes, these having never as yet been sufficiently tested.¹ But I think that, after what has been stated, there are certainly no very encouraging hopes to be entertained of any of the methods as yet adopted being successful in their present modes of employment as local anæsthetics in dentistry. Indeed, had any chance existed of their being so, there is wanting among the leading members of the dental profession, in London and elsewhere, neither the resources nor the will to adopt any such improvements should they be found at all practicable. None of these, however, have ever come into anything like general use, and this fact speaks for itself.²

There seems, however, to be no reason for altogether despairing of ever being able to discover some mode of producing insensibility over a limited surface. We know that several anodyne remedies produce this effect *to a certain extent*; and from the relations of the teeth to the tissues covering them—no part of them being in reality at any depth from the surface—we may, at least, hope with some confidence of their extraction being yet practicable with much amelioration, if not entire absence of pain. In the meantime, however, no method which has been tried can ever be compared, either for facility or effectiveness, with that of inducing a state of *general* anæsthesia; and to do this, chloroform, so far as our knowledge of such agents as yet extends, is decidedly the most desirable in every way. I do not mean to say that this anæsthetic is free from objection on the score of danger to life; and this objection becomes all the more serious, when we consider that the exhibition of such dan-

¹ Several expedients have, from time to time, been advanced, as calculated to serve such purpose; compression of the nervous trunks, as recommended by Dr Moore, 1784, inducing that state known as the "sleeping" of a part; the employment of heat; and, more recently, the employment of carbon and its compounds in various ways—the application of carbonic acid in the solid form, etc., have been suggested as local anæsthetics, and, possibly, some such measures may yet be found effectual in tooth extraction.

² I have been favoured with the opinions of many of the principal dentists in London as well as elsewhere, including the names of Cartwright, Saunders, Barrett, Hepburn, etc., on this matter, none of whom have found freezing or electricity, especially the latter, available in the manner that has been represented.

gerous remedy is often undertaken by those who have no knowledge of either medicine or surgery—a practice not only most reprehensible, but of itself calculated to bring this or any other such means into discredit. But there is no question that to extract a tooth, or, indeed, to perform any other operation painlessly, we at present know of no other method at all generally applicable, or entailing less risk.

Before concluding, let me add a single sentence regarding one little point essential to the extraction of teeth with the minimum amount of pain, that is, the use of proper instruments in the proper manner: a matter too often altogether overlooked, and the knowledge of which is by no means to be attained merely by a few conventional maxims regarding the “pulling of teeth,” as is frequently supposed. When the operation is performed in a correct manner, the pain is by no means so great as is generally expected—indeed, unless inflammation exist within the alveolus, there is very frequently little or no pain felt, especially in the extraction of stumps—a fact which has served the purpose in many cases of imposing upon patients, under the pretence that such immunity from pain was due to the triumphant success attending the employment of “local anæsthetics” in dental surgery.

From the foregoing observations, then, it would appear:—

1st, That the application of narcotic and other substances to the unbroken surface, or even their injection into the tissues, has as yet failed to render tooth extraction painless.

2d, That freezing, from the want of uniformity and uncertainty in its action, and the difficulty of its application, is also inadequate for this purpose.

3d, That electricity, applied in any way yet practised in dentistry, is not an anæsthetic; and that any apparent effects of this nature are due to causes quite apart from any such quality in that agent itself.

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ARTICLE V.—*Case of Sun-stroke—Exposure for Thirty Hours—Recovery.* By F. R. MACDONALD, M.D., Edin.

ALTHOUGH it appears that a considerable number of casualties occur from sun-stroke annually in this country, the case now reported presents one or two features that, from their novelty, may render it worthy of record.

At an early hour on the 13th August last, D. MacA., æt. 20, a shepherd, residing eight miles from Inverary, left home on his customary morning visit to the hill. About 8 A.M. he was seen by a fellow-shepherd apparently on his way back to breakfast. He did not appear, however, at the usual hour, a circumstance that occasioned neither uneasiness nor surprise, as in extensive sheep-walks it is not unusual for a shepherd to be detained the greater part