Anaesthesia : considered especially in reference to operations in dental surgery / by Alfred Coleman.

ANÆSTHESIA:

CONSIDERED ESPECIALLY IN

REFERENCE TO OPERATIONS

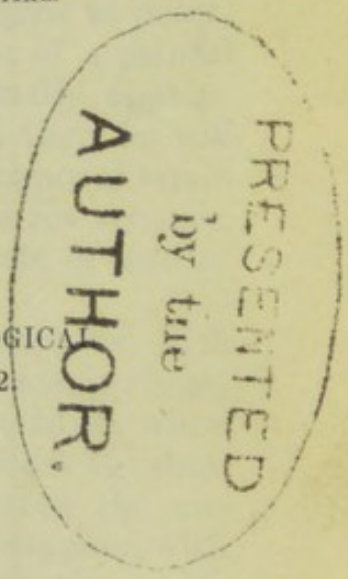
IN

DENTAL SURGERY.

BY

ALFRED COLEMAN, M.R.C.S., L.D.S., &c.,

DENTAL SURGEON TO THE METROPOLITAN FREE HOSPITAL.



A PAPER READ BEFORE THE ODONTOLOGICAL SOCIETY OF LONDON, FEB. 3RD, 1862.

PRINTED BY

J. E. ADLARD, BARTHOLOMEW CLOSE.

1862.

ANÆSTHESIA CONSIDERED ESPECIALLY IN REFERENCE TO OPERATIONS IN DENTAL SURGERY.

Mr. President and Gentlemen,—The subject of anæsthesia, whilst undoubtedly of great interest to the medical profession generally, is one which addresses itself with peculiar interest to the Dentist, when it is considered that the early experiments which laid the foundation for the discovery of this, the greatest boon that has ever been conferred on suffering humanity, were carried out by those engaged in this department of surgical art.

That greater attention should have been devoted by the Dentist to the subject of performing operations without pain than has been bestowed by those practising general surgery may be explained when it is remembered, that operations undertaken by the latter are usually either for the removal of a deformity, or for that which, if permitted to remain without interference, would probably shorten existence. Personal vanity in the former, and love of life in the latter instance, are inducements which have seldom failed to determine patients to submit to them. In the case of a painful tooth, neither of the above considerations usually applies. The patient hopes that the pain may cease, and then he will be as before: he knows that the operation of its removal would be of but very short duration, yet he dreads those few seconds, and wishes he could pass through them in a state of unconsciousness.

That the operation of removing a tooth is attended with as severe a pain, during the short period it lasts, as is, perhaps, felt in almost any operation, is not to be wondered at, when it is considered that in detaching it from its socket the dental periosteum is lacerated and contused between the unyielding fangs and their alveoli—a membrane supplied with branches from that nerve, which so high an authority as M. Brown-Séquard regards as the most sensitive in the body, and we know that crushing a nerve is far more painful than incising it.

Although it is not the object of this paper to enter into the history of anæsthetics, which has already been done by those who have devoted treatises to the subject, we may briefly remark that, if we except the occasional employment by the ancients of certain drugs compounded of preparations of the mandrake, Indian hemp, and some others which they kept secret, the first suggestion which laid the foundation for all that we have since known of this subject emanated

from our illustrious countryman, Sir H. Davy, who recommended a gas, nitrous oxide, commonly called laughing-gas, to be inhaled in order to remove pain in surgical operations. In the year 1844 this suggestion was acted upon by Mr. Wells, a Dentist of Hartford, in Connecticut, though with only partial success. Dr. Morton, also a Dentist in America, and formerly a partner of Mr. Wells's, in conjunction with Dr. Jackson of the same country, experimented with the vapour of ether, the effects of which had for some time been known to be similar to those of nitrous oxide gas, and with complete success.

The first operation performed in this country under ether was also by a member of our profession. The introduction of the so-called chloric ether, in the year 1847, by the late Mr. Jacob Bell (whose assistance in the formation of this Society I trust we all gratefully remember), has, I think, failed to receive the merit it deserves. Mr. Bell employed it at the Middlesex Hospital, where several Dental operations were performed under its agency. Had the nature of this compound been fully known at the time, the cause of uncertainty in its action would have been discovered, and chloroform brought under the notice of the profession. This discovery, however, was left for Dr. Simpson, of Edinburgh, whose labours in the work of rendering operations painless cannot be too highly praised. It will, I think, appear that the Dental profession has played no unimportant part in the introduction of general anæsthesia, whilst its members have probably bestowed a still greater share of attention to producing the more desirable condition of local anæsthesia.

What is really required to extend our knowledge of this subject, which at present is very imperfect, is a more accurate observation of the effects of anæsthetics under different circumstances, and more careful records of those cases which unfortunately have been attended with fatal results.

On the grounds of its more certain and speedy action, as well as of its agreeable odour, chloroform is the anæsthetic generally employed. Its effects have usually been divided into four stages, but as there is no sudden transition from one stage to another, the accounts of observers do not all accord.

From my own observations I should say that the first stage commences with rather agreeable sensations, derived from the first few inhalations, though attended with a feeling of suffocation when too large a quantity of the chloroform is employed; a feeling of warmth is soon felt about the region of the thorax; the intelligence is but slightly impaired and the senses not much altered; the patient sees

and hears most of what is going on around him; the pulse is generally accelerated, and respirations are hurried and irregular. He often feels the pulsations of the cerebral arteries like strokes of a hammer upon his cranium. This stage ends, and the second commences with singing in the ears and tingling in the extremities; a mist rises up before the eyes and the patient becomes unconscious; combined with these, there are frequently muscular movements, often excessive and mostly purposeless; the patient talks or shouts, commencing a sentence and losing his ideas before he has had time to complete it. The pulse I have usually noticed to become very feeble towards the close of this stage. In the third stage we have complete unconsciousness; the muscular movements are replaced by rigidity; the eyelids are commonly closed, the pupils contracted, and the eyeballs turned outwards and upwards as in sleep; the pulse usually recovers itself at this stage, and the respirations are quiet and even; stertorous breathing, accompanied with dilatation of the pupils, constitute the fourth stage. Beyond this is death, a stage which fortunately I have never witnessed.

The effects on the nervous centres in the different stages are, I believe, somewhat as follows:—Towards the close of the first, the cerebral lobes are chiefly affected, as are also those nervous centres through which we appreciate pain—whether through suspension of the function of the grey substance of the spinal cord, which is supposed to convey the impressions of pain, or of some nervous centre through which it is appreciated, I will not venture to decide. In the next stage the centres of the various senses are impaired, and from the character of the muscular movements, I should apprehend the function of the cerebellum was interfered with. In the third stage the spinal cord first suffers irritation, producing muscular spasm, often resembling tetanic convulsions; but as it proceeds it fails to respond to stimuli, as in the fourth stage, where reflex action ceases, except that of respiration, which continues only so long as the office of the medulla oblongata is preserved, which terminates at the end of the fourth stage.

I would not insist that this order is followed out in every case of anæsthesia produced by chloroform, but I believe it applies to the generality of cases, my conclusions having been drawn from observations on about a thousand administrations that I have witnessed.

From the great diversity of opinion which prevails respecting the action of chloroform on the blood, little appears to be known on the subject. Some contend that chloroform replaces oxygen in the blood, and, by preventing its being arterialized, interferes with the proper nutrition of the nervous

centres, and, consequently, with their proper functions; others, that it prevents the carbonic acid being given off at the lungs, producing the same effects upon the nervous centres as the deficiency of oxygen. Many have believed it to be due to carbonic acid formed by decomposition of the anæsthetic; one writer, Dr. Jackson of Boston, is of the opinion that the chlorine of the chloroform replaces oxygen in the blood. A variety of phenomena lead us, I think, to believe that the first mentioned is probably the true effect of chloroform in the circulation; thus, if an animal be made to breathe hydrogen gas, all the effects of anæsthesia are produced, in this case carbonic acid will be given off at the lungs, but no oxygen absorbed, and the nervous centres when called upon to act fail to do so perfectly; anything that prevents perfect oxydation of the blood produces anæsthesia and this whether it be accomplished by witholding oxygen or by supplying its place with some other agent, as nitrous oxide, oxide of carbon, sulphuret of carbon, carbide of hydrogen, chloride of carbon, &c. In the act of strangulation the latter stage is one of anæsthesia, persons who have been resuscitated have stated that after a few moments of great pain from inability to breathe, a most agreeable sensation has followed, in which a colour of magnificent crimson hue or crimson flame has come before their eyes, no doubt the effects of congested retinæ. Blood injected from the external jugular vein into the internal carotid artery, produces anæsthesia. If the effects of anæsthetics were due solely to the carbonic acid formed in their decomposition, such gases as hydrogen and nitrous oxide ought not to produce the state of insensibility which they do. The advocates of this view have reasoned solely on the fact of carbonic acid being an anæsthetic. If chlorine, as Dr. Jackson of Boston, supposes, replaces the oxygen in the blood, then it ought to be detected in the gases expired from the lungs. I have tested for it, but have never found it. Chloroform appears to be absorbed at the lungs and given off again as such by the same organs. Chloroform may act as such upon the nervous centres of the body in a way unknown to us, and it is urged by some, that the effects of narcotics introduced into the circulation through the alimentary canal support this view. They may, however, also act by preventing proper absorption of oxygen, or uniting with it so as to prevent its action on the nervous centres when required; we know that small quantities of stimulants, and certain narcotics prevent a waste of the tissues of the body.

Much difference of opinion prevails as to the best method in which the vapour of chloroform should be administered, some contending for the simple plan of allowing the fluid to evaporate from a handkerchief or piece of folded lint, others

recommending the employment of an instrument; each has its advantages. The lint or handkerchief is easily procured and the patient often less terrified than when an instrument is applied over the face; this is occasionally very important, when it is desired to administer chloroform without the patient's previous consent or knowledge. The advocates for the employment of instruments point out the advantages of being able to administer the agent more regularly, and when properly constructed they prevent the patient breathing over again the air that has just left the lungs, which a moist handkerchief or lint causes to hang about the head and face; where an instrument is used there is less chance also of the face being excoriated from the chloroform touching it. With the instrument a great economy of chloroform is effected, and as in it there is a much smaller evaporating surface, the surrounding air is much less impregnated with chloroform than where the handkerchief or lint is employed, an important point when dangerous symptoms present themselves, and the immediate access of fresh air is required. The best form of apparatus is that of a bag from which air containing the proper proportion of chloroform—about four per cent.—is inhaled, but such an apparatus is not a very convenient one for carrying about. The instrument I have usually employed is Dr. Snow's portable one. These before you on the table are the ones most commonly in use.

But the most important point connected with the subject of anæsthesia, and one that bears directly upon the question before us, is that of the danger of its proving fatal, a circumstance which has led some eminent surgeons to express feelings of regret at its ever having been introduced, and others to pronounce its use unjustifiable except in what are termed capital operations.

In considering this part of our subject, let us endeavour to ascertain in what proportion fatal cases occur. Dr. Snow informs us that in his practice he administered chloroform about four thousand times, and met with two deaths, neither of which he considered due to the effects of this agent, and from his accounts of them, one at least certainly appeared to be due to other causes.

Dr. Simpson, in the article 'Chloroform' in the last edition of the 'Encyclopædia Britannica,' though he does not actually give the proportion of fatal cases, says: "Occasional disagreement with, or deleterious influence upon, one in ten or twenty thousand is no sound argument against other patients benefiting from its employment."

Dr. Kidd, who has given great attention to this subject, states that he has witnessed about eleven thousand administrations, and has seen only two deaths. At St. Bartholomew's

Hospital I calculate that chloroform has been administered, in round numbers, about five thousand times, and there have been two fatal cases. In the Crimea, according to M. Flourens, chloroform was given in twenty-five thousand cases without a bad result.

There is little doubt but that many of the deaths attributed to chloroform have resulted from other causes than the deleterious effects of that agent. Shock, loss of blood, and other causes which before the introduction of anæsthetics killed patients on the operating table, should be taken into account, so that, perhaps, one death in ten thousand might not be far from the correct proportion.

How does chloroform kill? is a question as differently answered as most connected with this subject. Dr. Snow was of opinion that it did so by its direct action on the nervous centres of the heart, causing paralysis of that organ. Dr. P. Black, in a pamphlet entitled 'Chloroform, how shall we ensure safety in its administration?' expresses his belief that all deaths from it are due to asphyxia, arising from spasmodic closure of the glottis, caused by the irritating effects of the chloroform when not sufficiently diluted with air. He regards it as similar to the mode of death which an animal suffers when immersed in a vessel containing a large proportion of carbonic-acid gas, the irritating effects of which cause closure of the glottis, and prevent the escape of carbonic acid from, or entrance of oxygen into, the lungs. The same effect occurs in drowning, the water entering the larynx causes closure of the glottis. Dr. Marcet, in a recent paper in the 'Medical Times and Gazette,' advances the view that this agent, when taken into the circulation in certain doses, will, like alcohol, cause spasmodic closure of the glottis. It is very encouraging to see a physician with the practical knowledge of chemistry which Dr. Marcet possesses, directing his attention to this subject. Some refer the source of death from chloroform, or at least many cases of it, to carrying the administration too far, until the function of the nervous centres controlling the muscles which effect respiration are suspended and the muscles paralysed. Probably animals are thus killed by it, when we see the muscles expanding the ribs first, and the diaphragm next ceasing to act, the heart beating some few seconds after the latter has stopped.

Another mode of death is when the blood is unable to give up its carbonic acid to the air in the lungs, which is too highly charged with vapour of chloroform; arrest of the blood in the capillaries will take place, and the right cavities of the heart becoming distended with venous blood, it ceases to act. It is probable that deaths have occurred in all the ways here mentioned; but the first noticed, viz., that where the heart's

action is arrested through the direct agency of the chloroform upon the nervous centres, is unfortunately the one least under our control, and does not always appear to be due to any disease in that organ.

The conditions, I believe, most important for the safety of the patient in administering chloroform differ somewhat essentially from those that have been advanced by several high authorities. It is my belief, but I express it with much diffidence, that the more slowly, within certain limits, chloroform is administered, the safer will be the condition of the patient—the view held by the late Dr. Snow, by Dr. P. Black, and by those who consider that death usually occurs through spasm of the glottis. Dr. Simpson, on the other hand, in the article on 'Chloroform,' before referred to, states "the principal error committed in using chloroform in surgery, consists in giving it at first in such small doses, or so slowly, as to keep up a state of excitement, instead of inducing a true state of anæsthesia." Dr. Kidd, also, whilst he deprecates the employment of large quantities of chloroform, appears to disapprove of the plan of inducing anæsthesia slowly, as prolonging the generally admitted dangerous stage of excitement. In this stage the heart's action is usually more excited, and respirations more frequent and irregular, so that a larger quantity of vapour may be taken suddenly into the circulation, than in the later stages, where the action of these two organs is moderate and regular. My own experience, however, does not at all convince me that the stage of excitement is longer or more severe when the chloroform is administered very slowly; on the contrary, I believe there is less excitement altogether, than when it is administered rapidly. My friend, Mr. Lloyd, who holds the appointment of administrator of chloroform at St. Bartholomew's Hospital, adopts this plan, and I think with much success.

The vapour of ether, although it has, without doubt, proved fatal in some cases, is, probably, a safer anæsthetic than chloroform. It is not impossible but that its inability to produce anæsthesia rapidly, constitutes the true ground of its being a less dangerous agent. Chloroform, mixed with ether, is much used on the Continent. In some cases chloroform diluted with alcohol, is employed with advantage, its effects I should imagine would not be very different from those produced when it is largely diluted with air.

In addition to the precaution of administering chloroform slowly, I would recommend its not being carried further than is absolutely necessary to produce anæsthesia, which is, I believe, very commonly done. From certain experiments made upon myself, and from watching the effects of chloroform on others, I feel convinced, that in the majority of cases,

if not in all, the sense of pain is removed before that of touch, and even before the complete absence of consciousness. That different nervous centres are the seats of pain and of the sense of touch, has, I think, of late been pretty clearly established. In support of this view, I may mention a few cases bearing upon this subject. On one occasion I administered chloroform at the request of Mr. Laurence, to a patient, from whom that surgeon removed some enormous growths, of the nature of hypertrophied skin, with the ecraseur. When the patient was sufficiently under the influence of the chloroform, three of these instruments were applied, and the racks moved at the rate of four times in a minute; the whole operation lasting about forty minutes. During the greater part of it the patient was sufficiently conscious to be aroused to answer a question put to her with some degree of correctness; but she felt no pain whatever. In another operation, under the same gentleman, I administered chloroform to a girl, from whose upper jaw a growth partly fibrous and partly vascular was removed. During the latter part of the operation, when the surface of the denuded bone was being destroyed by the actual cautery, the patient had recovered much of the effects of the chloroform, and cried out as if in pain; but, on complete recovery, which took place very soon after, she declared she felt no painful sensation at all. Most persons would suppose, that in this case the pain was felt but not recollected. I am inclined to believe that the cry under chloroform is not necessarily an indication of pain, any more than the flinching or drawing away of a limb when incised under similar circumstances; but that it is a reflex action. A patient in a state of coma may often be heard to utter a sound when addressed, so a person also will answer in his sleep; an impression is made upon a certain portion of the nervous centres, and an action is produced, just as a stimulus upon a portion of the spinal cord below a point, were it is cut off from the sensorium, will produce a muscular action through motor nerves supplying the part irritated. I am in the habit of sitting up late at night, and consequently am very heavy in the morning, and when called often answer in my sleep that I am getting up; a form of reply I am in the habit of making when aroused. I believe this to be similar to a reflex action. A few weeks ago, I administered chloroform at the Metropolitan Free Hospital to a patient, upon whom my colleague, Mr. Childs, intended to perform Symes' operation of amputation of the foot. From the very altered condition of the parts about the ankle, the operation lasted some time, and, owing to the diseased state of the tibia, amputation just below the knee had finally to be resorted to. During the operation, I was asked if the patient could feel,

and, upon my replying that he could not, the patient said he could, and when contradicted, again said he could. Yet he evinced no symptom of pain when a portion of the posterior tibial nerve was cut off. During the early part of the operation, the femoral artery was compressed with the hand, for which afterwards the torniquet was substituted, as this was being applied the patient said, without any indication of suffering, I can feel that you are pinching my leg; the sense of touch was present, that of pain absent.

I might narrate many cases of a similar kind, but will just relate what has occurred in experimenting upon myself with small quantities of chloroform. About three years ago, whilst suffering acutely from an abscess in my mouth, I attempted to open it, but experienced so much pain in doing so, that I did not advance beyond a slight superficial incision. I then took a few inhalations of chloroform, and without any sense of pain cut through the indurated tissues about half an inch, and let out the contents of the abscess. I could distinctly feel the progress of the lancet through the structures; it felt as if I were cutting india-rubber. About two months ago, a first upper molar tooth on the right side of my mouth, from which a filling had recently come out, became rather painful, and thinking this a good opportunity for trying an experiment, I applied a pair of forceps to the offender, but they being cold, I experienced a sharp twinge. I took a few inhalations of chloroform, and then re-applied the forceps, but without any painful sensation; and, on taking one or two more inhalations, when I began to have singing in my ears and tingling in my limbs, I applied extractive force, not very cleverly, I suppose, for the tooth came out minus its anterior fang. I distinctly felt the yielding of the alveolus, the movements of the tooth, and the laceration of the dental periosteum, but not a particle of pain. As a rule, my teeth are only removed with some difficulty, and, from the amount of force I remember to have applied, I am satisfied this one afforded no exception. I once removed a tooth from a gentleman who had just drunk the best part of two bottles of wine, and some spirits and water. He declared he did not feel the operation at all, and for some time would not be persuaded it was out. I believe he was in a stage of anæsthesia very similar to that produced by a few inhalations of chloroform.

In addition to the usual precautions of making the patient unloose any portions of the dress that might impede the movements of the muscles of respiration,—of not administering chloroform too soon after a meal, though the opposite extreme of giving it too long after one is perhaps worse,—nothing can be more important than the endea-

vour to calm a patient's fears before commencing the inhalation. Fear has a most depressing action on the heart and nervous system, and this, added to the effects of the chloroform, has been undoubtedly the cause of many deaths. On this account, I think it is a great advantage to be able to tell your patient that you are not going to send him to sleep, but only to make him unconscious of pain; so that he shall know all that is going on, but not undergo any suffering. In addition to the satisfaction of knowing whether any disease of the heart exists, there is an advantage in listening to that organ, as after doing so you may in all probability be able to assure your patient that he will take chloroform exceedingly well; intelligence that is always received with satisfaction. Patients with valvular disease of the heart appear to take chloroform very satisfactorily, although the existence of this, or disease of the lungs, should, if possible, make us more than usually cautious when administering it.

In employing chloroform in Dental operations the first question that may be asked is,—"Are operations on the teeth sufficiently painful to justify the employment of a means by which the life of a patient may be hazarded?" In answering this question, we naturally ask another, viz.,—What proportion of risk does a patient run who takes chloroform? Every person who rides in a railway train runs some risk of being killed, but the risk is so small that no one feels it is imprudent to do so. We came to the conclusion, when considering the proportion of fatal cases of chloroform, that they were about one in ten thousand. As every Dentist probably removes more than ten thousand teeth during the whole of his practice, if he employed chloroform in every operation he might expect one fatal case to occur to him in the course of his lifetime, an event which no sensible man would desire. In the above proportion are included deaths from all causes occurring whilst the patient is under chloroform, together with those that have arisen from incautious and improper administration, especially that of commencing with such quantities as ℥j to ℥ij poured upon lint or a napkin; whilst want of knowledge or presence of mind has prevented the resuscitation of many whose lives otherwise might have been saved. I think it would be a safe rule to lay down, never to recommend chloroform for the extraction of one or even two teeth, provided there appeared nothing remarkably difficult about their removal; but not to refuse it if the patient very much requested it, and then to apply it only in the small quantity before recommended. If only carried thus far, I do not believe the proportion of fatal cases would exceed one in fifty to one in a hundred thousand. In looking over the recorded cases of those who have died after taking

only a few inhalations, if we exclude those where the patient was evidently asphyxiated from an over-dose of the agent, I do not think they will be found to exceed ten in number.

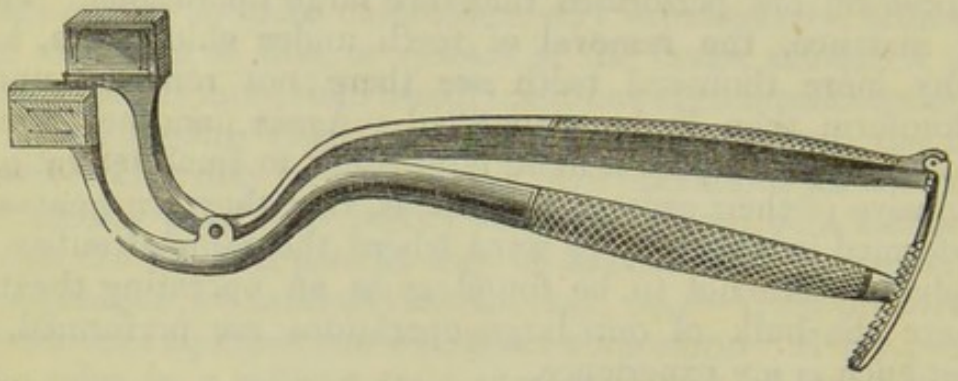
When, however, our patient requires four or more teeth removing at one time, our course then becomes clear, and, on the ground of humanity, unless an objection is expressed, we may justly urge its employment.

I must here make some reference to a paper by Dr. Kidd, in the 'Medical Times and Gazette' of June, 1860, in which the author endeavours to point out how much more fatal small operations have proved under chloroform than large ones; but, in his calculations, he never once takes into account how much more frequently small operations under chloroform are performed than are large operations. Take for instance, the removal of teeth under chloroform, how many more thousand teeth are there not removed under chloroform than limbs amputated. Again, another reason why we might expect a more fatal result to small operations, exclusive of their greater number, is, that they are generally performed in a surgery or ward where the same attention or appliances are not to be found as in an operating theatre, where the bulk of our large operations are performed, at least such is my experience.

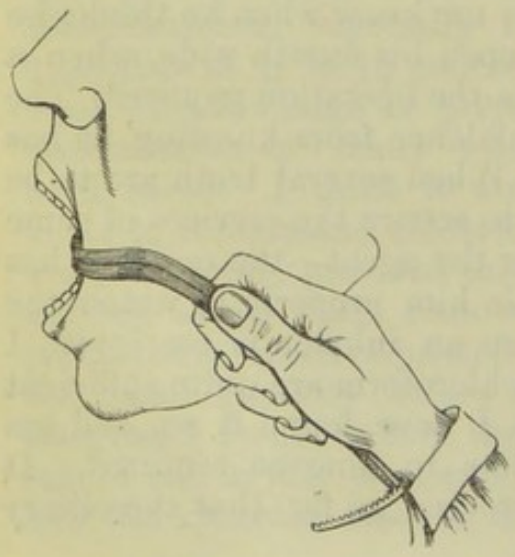
Operations on the mouth under chloroform are always difficult to perform. The patient's position, usually semi-recumbent, permits the head to fall down upon the chest; the tongue also gets in the operator's way; blood runs down the throat, exciting coughing and vomiting, as well as hiding the teeth and stumps to be removed, and often it is difficult to keep the patient's mouth open sufficiently wide for the ready introduction of instruments. Should it be required to remove one or two teeth only, the plan of giving a few inhalations may be adopted with advantage. When doing so, I usually allow the patient to hold the inhaler himself, telling him to let me know when he thinks he has had sufficient, and then to open his mouth wide, when a second or two probably completes the operation required. The patient, I think, feels much confidence from knowing he has the control of the chloroform. When several teeth are to be removed, it is always expedient to secure the services of some person accustomed to administer the agent—the operator has too much to attend to, to enable him properly to watch the effects of the anæsthetic. When an inhaler is employed, I think ten or twenty minims of chloroform are quite sufficient for commencing with, at least I have found it so, and ten minims may be added from time to time as required. It is commonly the practice to proceed so far that the ciliary

margin of the eyelid is not sensible to the touch; but, as this is a reflex as well as a voluntary movement, it is, as Dr. Kidd and others have shown, a test by no means well adapted for ascertaining the degree of anæsthesia; pinching also is felt by the sense of touch after that of pain has been removed. I think one of the best tests is speaking to the patient, or very slowly commencing the operation, and watching its effects.

Supposing the patient to be sufficiently under the influence of the chloroform, the next step is to open the mouth and keep it open, often difficult to manage on account of muscular rigidity. To meet this difficulty I constructed, about a year ago, an instrument, of which the following description was given in the 'Medical Times and Gazette' of 26th January, 1861:



"The instrument is constructed upon the principle of a pair of forceps, with this difference, however, that the handles do not cross each other at the hinge, so that by pressing them together, the blades or short extremities are separated. About the hinge the instrument is curved upon itself. Attached to one of the handles is a spring catch, which keeps the blades fixed at any required distance from each other. The extremities of the blades are made broad, and covered on their outer surface with vulcanised india rubber. In using the instrument the handles are opened, and the blades brought together, and the latter are introduced between the teeth at the back of the mouth at the opposite side to that on which any operation is to be performed. The curve of the instrument adapts itself to the cheek, and prevents either the handles or blades being in the operator's way. By compressing the handles, the blades, and, consequently, the patient's jaws are separated from each other, and by means of the catch can be maintained in the required position at the will of the operator.

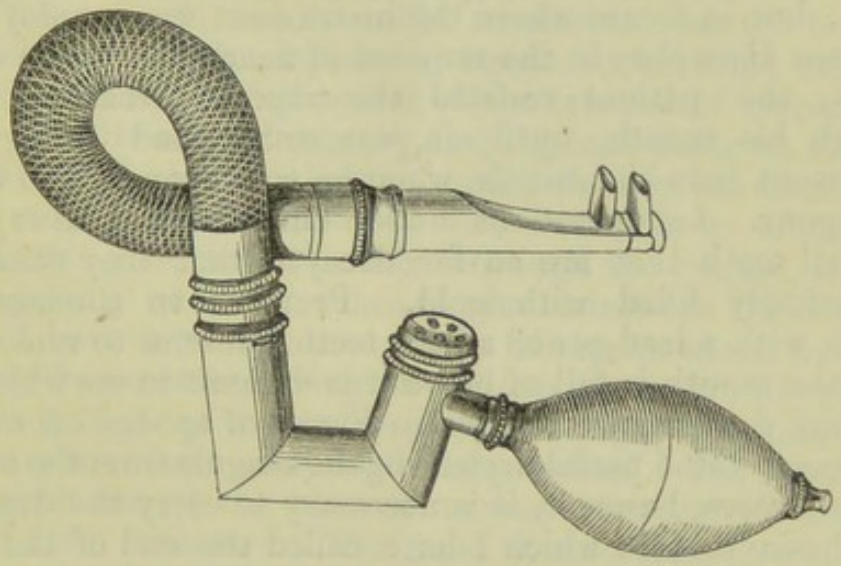


"The instrument was constructed and is best adapted for operations on the teeth under chloroform, but it has been found useful in other operations on the mouth as well.

"It possesses the following advantages: of being readily introduced into, and removed from, the patient's mouth; of quickly increasing or diminishing the distance of the jaws from each other; of enabling the assistant who administers the chloroform to apply this agent from time to time without removing the instrument from the mouth; of being quite out of the way of the operator; and, by means of the vulcanized india-rubber pads, of avoiding all risk of injury to the teeth or gums."

That portion of the instrument which keeps back the cheek on the opposite side of the mouth to which the instrument is introduced, was suggested to me by Professor Humphry, of Cambridge.* I have used the instrument on very many occasions, and have found it invaluable; a first, and even, at times, a second molar tooth may be removed on the same side of the mouth as that at which it is introduced.

The cases we select for operations under chloroform are generally those where there are several difficult teeth or stumps to be removed, and the time required to effect this usually necessitates the reapplication of the chloroform often more than once, prolonging very much the operation and increasing its danger; in addition to which more blood finds its way into the stomach and excites the annoying occurrence of vomiting. I had long felt this inconvenience, and upon seeing in one of the medical journals an account of chloroform being inhaled through the nose in an operation on the mouth, I constructed an instrument for the purpose, which was thus described in the 'Lancet' of the 11th of last month:



"The difficulty of keeping up the anæsthetic effects of chloroform in operations on the mouth induced Dr. Richardson to adopt the ingenious plan of administering this agent through the nose. The instrument here figured is one designed by Mr. Coleman for this purpose.

"It consists, firstly, of that portion of Dr. Snow's portable apparatus which contains the bibulous paper to be saturated with chloroform; to this an elastic tube, about 10 inches long, and of the same diameter as the instrument, is fitted in the same simple manner as the face-piece of Dr. Snow. In the brass cap at the further extremity of the tube, a valve, opening outwards, is inserted. To this cap is also attached the nose-piece—a silver tube flattened upon its upper surface, and having soldered into its end, at a right angle, two smaller tubes of an oval form. These converge slightly towards each other at their extremities, and by means of a slide the distance between them may be diminished or increased. Just below the open extremity of the instrument, where the air enters and the chloro-

* This is not shown in the woodcut.

form is introduced, an elastic india-rubber bottle is connected, having a valve at each extremity, opening towards the tube.

"In using the instrument the patient may be brought under the influence of chloroform with the face-piece attached in the usual way. When the patient is sufficiently insensible, the face-piece is removed, and the tube with the nose-piece substituted, the smaller tubes being inserted into the nostrils. In consequence of the nostril-tubes being made to approximate, they can be adapted for persons of different ages, and when introduced by closing them the nose-piece is held in its proper place. It having been found in some cases that when the mouth is open the full effects of the chloroform cannot be kept up, the india-rubber bottle has been added, to enable the administrator to force a stream of air through the instrument into the patient's nose. By placing the thumb on the open extremity and compressing the bottle in the palm of the same hand this object is readily accomplished. By simply closing the opening with the thumb, the action of the instrument is immediately suspended; by partially closing it the effects are lessened. The valve in the tube prevents the return of air which has been respired, which escapes at the patient's mouth."

This instrument was first tried, and with complete success, in a case of necrosis of the lower jaw, from fumes of phosphorus, on which occasion Mr. Paget removed nearly the whole of that bone. Since I have employed it, it has never failed to accomplish all that I require.

The india-rubber air-propeller I have rarely had occasion to use; but in a case where the instrument was employed by Professor Humphry in the removal of nearly the whole of the tongue, the patient resisted the vapour, breathing only through his mouth, until air was compressed through the instrument into his nostrils, when he was compelled to inhale the vapour. In operations under chloroform I always remove all teeth that are so far decayed that they cannot be satisfactorily filled with gold. Previous to commencing, I mark with a lead pencil all the teeth I intend to remove, as when the mouth is full of blood it is difficult to see which the teeth are that require removal. Pieces of sponge on wooden handles are found useful in clearing the coagula from the mouth. In some cases, however, it is necessary to carry the degree of anæsthesia to that which I have called the end of the third stage, viz., where it is required to overcome muscular spasm, as in the reduction of dislocations, the extension of contracted limbs, &c. In cases that come more especially under our notice, we occasionally meet with some where rigidity of the muscles of the lower jaw arises from a diseased tooth. The mouth is sometimes so firmly closed that it requires the aid of chloroform to the above extent to enable the mouth to be opened sufficiently wide to remove the exciting cause. Such a case as the following is one in point:

Elizabeth Tucker, æt. 11, a pale, unhealthy-looking child, with a somewhat idiotic expression, was sent to me by a surgeon to one of our large hospitals. She had been a healthy child up to eight years old, when she had scarlatina. In addi-

tion to some of the common sequelæ of this disease, she had numerous abscesses on various parts of the body, for which she had been in King's College Hospital. About a year after leaving this hospital, she had pain in a left first lower molar tooth, and from that time up to the period I first saw her there had been increasing difficulty in opening the mouth. The only movement she could make separated the teeth scarcely one eighth of an inch apart. This patient was placed under chloroform, carried so far that muscular rigidity was overcome, and without much difficulty, with the aid of the mouth-opener I have described, I was enabled to remove the tooth. When I saw her a week afterwards she could open her mouth very well.

Before offering some remarks on local anæsthesia, it is perhaps right to say a few words upon the best means to be adopted should any alarming symptoms occur whilst operating with chloroform. Ordinary syncope is not uncommon, especially when much blood is lost. In such cases the horizontal position, or what is still more effective, pressing the head down upon the knees, would, in all probability, suffice to restore the patient; but we must remember that the blood is charged with a very depressing agent, so we must excite as soon as possible the full action of the muscles of respiration, to get rid of it at the lungs, by dashing cold water on the face and chest, and moderately stimulating the mucous membrane of the nostrils, &c. It may be also advisable to administer stimulants: this should be done through the rectum, for fear of any getting into the trachea if administered in the ordinary way. I have witnessed many cases of this accident, but have had only one case occurring in my own practice. My patient was a lady of about twenty-seven years of age, for whom it was necessary to remove every tooth she possessed. The gentleman who administered the chloroform was her relative—a physician of some eminence. She came to me about 12 o'clock in the day, having eaten very little breakfast. She was pale, apparently much alarmed, and her pulse was quick and feeble, on which account a little wine was given her. She took the chloroform well, which had to be applied two or three times, as she came round very rapidly. When all her teeth had been removed but six, her face suddenly became pale and her lips rather livid, her pulse became very feeble, and soon could not be felt. I applied a stethoscope over the heart, but could not hear it acting. The recumbent position was immediately adopted, fresh air admitted by the window, and cold water dashed on to the face and chest. This soon produced one or two sighing respirations, followed by return of the pulse and subsequent animation. On the same day the lady dined with

her relative, and, under his advice, returned to me in the afternoon, when the six remaining teeth were removed under chloroform, which she took remarkably well. I may here state, that I think it best not to remove all a patient's teeth at one operation, but rather to remove the teeth on one side of the mouth at a time, leaving the second operation until the side first operated on has pretty well healed up. This plan enables the patient to have one side of the mouth to eat upon. When they are all removed at once, I have found that the gums are often some time in healing up, and frequently do so only by granulations which prevents the patient using a temporary set for some time.

To return to the subject of resuscitation. Should the means proposed, viz., the horizontal position, the admission of fresh air, the application of cold water, and introduction of brandy into the rectum, fail to restore animation, recourse must be had to artificial respiration. Should the accident occur when only one medical man is present, Marshall Hall's method is that most easily performed; but when there is plenty of assistance I should prefer the plan of placing the patient in the supine position, pressing upon the ribs and abdomen, and remove the pressure, about twenty times in a minute. It is an advantage to be able to watch the patient's countenance during this operation, and to see that air freely enters and is expelled from the lungs. Should it not do so, tracheotomy should be performed, as Dr. Marcet has recently shown that the chloroform in the system may produce spasmodic closure of the glottis. Of course, before doing so, the tongue should be drawn forward, as this might, by falling back, have closed the glottis. I would myself keep up artificial respiration for an hour before giving up a case as hopeless. Galvanism has been found of little avail in these cases, and probably, from the time lost in employing it, worse than useless. If the veins of the neck and face appeared much distended, an external jugular vein might be opened, but artificial respiration will usually soon relieve the right cavities of the heart.

Since the introduction of ether and chloroform, much attention has been directed to the truly important object of producing local anæsthesia. Dr. Arnott, in introducing a mixture of pounded ice or snow, and salt, to a part to be incised, or otherwise injured, has to some extent accomplished this object. The intense cold thus applied to a part causes contraction of the capillaries, and shuts off from the nerves their supply of blood, rendering them insensible to the impression of external agents. Mr. Walter Blundell, in conjunction with Messrs. Horne and Thornthwaite, of

Newgate Street, invented an ingenious instrument for applying Dr. Arnott's principle in removing teeth, a description of which is to be found in an account of patents relating to Dentistry, given by Mr. Owen in the recent numbers of the 'British Journal of Dental Science.' The important part of their method of applying cold, is in doing so very gradually, and in not permitting the return of warmth suddenly. Notwithstanding every care that may be taken, the operation is frequently a painful one, and cases of sloughing of the gums and exfoliation of bone not very rare, one of which has come under my notice. Putting aside the length of time it occupies, the results given by those who have employed it are anything but satisfactory. I have seen cold used with most success when the surface of a part, as that of a cancroid ulcer, had to be destroyed by the action of liquid escharotics.

In the spring of the year 1858 I tried a number of experiments with electricity, my object then being to cause contraction of the capillaries by that agent, as is done by cold, and so by shutting off the supply of blood to the nerves of a part, render them insensible to impressions otherwise painful. Ill health, arising from overwork, prevented my continuing these experiments, and compelled me to leave town for some weeks. On my return, the daily papers were full of the accounts of the painless removal of teeth by electricity. So encouraging did the accounts of operations done in this way appear, and so satisfied did some of our patients express themselves with it, that its application in Dental Surgery seemed likely soon to become universal. Yet I apprehend but few practitioners now employ it to any extent. I rarely do so even for those who previously believed they had been saved suffering by its application. In attempting to estimate the amount of pain a person feels in any operation, great allowances must be made for the nervous condition of the patient. Persuade your patient that an operation can be performed without his feeling pain, and you have done much to save him suffering; his attention is withdrawn to some extent from the sensations, and they are less acutely realised. On the other hand, we see how much an individual feels who has the mind strongly impressed with the idea that acute pain is impending. The exclamation which often precedes the application of the forceps to a tooth shows how the mind anticipates the coming pang. Electricity distracted to some extent the attention, which was engaged with the sensation it produced, so that the true sensation of pain was not so greatly appreciated. persons often told me they felt as much pain, but they

seemed better nerved to bear it. When it was employed, the operator experienced the advantage of having his patient in a good position, in which he was kept by muscular rigidity. In experimenting upon myself, I could never so far remove pain with electricity as to enable me to remove one of my own teeth, which I found no difficulty in doing after a few inhalations of chloroform. Several substances, as ether and camphor, chloroform and camphor, &c., have lately been recommended as removing pain in Dental operations when applied locally to the gums. Under my hands these bodies thus applied have not produced the desired results. When they have, I believe it has been chiefly due to several causes:—1, the effect on the mind, as just noticed; 2, some of the body getting into the circulation through the mucous membrane; and 3, some of the vapour of the chloroform or ether getting into the circulation through the lungs; I am very much in doubt as to whether the action of ether or chloroform on a nerve-fibre would have the effect of preventing its conducting impressions to the brain. Many of the remedies applied locally to alleviate pain do so by getting into the circulation, and so affecting the nervous centres. I have lately seen several cases where morphine has been injected into the subcutaneous tissue with this object; but it appears to make no difference at what part of the surface of the body it is injected, whether near or distant from the affected region. I have attempted to inject the gums with chloroform; but, although I employed the best constructed syringes, failed, in consequence of this structure containing no loose cellular tissue. I do not deny that certain bodies, as aconite, &c., act locally upon the peripheral extremities of nerves; but I think Dr. Simpson is not far wrong in the statement, "that in the human subject the degree of partial or superficial anæsthesia which is capable of being produced by chloroform in the state of liquid or vapour, is never sufficiently great to allow of the part being cut or operated upon without pain, at least not in man, probably in the lower animals."

The method of producing anæsthesia by pressing upon the nervous trunk supplying a part, is, I think, not applicable in operations on the teeth.