Painless tooth-extraction without chloroform : with observations on local anaesthesia by congelation in general surgery / by Walter Blundell.

Painless Dentistry

by

WALTER BLUNDELL

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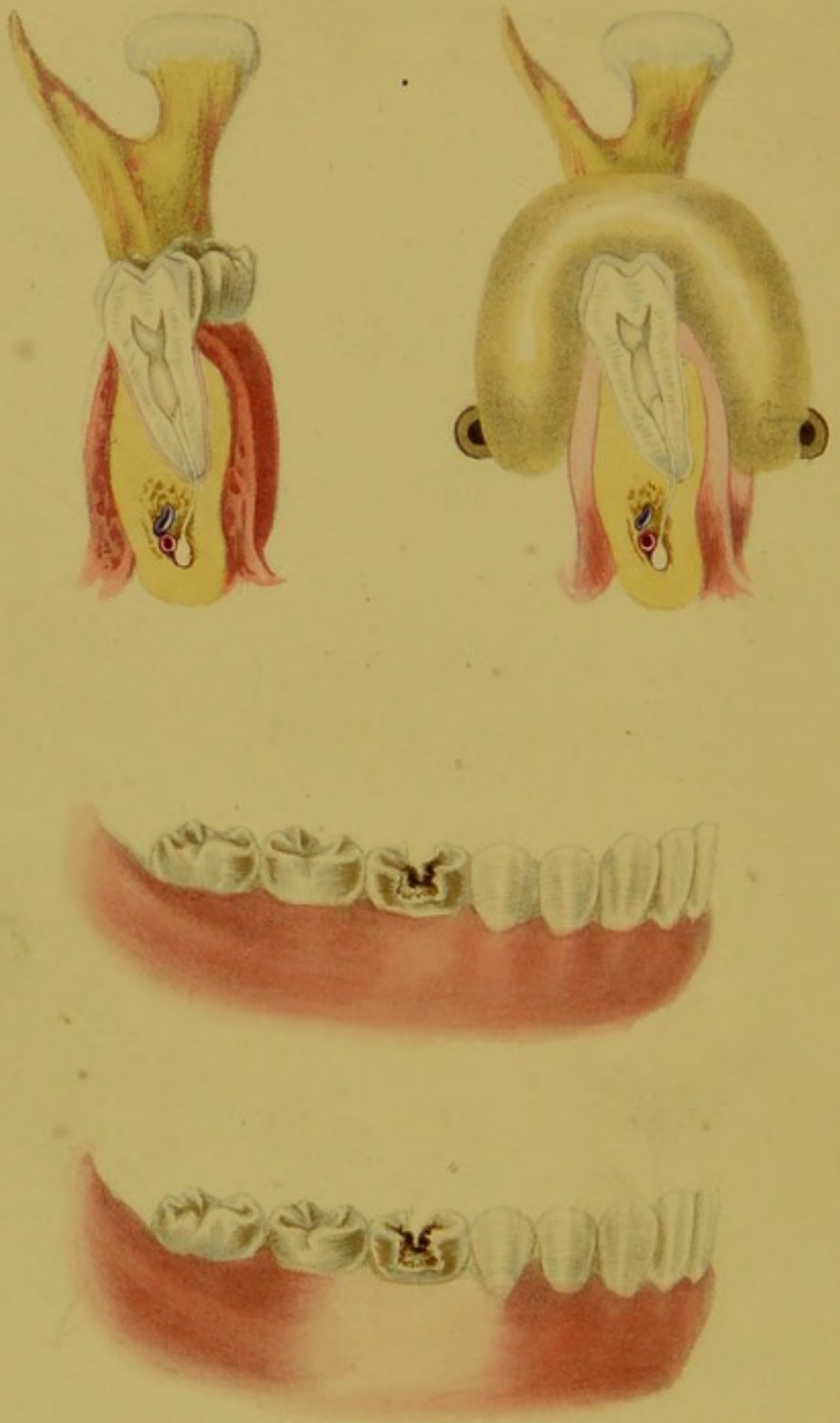

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PAINLESS TOOTH-EXTRACTION

WITHOUT CHLOROFORM.

WITH

OBSERVATIONS

ON

LOCAL ANÆSTHESIA BY CONGELATION

IN

GENERAL SURGERY.

BY

WALTER BLUNDELL,

SURGEON-DENTIST TO THE METROPOLITAN FREE HOSPITAL.

Second Edition.

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PREFACE.

THE very encouraging sale of the first edition of this pamphlet has induced me, in the present instance, to spare no expense to render a second issue still more worthy of professional and public notice. To effect this, the subject-matter has been in many parts rewritten, as well as arranged in separate chapters, in order to facilitate reference to the chief points of argument in favour of the *benumbing process*, and as superseding the future employment of *chloroform* in dental operations.

The following pages are in advocacy of an agent which may faithfully and effectually serve mankind as a rational anæsthetic. It is one, moreover, which, to render the body insensible to pain, does not require (as all others hitherto have done) *the surrender of consciousness*. Thus it will appear that, though chloroform has failed in one great essential point—*safety*, the hopes of the human race are

not thereby annihilated; and that for the prevention of pain other effective means are open to us all. Etherization, to annul the pain of surgical operations, is an agent which for some time bade fair to realize the dreams and hopes of the afflicted; but of late it has too plainly manifested an inglorious subserviency to a power whose resistless hand no surgeon's art can stay. This feature of its character is rapidly developing itself in the form of *frequent* fatal accidents. Such misfortunes are, we find, publicly chronicled, to the dismay of its staunchest advocates; and, as an inevitable consequence, the former unalloyed delight of the public mind is giving place to increasing anxiety and fear. It will therefore appear that I have not appealed against the use of chloroform in surgery *beyond* the wide circle of *minor* operations; nor have I exaggerated its dangers.

It is now nearly five years since I commenced a series of experiments to overcome the obvious disadvantages attending the direct application of *cold* to such sensitive parts as the mouth and teeth, and have at length succeeded beyond my most sanguine expectations. I early found that the means used by my predecessors in the cause of local anæsthetics, as elsewhere described, served only to maintain those disadvantages, and that some method should be found to produce insensibility or numbness in the part without "shock" or inconvenience

of any kind. This was the object steadily pursued—*and this I have attained.*

I have much pleasure in acknowledging the assistance of Mr. Bagg,—whose talent and truthfulness as an illustrator are too well known to require further notice.

WALTER BLUNDELL.

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AND
15, Stratford Place, Oxford Street.

London: *January* 1*st*, 1856.

EXPLANATION OF THE COLOURED PLATE.

FIG. 1. A section of the right side of a lower jaw, dividing the second molar tooth.

FIG. 2 presents the same part as in fig. 1, with the addition of the terminal portion of the apparatus which comes in contact with the tooth and jaw. The gum and dental periosteum are shown in their frozen or bloodless state.

FIG. 3 presents the side view of a lower jaw in its natural condition.

FIG. 4. The same as fig. 3, but showing the blanched appearance of the gum when under the influence of the numbing process.

CONTENTS.

PART I.

ANÆSTHESIA IN GENERAL SURGERY.

CHAPTER X.

CHAPTER XI.

CHAPTER XII.

PART II.

ANÆSTHESIA IN DENTAL SURGERY.

CHAPTER I.

CHAPTER II.

CHAPTER III.

CHAPTER IV.

PAINLESS TOOTH-EXTRACTION,

ETC.

PART I.

ANÆSTHESIA IN GENERAL SURGERY.

CHAPTER I.

NITROUS OXIDE GAS AND SULPHURIC ETHER AS ANÆSTHETICS.

It is worthy of note that the first attempts at modern etherization were undertaken by a *dentist*, with the object of annulling the pain of tooth-extraction. In the year 1844, Mr. Horace Wells, a dentist of Hartford, Connecticut, U.S., following up the suggestion of Sir Humphrey Davy, respecting the anæsthetic property of nitrous oxide gas, submitted to the loss of one of his teeth, which was accomplished without consciousness, while under the influence of that gas. Several of Mr. Wells's patients afterwards underwent the same process, and with the same happy results. A bitter disappointment, however, awaited him. Transported with the prospect of a glorious career, he set out for Boston, to make a public demonstration of his discovery to the medical profession: but, through mismanagement, this

attempt failed, and the failure ultimately cost him his life. The scorn and derision of the medical public drove him from his profession. He wandered about a year or two, an unquiet spirit, and at length, finding that his own failure was but the forerunner of surer means of anæsthesia, and that to another were to be given laurels of which some were due to him, in reckless vexation he sought relief from disappointment in death. Horace Wells had, however, lived to some purpose. He lived to restore to humanity, in recent times, the idea of, and to revive attempts at, a *painless surgery*.

The revival of these attempts in the nineteenth century, owing to the great progress of chemical science, and the general advancement of the age, was not likely to be doomed to the same isolated fate as in ancient surgery. We consequently find an old pupil and partner of Wells, W. G. T. Morton, carrying on the experiments. Nitrous oxide gas was abandoned as incompetent. The inhalation of sulphuric ether was destined to replace it. Morton first tried the anæsthetic property of this ether in his own person. It was then tested, and certified to by witnesses as completely successful in the person of one Ebenezer Frost, a timid man, shrinking from the operation of tooth-extraction. He inhaled the ether from a handkerchief, fell into deep unconsciousness, and waking up, found his old enemy, a carious tooth, lying by his side. And thus, as Dr. Bigelow tells us, at nine in the evening of the 30th of September, 1846, a new era in surgery began by the *painless extraction of a tooth.*

The power of the new agent to annul pain was soon

tested in other surgical operations, and with the same success. The operating theatres of the American hospitals resounded with its praises. The accustomed wailing of sufferers beneath the surgeon's instruments were all hushed. Stillness reigned around the dreaded operating table. The sting of surgery was plucked out. The surgeon's nerve was now all strung: calmly, deliberately, he could do his work. Unimpeded by muscular contractions—unembarrassed by the sufferer's contortions —unharassed in his mind by bewildering cries, he pursued his manipulations as on lifeless forms. Surgical impossibilities at once became possible. And the mortality from operative surgery gave indications of diminution, from the annihilation of nervous shock. Nor was this pain-destroying ether to be the exclusive agent of the surgeon. To the physician, it alike extended its kindly aid in assuaging the agonies of internal acute disease, and also in soothing the often tortured passage to the grave. Nor was it to be a boon to those alone departing from the world, but also to many on their arrival into it. The pains of the parturient chamber, often not less fearful than those of the operating theatre, were quelled, and operative midwifery saw many of its difficulties vanishing.

The grateful news soon crossed the Atlantic; and speedily, praises of the pain-destroying ether were uttered in every corner of this country. It came, however, to show its virtues only to have them supplanted. An alarm was sounded; it had been fatal. The warning was little heeded; by most it was disbelieved. Nevertheless, objections and inconveniences were alleged to

pertain to sulphuric ether. Its odour was not grateful; it irritated the bronchi during inspiration; its required quantity, to produce its effects, was excessive. Prompted by the conviction, that "we would ultimately find that other therapeutic agents were capable of being introduced with equal rapidity and success into the system, through the same extensive and powerful channel of pulmonary absorption," Professor Simpson, of Edinburgh, applied himself to the discovery of a new agent.

CHAPTER II.

DISCOVERY OF CHLOROFORM.

MANY attempts were made, and met with as many failures. In an interview with Mr. Waldie, of Liverpool, the conversation turned upon anæsthetics, and Mr. Waldie recommended *chloroform*. Professor Simpson, forthwith, delaying no time, puts chloroform to the test. It comes out victorious. Its anæsthetic effects are produced with "a greatly less quantity than of ether; its action is much more rapid, complete, and persistent; its inhalation is more agreeable; its perfume is more pleasant, possessing an agreeable, fragrant, fruit-like odour; it leaves no disagreeable exhalation from the lungs, is less expensive,"* &c. &c. From this time (1847) chloroform became the popular anæsthetic on this side the Atlantic. Notwithstanding its alleged superiority, however, it has failed in acquiring universal ascendency. Not a few practitioners in this country, and still more on the continent, think they find a better and safer agent in a mixture of chloroform and sulphuric

* 'Anæsthesia in Surgery and Midwifery,' by Dr. Simpson, p. 194.

ether; while in America, the latter has always maintained its pre-eminence: and even in our own country, there is a growing conviction among surgeons of the far greater safety of ether. And it is a recognised fact, that ether has the decided advantage over chloroform, in producing perfection of muscular relaxation, rendering it the preferable anæsthetic in cases of hernia, dislocations, spasm, &c. Doubtless chemistry is not yet exhausted of its available anæsthetic agents: and, for aught we know, another material may one day substitute chloroform, as chloroform has, in Europe, taken the place of ether.

CHAPTER III.

THE DANGER OF CHLOROFORM.

Brilliant, however, as has been the career of modern etherization, whether by sulphuric ether or by the vapour of chloroform, it has proved itself defective in one most essential point. It has, indeed, accomplished the annihilation of pain, but it has not accomplished the other requisite accompaniment; viz., immunity from accidents. Cautious men, not blinded against possibilities, from the first, saw and predicted danger. They saw in chloroform an agent which might possibly *kill*. They lived to see it become the destroyer of life. The alarm was first rung on the banks of the Tyne. A young woman died while under its influence, for an operation on the foot. Professor Simpson was unwilling to see in this instance a death by chloroform; and endeavoured to explain it away as a death by asphyxia, from the means employed at reanimation. Dr. Glover of Newcastle, and others, took from it a graver and truer lesson. Other instances sprung up in different parts of Great Britain, and on the continent, and the blame was now shifted from imaginary asphyxia to chloroform badly made, or badly administered. Chloroform-deaths

marched on apace, but in every case was sought a palliation. At length, death took its stride northward, near home; placed its resistless hand on a poor person in the Edinburgh Infirmary. Old excuses and explanations were now scattered to the winds. The stoutest defenders of its innocuity were silenced; for in this case the chloroform was undoubtedly good, was properly administered by an experienced hand, and was contra-indicated by nothing ascertainable in the condition of the patient. The inference became inevitable: the most unwilling were compelled to admit the *possible fatal effect of chloroform, per se, without distinction of person or state.* From fifty to sixty recorded deaths confirm the correctness of this conclusion. The post-mortem examinations have revealed nothing satisfactory as to the fatal cause. Nay, they have rather added to the bewilderment. Some have looked with suspicion on a fatty degeneration of the heart,—a circumstance that can only come to light too late; viz., when that organ is laid bare by the scalpel. On the other hand, the chemical composition of chloroform throws no ray of light over our darkness; for it is important to observe, that *the same chloroform administered in the same quantity to the same individual, may be innocuous at one time, and fatal at another.* Viewed in this double aspect, the question becomes ominously grave. Men *may* die,—men *have* died, under the influence of chloroform, without any previous monition either to the patients themselves, or to their surgeons. The utter absence of any pathological condition on the part of the patient, or of any chemical defect in the chloroform itself, or in the

mode of its administration, to which accidents can be attributed, have led many of our best surgeons to infer that death, in these cases, arises from *paralysis of the heart.* A fearful contingency this. And who is secure against this contingency? Where is the patient whose *heart may not be thus paralysed?* The wave of life sometimes flows tremulously and uncertain. Who knows, that in the hour of anæsthetic unconsciousness, his own wave of life may not recede, or cease to flow? The question cannot but all forcibly present itself to every and any individual, since the condition determining paralysis of the heart is imperceptible, and unascertainable.

It may be alleged that we are prejudging the question, inasmuch as it is possible that further investigation may reveal the fatal cause. But what if, when ascertained, it be neither removeable nor remediable? What if it leaves us to the risks and chances of ever-varying constitutional states? We confess to have our fears. Stern facts have fostered those fears. The end of those who have never awoke from the unconscious moment of artificial repose, makes us tremble.

CHAPTER IV.

MORTALITY FROM CHLOROFORM COMPARED WITH OTHER REMEDIAL COMPOSITIONS.

We do not participate in the wholesale repudiation of chloroform, *solely* because it has been productive of a few deaths out of, probably, a prodigious number of cases. For, in all probability, the ratio of fatal cases to the entire number of successful ones, may not exceed, or equal, the ratio of mortality from many medicines in ordinary use. Mercury, opium, &c., may, in a slower and less ostentatious, though not less certain way, have despatched mankind from the theatre of existence at a far higher rate. There is, however, this essential difference. In the one case, the fatal result is sudden, immediate, irretrievable. In the other, it is less summary, and more under human control. If a practitioner has pushed his mercury or his narcotic too far, he has antidotes or means at hand to arrest its fatal action. But when the heart is once paralysed, the end hath come. And another most important distinction consists in the object for which such powerful agents are employed. The risk incurred in taking almost dangerous doses of a powerful medicine to counteract the fatal tendency of disease, is a far more

legitimate course of conduct, than to resort to such dangerous doses merely to become insensible to a temporary pain. One may be justified, for example, in resorting to partial poisoning, as in salivation, to arrest an inflammation which is hourly reducing his chance of life, when no justification could be awarded for adopting a similar course for the inadequate object of saving pain. It is the inadequacy between the means used, and the end gained, which forms the line of demarcation between chloroform and general medicine. Our objection, moreover, lies rather against the *principle* of the production of anæsthesia *by pulmonary absorption.* It is doubtful if any agent, sufficiently powerful to produce complete anæsthesia, can be altogether innocuous, when absorbed into the circulating system. The changes it must necessarily work upon the vital fluids, sanguineous and nervous, must be of a character and extent which cannot be conceived free from danger. Nor does it appear possible to produce anæsthesia by pulmonary absorption without at the same time abolishing consciousness. The anæsthetic that is wanted, is one, which shall so act upon the nervous system as to *annul pain with perfect safety to the general system, without abolishing consciousness.* Neither chloroform nor ether come up to this standard. They are therefore thus far to be condemned, as not fulfilling all the conditions of rational anæsthetics.

CHAPTER V.

CHLOROFORM AS A LOCAL ANÆSTHETIC.

It seems most probable, that the anæsthetic possessing that happy combination of innocuity and effectiveness to which we have alluded, will be one of a class of *local* anæsthetics; or an agent, the influence of which shall be capable of limitation, and easily controllable. The dread of danger attending the artificial production of general insensibility, for surgical purposes, appears to have been entertained from the earliest recorded mention of anæsthesia. Similar ideas seem to have occupied the minds of those who have been most influential in introducing general anæsthesia. Hence we find Professor Simpson himself not altogether content with the agent he advocated. He shared the common sentiment as to its radical defect; and alluded to the production of local anæsthesia as vastly preferable, if any effectual method could be discovered. With this view he undertook a series of experiments in the hope of showing, that in chloroform, locally applied, that end was attainable. But the experiments conducted by himself, as well as others by Mr. Nunneley, of Leeds, convinced them of its inefficacy for surgical purposes. It was not, therefore,

without some surprise, that we lately witnessed an attempt at the revival of local anæsthesia by chloroform, by Mr. Hardy, of Dublin. The instrument invented by him to produce a strong local current of the vapour was ingenious enough, but appears to have failed in accomplishing the proposed object; while, in its application to the mouth, before operations on that portion of the body, its effect was no longer local, but general. It was put to the test in the Parisian hospitals and elsewhere, and the unfavorable verdict of the profession has, we presume, consigned it to oblivion. For therapeutic purposes, however, this mode of producing a slight degree of local anæsthesia may have its uses, though we know of no cases in which the application of cold is not far preferable, both as regards its immediate and ulterior results.*

* One example may suffice in proof of this opinion. Mr. Hardy's apparatus has been much commended to assuage the pain attendant on cancer; and a case is reported by Mr. Conde in the 'El Heraldo Medico' of June, 1854, of its beneficial results in that disease. Now these results only amount to an *alleviation of its distressing pain;* whereas by the application of intense cold, not only is the pain alleviated, but the frightful *disease itself is arrested or retarded.* And, moreover, the experience of Dr. Arnott and others serves to show that when congelation is applied in an early stage to an accessible cancerous growth, the *disease will be cured by it.*

CHAPTER VI.

CONGELATION.

A much nearer approach towards a truly rational anæsthetic, is to be found in a *diminution of temperature*. Dr. Thomson, in his 'Lectures on Inflammation,' p. 617, observes that "the sensibility to external impressions of the parts exposed to cold, is always more or less impaired, and the diminution in the sensibility of the nervous system seems to admit of degrees, from the slightest perceptible numbness to that of *the most complete insensibility*." This benumbing influence and arrestive power of cold, are matters of individual experience in these northern climes. We witness the depressive action of cold in the annual increase of our mortality bills, during the colder months of severe winters. We behold it again in the instantaneous death which sometimes succeeds a draught of cold water, when the body is heated from exercise. On a larger scale, it is presented to us in the gradual diminution of life, as we ascend high mountain-slopes, as also in the barren wastes of frozen regions, and in the arrested development of polar forms of life. The vegetation which, beneath more genial skies, is abundant

and beautiful, is stunted and diminutive towards the poles. The huge oak, the king of our forests, becomes but a small tree in the north, and refuses to grow at all beyond 62°; and aggregations of shrubs and shrublets take the place of waving forests. The willow travels further north than all trees; but, chilled by the northern blasts, its development becomes so arrested, that seven or eight of these northern willows would only cover a page of this pamphlet. And such is the effect of temperature on the animal creation, that at the approach of winter, our feathered tribes depart to warmer skies; and at no time beyond 55° N. is the voice of the nightingale ever heard.

Following up the hint given by nature in the benumbing cold of our northern winters, Dr. James Arnott, in the autumn of 1848, suggested the adoption of diminished temperature as "a safer mode than any hitherto in use of producing insensibility in surgical operations." But the surprise and delight of the medical profession at the discovery of anæsthesia were too fresh and excessive, to allow a calm consideration of the pretensions of this new agent. Two years afterwards, however, Dr. Arnott found a listener to his claims in the person of the celebrated surgeon of La Charité, in Paris, M. Velpeau. Several operations were performed with perfect freedom from pain, the part operated upon having been previously congealed by a frigorific mixture. One case was the opening of a large abscess. In six others the operation consisted of the removal of the toe-nail, ordinarily an agonising procedure. In all these cases, we are told, "the patients watched the different steps of the operation like unconcerned

spectators."* Now it is worthy of observation, that the mere opening of abscesses under the influence of chloroform has proved fatal. And, from some hitherto unexplained peculiarity, the operation of removing the toe-nail has been singularly fatal under chloroform. During the same year (1850) Mr. Thomas W. Nunn removed some warty excrescences, which had been previously only imperfectly anæsthetized by cold, with very slight suffering to the patient, and with very little hemorrhage, both of which in such cases are unusually severe.† Notwithstanding these successful cases, with this new agent, and though it was brought before the Imperial Academy of France, by its own president, it made little progress in popular favour. We can only account for this upon two grounds: the first, from a strong prejudice in favour of anæsthesia by inhalation; and the second, by some misapprehensions as to the ulterior effects of cold anæsthetically employed, and of difficulties in its application. It is not, in fact, until the grim monster Death has again and again stepped in, and with a peremptory grasp of his cold hand has momentarily claimed the unconscious victim of the surgeon's knife, that the medical profession is aroused from its apathy. Not till then is there any remarkable readiness manifested to listen to any proposal for the production of a harmless local anæsthesia, in lieu of the hitherto dangerous central anæsthesia.

* See 'L'Union Médicale,' No. xlii, for 1850.

† 'Lancet,' 1850, vol. ii, p. 262.

CHAPTER VII.

PROGRESS OF THE USE OF CONGELATION.

EARLY in the new field was Mr. Paget, of St. Bartholomew's Hospital.

The first attempt which this eminent surgeon made with the new anæsthetic, was in the excision of a large fatty tumour on the shoulder of a lady. The skin was previously frozen in the ordinary method, when Mr. Paget made an incision *four inches* long, and proceeded to dissect out the tumour; yet, we are told, "no pain was complained of."

In a conversation with that gentleman, he informed me that his experience in the anæsthetic use of congelation had confirmed his confidence in its efficacy and availableness. He stated that he had employed it before operating in at least *twelve cases* with the happiest results. He shared the common sentiment as to the defectiveness of the present methods of applying it, limiting as they do its adaptation to the varied demands of surgery. As well as that he doubted its equal efficacy with chloroform in cases of deep-seated operations.

More lately, Dr. Thomas Wood, of Cincinnati, reports

that he has "used cold for preventing pain in surgical operations in various cases," and that "in most of these it has met his expectations." He enumerates a number of operations in which he speaks most decidedly of cold as an anæsthetic being *far preferable* to chloroform, not only because of the non-abolition of consciousness, but because the anæsthetic effect itself, to use his own words, "*is more complete than is ordinarily obtained by chloroform, and is fully equal to the most overwhelming dose.*"* In the same communication, however, Dr. Wood mentions several operations in which the application failed. But these very operations, as he admits, have been performed in Europe without pain under the same means, viz., by cold. And, moreover, his failures are attributable, as he acknowledges, to a defective means of keeping up a sufficiently continuous degree of cold. This defect, as we shall presently show, is now overcome by a method of applying the cold, so as to retain the same low degree of temperature, however high is that of the part to which it is applied. We have no hesitation in saying, that all those operations which Dr. Wood enumerates as impossibilities, have by this new method become possibilities. Nevertheless, a great step, we consider, has been gained in anæsthetic surgery, when a celebrated surgeon of one of the large American cities can write, "I have repeatedly witnessed the most perfect composure of countenance in my patients, while a nail of the toe or finger was rudely torn with a strong forceps from its matrix, without the least exhibition of a sense of

* See 'Western Lancet,' for April, 1854.

pain, or a consciousness of the progress of the operation, except from sight."*

Still more recently, Mr. Nathaniel Ward, of Broad Street Buildings, has added important evidence on the efficacy of cold as an anæsthetic.

"I was consulted," says Mr. Ward, "a few days back by a gentleman between 30 and 40 years of age, of a highly nervous temperament, concerning a tumour situated over the right clavicle, and which required removal. It was just one of those cases in which a surgeon, on the one hand, would not have sanctioned the use of chloroform, and, on the other, in which the patient would have protested against anything being done unless it could be accomplished without pain. The tumour was of a sebaceous character, as large as a walnut, had been gradually increasing for two or three years, and gave him inconvenience during every movement of the arm. On informing my patient that chloroform (to which he was much averse) would be attended with risk, but that the removal of the tumour could be effected with safety and without pain by the previous application of cold, his nervous anxiety subsided, and he consented to the operation.

"I mixed together two parts of pounded Wenham Lake ice and one part of salt, and put them in a common white pocket-handkerchief, and kept the mixture pressed on and around the tumour during the space of one minute by the watch. The integument that was submitted directly to the action of the cold became remarkably corrugated. It was then cut into, and the tumour removed without the slightest sensation of pain, and much to the astonishment and delight of the patient, who said the only thing that annoyed him, and that not much, was the burning sensation of the application. No vessel required ligature, the bleeding, in fact, being very trivial, and the wound had healed up at the end of the week." †

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* See 'Western Lancet,' for April, 1854.

† 'Medical Times and Gazette,' Sept. 2, 1854, p. 248

Now the operations we have enumerated, though comparatively few in number, afford ample evidence of the efficiency of the means advocated by Dr. Arnott; viz., the anæsthetic power of intense cold. It is admitted on all hands, that the operation of removing the toe-nail is one attended with the most excruciating pain under ordinary circumstances. That operation has now been repeatedly performed without pain, and without any untoward accident, under the simple application of cold. In the opening of abscesses, cold is proved to act in the double capacity of annihilating pain, and modifying the inflammatory process. In the cases by Mr. Paget and Mr. Ward, we have instances of its perfect adaptation to a very large class of surgical operations, viz., tumours; while in those cases enumerated by Dr. Wood, its adaptation to a variety of surgical operations is made manifest. And it may be added, that many distinguished surgeons have adopted this method of inducing insensibility, and publicly record the success which attends its employment in their hands.

CHAPTER VIII.

PREFERENCE FOR CONGELATION WHEN COMPARED WITH OTHER LOCAL ANÆSTHETICS.

Congelation may now be said to take a high place among our available anæsthetics. But we are justified in proceeding farther than this, and asserting, that it has a most decided preference over all other modes of producing anæsthesia yet known. This preference is based on several important considerations. The first of these is, that it accomplishes the great desideratum of a rational anæsthetic, of *annulling pain without abolishing consciousness*. "If," says Professor Simpson, "we could by any means induce a local anæsthesia without that temporary absence of consciousness which is found in the state of general anæsthesia, many would regard it as a still greater improvement in this branch of practice."* We echo that sentiment. It is but the echo of our natural dread of the artificial loss of consciousness. There is in the human mind a natural abhorrence and shrinking from the power that our fellow man can thus exert over us, of shutting us out,

* 'Anæsthesia in Surgery and Midwifery,' p. 216.

though only for a passing time, from the perception of our material existence. Even our nightly slumbers themselves would be our greatest mental foes, if we were nightly conscious of the loss of consciousness. Happily they steal over us unawares, and we surrender ourselves to them in the full assurance of security, under a wise and indispensable ordination of nature. Natural sleep presents us with no terrors. It is a sleep induced by the action of the physical laws of our system. It is a sleep perfectly harmonious with the entire workings of our constitution. It is otherwise with the artificial sleep of anæsthesia. We submit to it with a latent dread that the consciousness we thus resign may be resigned for ever. We believe that even the boldest man feels this lurking fear. And now that it is demonstrated beyond all contradiction, that perfect security of a return to life and consciousness, when once under the influence of chloroform, can be guaranteed to no man, the fear is one too rational to be despised, and too solemn to be ridiculed. Shall we not then give the palm to that anæsthetic under the influence of which we are able to *see* ourselves operated upon without *feeling* the cut of the knife?

CHAPTER IX.

SAFETY AND ADVANTAGE OF CONGELATION.

Not only does local anæsthesia by cold at once supersede the natural dislike of unnecessarily parting with our consciousness, and by that means obviate the greatest source of danger, but in the second place we urge for it, a *freedom from outward complications*. It is an agent completely under the control of the operator; and its influence does not extend beyond the limits of the part to be operated upon, consequently the general system remains untouched by any possible accident. It is true that the idea of a frozen limb, or of a frozen portion of a limb, presents to us, at first view, a sensation not altogether agreeable. Our memories recall the histories of limbs lost by a long exposure to cold in high latitudes. We have pictured our enterprising Expeditionists to the regions of eternal ice and snow, returning to us with disjointed toes and fingers; and we have listened to many a sad tale of human life sacrificed on snowy altars. But the notions we have been accustomed to connect with the operation of severe cold on the human body in Arctic regions, are fallacious inferences when applied to the matter before

us. In those cases the operation of cold is unlimited and continuous. When used, on the other hand, for the production of anæsthesia, its operation is limited to a small sphere, and is continued at a safe temperature. Hence its more severe results never accrue. But it will perhaps be urged, *the intensity of cold required to produce anæsthesia is liable to result in devitalizing the tissue to which it is applied.* The objection may take its place among the visions and dreams of unrealities. *Experience* testifies to an opposite result. Congelation of the surface, to a sufficient extent to produce anæsthesia, has now been practised some hundreds of times under every variety of circumstance, and in different diseases; yet, no such untoward event has transpired.

It is, again, alleged, that the pain of returning consciousness in the part anæsthetized by cold, is almost as severe as the pain of the knife itself. This, however, is due to the mismanagement of the operator. A too rapid elevation of the temperature produces an almost intolerably burning pain. The remedy is simple. Graduate the return to the natural temperature of the part by the application of melting ice or cold water. In many cases of the therapeutical use of this agent, all its good effects have been counterbalanced by this neglect. And we know of instances in which this remedy has been altogether eschewed on this ground. In short, all the outcry about devitalizing the tissues, all the visions of impending gangrene and mortification, and all the complications which it is alleged the application of cold of such limited intensity as is required for surgical purposes may produce, are without the slightest foun-

dation. On the other hand, cases of great nervous excitement, irritability, phrenitis, hysteria, and mania, have not been uncommon results of etherization;* while vomiting is such an ordinary accompaniment, that rules have been laid down for a partial abstinence of patients about to be submitted to its influence. Added to which are other inconveniences unnecessary to name.

By the use of intense cold, then, a state of local anæsthesia can be produced sufficient for the majority of surgical operations, without the slightest caprice of action, or risk of complication; and thus is removed one of the great doubts formerly entertained of the possibility of obtaining sufficient local anæsthesia without a dangerous effect upon the general system.

* That the inhalation of chloroform is capable of leaving behind it a permanent impression on the brain, is manifest in the singular circumstance that some patients invariably take up the same train of ideas at every repetition of the inhalation, though the interval consist of several years. Cases have, for example, been known, in which a patient has taken up the same strain of conversation at the second and third inhalations as at the first. They have discussed the same subjects, spoken in the same foreign language, sung the same songs, and uttered the same prayer, as those which they adventitiously did at the time of their first inhalation. It is a curious psychological circumstance, independently of its physical relations to the influence of etherization on the cerebral system.

CHAPTER X.

SHOWING HOW CONGELATION INDUCES A FAVORABLE CONDITION IN THE PART TO BE OPERATED ON.

The anæsthetic use of intense cold *does not place the parts in an unfavorable condition for being subjected to operation.* All local anæsthetics hitherto experimented upon, have this insurmountable objection in common,—that they produce a derivation of blood to the very part where its absence is most desirable, and a consequently increased liability to hemorrhage during the operation, and to inflammation after it. Now this is just the condition which cannot coexist under a wisely directed application of cold. In fact, the very principle or mode of its action is by producing the complete temporary arrest of the circulation in the part to be operated upon. Its full effect cannot be obtained unless it succeed in blanching the surface it is applied to, thus rendering congestion an impossible occurrence; as well as effectually checking any undue amount of hemorrhage resulting therefrom. Not only has cold, employed anæsthetically, the negative benefit of not placing the parts in an unfavorable condition to be operated upon;

but, on the contrary, it offers the surest and readiest means for the improved appliances of modern surgery. The application of cold to check hemorrhage, is one of the commonest and most effectual appliances offered in surgery. By using cold as an anæsthetic, the great liability to hemorrhage is at once obviated. That complication, in fact, which so often constitutes the most serious part of operative surgery, is not only not left to the risks of being checked or not, but is prevented. It is of equal value in the sequelæ of operations. Cold water dressing, in superseding fetid, cumbrous poultices, and rancid, irritating ointments, is recognised as one of the best appliances of post-surgical processes. The surgeon applies a simple cold cloth to the parts after operation, to keep down inflammation. What the surgeon sees fit to do *after* an operation, to repress inflammatory action, he cannot reasonably object to being done *before* the operation, to attain the same object, especially when, at the same moment, it renders the part insensitive to the necessary suffering of his art. "The characteristic tendency of disease, at the present day," [after operations,] says Mr. Druitt, "is decidedly toward phlebitis, erysipelas, diffused inflammations, and other maladies of a low type." Now, we would submit as highly probable, that under the well regulated application of cold as an anæsthetic before operating, especially if combined with a discreet employment of the same agent in deep operations, this characteristic inflammatory tendency, which is the drawback of modern surgery, would disappear. Congelation has already been employed many times in cases of idiopathic erysipelas

with the best results;* and from the property which cold possesses of preventing vascular excitement, we think there is every reason to believe that under the use of congelation as an anæsthetic, traumatic erysipelas would rarely occur. Whether these opinions be correct or not, we claim for congelation decided advantages, as placing the parts to be operated upon in a far more favorable condition, both as regards the liability to accidents primary or secondary, than those parts would possess either without this local anæsthesia, or under etherization. And the mode of its action is notably in accordance with the principles of after-treatment adopted by our best surgeons.

* See Dr. Arnott, on the Treatment of Erysipelas by severe Cold, &c., in 'London Medical Gazette,' March 9th, 1849.

CHAPTER XI.

THE EFFECT OF CONGELATION UPON WOUNDS AND STRUCTURAL DISEASE.

The application of cold expedites the cure of wounds. Dr. Arnott, in his pamphlet on 'The Question Considered,' &c., p. 19, remarks, "that wounds of the skin so congealed, have invariably healed by the first intention, more speedily than under ordinary circumstances;" and in another place, he tells us, "Congelation has often at once converted an irritable into a healing ulcer."* And in Mr. Paget's case, quoted at p. 17, although "the incision was four inches in length, a considerable portion of the wound readily united by the first intention, and the rest soon closed." Again, Mr. Wood informs us, that in his case, "the wound had healed at the end of the week." It were vain to insist on the paramount advantage of this result. It accomplishes the most anxious hope of the surgeon, and overcomes what is often a serious difficulty. We would submit whether the frequently tedious continuance of the cold water application after amputations, &c., might not

* 'Monthly Journal of Medical Science,' July, 1854, p. 36.

be advantageously substituted, for a time at least, by cold at the intensity of congelation. If the application of cold for anæsthetic purposes is productive of a readier and more effectual healing of incised wounds, it appears only a fair conclusion that a greater intensity of cold water dressing than is in ordinary use would greatly expedite the recovery. Not an inconsiderable advantage, however, to operative surgery will be gained, if, through the anæsthetic use of cold, union by the first intention become a more frequent and more certain occurrence.

Another advantage attending the production of anæsthesia by congelation is, *that it can be applied to all persons without distinction.* Its influence, extending over only a limited portion of the external surface, leaves unscathed any of the internal viscera. If they be healthy, there is nothing in it to produce in them a morbid state; and if they be functionally or structurally diseased, or even undergoing disorganization, it has no power of hastening, or increasing, or complicating the morbid processes. It is far otherwise with anæsthesia by inhalation; for it *cannot* produce its effects until it has induced a *disease* in the system. An irregular action of the ganglionic system of nerves, consisting of a morbid stimulation and a succeeding depression, has to be superinduced. The blood, which should be in free unrestrained circulation, is pent up in the internal viscera, to the detriment (however transient) of the organs of animal life. And the annihilation of sensibility does not occur until the quantity of blood ordinarily sent to the brain has been materially lessened, or until the equilibrium of pressure has been destroyed. And a passive state of

the muscular system is not induced until the circulation is considerably diminished in the spinal cord—until, in fact, a point is arrived at, to exceed which is *death*. This has been demonstrated by experiments on animals. And the same experiments have shown, despite all former assertions to the contrary, that etherization is only a *rapid intoxication*. The blood circulating through the brain must be vitiated—must be rendered less capable of sustaining life, and less adapted to sustain the functions of the internal viscera in all their integrity. Hence with what anxious eyes do surgeons watch every heaving of the patient's chest, and how unremittingly does the finger keep guard upon the pulse, fearful lest, from the presence of unascertained disease, the liability to asphyxia may be increased, or that the poisoned blood arriving at the heart may be inefficient to stimulate its contractions. In anæsthesia by chloroform, the patient's state is matter of momentous concern; and in many cases is such as to render its use wholly inadmissible. In the adoption of congelation as an anæsthetic, we, on the other hand, cast all fears to the winds. It is an agent destroying sensibility, it is true, by destroying the equilibrium of the circulation; not of the general circulation, but only that of the part to which it is applied; and the disturbance is therefore of only a very limited extent, so limited as not to reach a vital organ, or affect the brain. No anxious eye watches the respiratory motions; not a finger becomes sentinel to the heart. No state of intoxication is induced; and thus no matter though the lungs be hollowed out by tubercle; no matter though the brain be surcharged with blood or disorganizing from disease; no matter though

fatty deposits have grown around the walls, and along the cords of the heart; no matter though its contractions be irregular or intermitting; no matter though a *bruit* tells the sad tale of a valve impaired—we have in cold an agent which offers its unrestricted aid to all alike—to all, though death's decaying fingers have already begun to mould the destiny of the vital organs.

Many other prominent advantages which cold, as an anæsthetic, possesses over chloroform, might be pointed out, but we forbear enumerating them. Enough has been said to show that, in congelation, we have an efficient anæsthetic, free from the dangers of ordinary anæsthesia, and more in harmony with the recognised principles and practice of modern surgery.

CHAPTER XII.

THE REQUIREMENTS OF ANÆSTHETICS.

It may be alleged *that our anæsthetic does not meet the requirements of all surgical cases.* There is a semblance of truth in this objection, though it is not valid to the supposed extent. Since the influence of congelation, when applied to a part, is capable, unless long continued, of penetrating only to a limited extent beneath the surface, it is alleged to be wholly inefficient for many capital operations, as amputations, &c., as also for any operations involving the deeper seated tissues. Now, the object of administering or applying an anæsthetic is to annul a pain which would act injuriously on the system. If an anæsthetic accomplishes that, it does all that is essentially required. There are degrees of pain under surgical operations which are not only quite endurable, but which do not injuriously affect the system. And in many cases such pain is conservative. This principle has been recognised in all our surgical theatres, even at Edinburgh itself, where there is the most profuse display of chloroform.

In operations involving only a slight or easily endu-

rable pain, it is rare that surgeons are at the trouble of mitigating it by anæsthetic application; which we take to signify, that such amount of pain is comparatively innocuous. What then, constitutes the chief pain of any operation—where is its seat? It is admitted, we believe, on all hands, that the first cut of the knife, or the incision through the skin, is what may be termed *the* painful part of an operation.* And the cause is obviously from that delicate net-work of nervous tissue which is so abundantly distributed on the cutaneous surface, whereby we are endowed with the sense of touch. That which gives to us our actual perception of material existence, is that which becomes to us a distressing sentinel of danger. The sensibility to pain of the subcutaneous or muscular tissue, is comparatively small. Sir Charles Bell, in his 'Bridgwater Treatise, on the Hand,' remarks, that "when the bones, joints, and all the membranes and ligaments which cover them, are exposed, they may be cut, pricked, or even burned, without the patient or the animal suffering the slightest pain" (p. 153). It would then appear that, if the extreme sensitiveness of the skin to pain could be destroyed by any anæsthetic application, the chief and only injurious portion of pain in surgical operations would be annihilated. And this is just what

* Thus, in the 'Medical Times and Gazette,' July 1, 1854, p. 12, it is observed—"As is well known, the cutting of the skin [in the removal of subcutaneous tumours] is almost the only painful part.' And again, in the same article, it is remarked—"In a very great majority of the cases for which chloroform is now used, the cutting of the skin is almost the only painful part of the operation."

we claim for congelation. It does destroy the sensitiveness of the skin; it has power to abolish the really agonising part of operations. For proof of this, we appeal to the foregoing cases by Mr. Paget, Dr. Wood, and Mr. Ward. The first incisions were rendered painless by congelation of the surface, and the dissecting out the tumours caused no appreciable suffering. But, even providing the sub-cutaneous tissue were sensitive to pain to a high degree, there are few operations which would not admit of the application of cold following the first incision to destroy even that amount of pain; so that even as regards deep-seated operations, we claim for congelation an anæsthetic power of far greater extent than at the first blush would appear.

But all operations are not capital operations—all are not deep-seated. The majority of operations are superficial. Consult the records of any large surgical hospital, and it will be found that the minor operations greatly predominate;—a fact which the private practice of every surgeon must confirm. And in all these cases, not a doubt can now be raised of the desirableness of the method we advocate. If, again, we select from the recorded list of fatal cases of chloroform those cases in which the application of cold was admissible to its full extent, we shall find that, in no less than *three fourths* of the whole, the agent we advocate has effected the desired state of perfect anæsthesia. We are justified, then, in asserting, that at the least three fourths of the lives which have been momentarily sacrificed by the inhalation of chloroform to annul pain, would have been

saved to the world, while the desired immunity from pain would have been gained.

We arrive, then, at this fact, that in by far the greater majority of surgical operations, pain may be abolished by the anæsthetic power of cold to the requisite degree without periling life, and without risk of grave complications. And what though it be inapplicable in the smaller number? Is it at greater disadvantage than chloroform? We think not. There are cases, and they are pretty numerous, in which chloroform is inapplicable. That insidious disease so peculiar to our climate—pulmonary *consumption*—constitutes nearly one fifth of the whole annual mortality of these islands, and carries away one in every 310 of the population. Diseases of the heart also increase our mortality bills in a very high ratio. In these cases there are few who would not hesitate to administer chloroform, while there is nothing whatever in them to contra-indicate the practice of congelation; so that what congelation may lose in one direction it gains in another. If it fail in some of the deeper seated operations in producing an entire abolition of pain, it has the advantage of being *universally* applicable. It will render painless operations on the bodies of a large proportion of the population, which chloroform cannot do. In this respect, therefore, it offers a compensation amply sufficient to warrant us in giving a decided preference to congelation over etherization for anæsthetic purposes.

To the art of the accoucheur, we confess congelation does not hold out the same advantages as to that of the

surgeon. Its influence does not extend to the parturient chamber, though in some obstetric operations it is as serviceable for anæsthetic purposes as in operations on other parts. Those ladies who wish to be unconscious during the physiological process of labour, must still find the accomplishment of their desires in other agents. It must be remarked, however, that the anæsthetic state required for operative surgery, and that required for midwifery, is vastly different in degree. In the one case anæsthesia has to be pushed to the point of danger, while in the other, the requisite degree is very far short of danger, except in rare cases, where extreme muscular relaxation is desirable. And we know it to be the opinion of eminent accoucheurs who use chloroform when requested by their patients, that its benefits in midwifery can be realised with an exceedingly small quantity of the vapour. To this limited degree of anæsthetic effect is to be attributed the safety of chloroform in midwifery. No fatal cases under its influence, in midwifery, have yet been recorded. It may, however, be asserted that, notwithstanding the strenuous efforts which have been made to bring anæsthesia into popular use in midwifery, its adoption is still the exception rather than the rule. In England, it has never made much progress in this direction. It is neither extensively advocated by the accoucheurs, nor demanded by the ladies.* It has not

* Dr. Merriman, for example, thus writes in the 'Medical Times and Gazette' for April 22d, 1854: "Chloroform may produce alarming results in midwifery practice, and, if given at all, should

yet come to be considered a *relic of barbarism* for ladies to endure the appointed pains of a physiological process. Most persons still look upon the production of anæsthesia in midwifery as a contravention of a religious ordinance. Whether the objections thus raised against anæsthesia for this purpose are grounded in reason or not, the fact remains unaltered, that among the general population insensibility in midwifery is rarely sought for, and rarely induced. And, in so far, the objection to the incompetency of cold as an anæsthetic loses much of its weight.

The question of the anæsthetic application of cold in preference to chloroform, &c., becomes to our mind one of professional morality. It is no longer a doubtful point, whether cold is capable of effecting sufficient insensibility for surgical operations. The nails which have been torn away, the tumours which have been dissected out without suffering, and other painless operations, have for ever silenced scepticism. There can be no fear of its perfect safety; for there is nothing in its composition or mode of administration to affect a vital organ. It is equally innocent as to giving rise to any serious compli-

be in small quantities only." And he adds—"The more I hear and see of the use of chloroform in midwifery, the more I am convinced that, though it may occasionally be useful, and even desirable, in the small quantities now administered in London, its administration is not desirable in ordinary cases." Dr. Merriman, in the same communication, relates the painful history of a patient whom the administration of chloroform, in her last labour, has driven within the walls of a lunatic asylum.

cation. No person, whatever be the condition of the more important viscera, is excluded from its benefits. These collateral advantages do not belong to chloroform. This latter can annihilate pain to any extent, it is true; but it does so for no one but at the risk of life. It can render men unconscious; but, for that temporary unconsciousness, it often demands a long endurance of ills. If, then, there be a means of annihilating pain unattended with these risks, and these possible ills, what is the manifest duty of the profession in regard to such an agent? Have not the public a right to demand of their medical guardians, that at the least, in all those cases in which the substitution of cold has been proved effective, human life should no longer be endangered? Have they not a right to demand that they have all the advantages which the progress of science presents, and that the cures of their disordered frames should be wrought by that means which is attended with the most certain results, and with the least pain consistent with the least danger? Will the surgeons of this age continue to abolish consciousness during their operations, when those operations can be made painless without depriving their patients of intelligence? Will the surgeons of this age be content to see their patients coming into the operating chamber full of hope, carried out lifeless corpses? We do not believe it. Death wears as grim an aspect to the surgeon as to other men. His visits are welcomed neither in the hospital ward nor in private practice. Death is the great foe whose invasions on the human form, in ever varied aspects, it is the surgeon's office to

repel. Humanity is the mainspring of his art. And we feel no apprehension that a class of professional men, holding such a high moral position with the public, would discountenance the realisation of a painless surgery, without the abolition of consciousness.

PART II.

ANÆSTHESIA IN DENTAL SURGERY.

CHAPTER I.

CONGELATION IN DENTAL SURGERY.

I PROCEED now to consider the paramount advantages of congelation, as a local anæsthetic, in that special department of surgery which I myself practise, viz., Dentistry.

Few operations, perhaps, are more painful than tooth-extraction. The operation itself consists of a violent dislocation,—of a forcible separation of bony plates,—of the division of nerves, and blood-vessels,—and detachments of the gum. The excruciating character of the pain is, in all probability, dependent rather upon the separation of the osseous plates, than, as popularly believed, upon the division of the nerves entering the fangs. But, to whatever cause attributable, it is a pain from which most men shrink, and is one which many fruitless attempts have been made to abolish. As we have seen in the foregoing remarks, it is this pain which

brought about the revival of anæsthesia; and this pain it was which was the first abrogated in modern times.

Many of the more enterprising followers of this branch of surgical art have, at various times, directed their energies to the attainment of a painless dentistry. It has been reported that a certain dentist at Limoges, in France, M. Pernot, had discovered a method of extracting teeth with little or no pain. This method was described as consisting in the application of an "obtunding agent" to the gums. What that agent was, has not, as far as we know, transpired; and the method does not seem to have extended itself beyond the private practice of that dentist. It is, however, much to be doubted if complete insensibility was accomplished; for the same experiment has been tried with the whole range of obtunding agents, by various individuals, without adequate success. I have also heard of a dentist on the south coast of England, professing painless tooth-extraction, by directing a current of chloroform around the tooth to be removed—a remedy which, we conceive, belongs to the same class as Perkins' metallic tractors of the last century; or a remedy, if one at all, acting through the imagination of the patient; and doubtless the imagination may be as effectively wrought upon by the dentist as we know it is by the physician. The public, who know little of the properties or action of chloroform, may have their own idea of it so designedly wrought upon as to *imagine* the absence of pain.

The introduction of etherization, combined with the brilliancy of its career, has doubtless had the effect of repressing these attempts at the production of a local anæs-

thesia for tooth-extraction. Nothing, in fact, seemed likely to supersede it. And thus, up to this present time, we have only been able to obtain relief from the pain of tooth-extraction by inducing a state of general insensibility. Unquestionably, under the insensibility of chloroform, dentistry may have the privilege of becoming a painless art; and had that insensibility been unattended with any of those risks we have already recounted, nothing better could be desired. Its later history, however, has brought it under condemning judgment. The irrefutable fact, that human life is in danger whenever brought under the influence of chloroform, has materially changed the aspect of anæsthesia so produced, for the purpose of tooth-extraction. So long as its dangers were unknown and unrealised, dental operations under its influence seemed as justifiable as other more severe operations of surgery. Under the new state of matters, we have no hesitation in saying that *dental operations under the influence of chloroform are not justifiable.*

This conclusion is based on two grounds. First, the pain of tooth-extraction, though severe, is brief in duration. In numerous instances, the mere pain itself rarely is productive of graver consequences than the momentary shock. In persons highly susceptible of pain, or in certain states of constitution, it is doubtless often of the utmost importance to obviate even this short duration of pain, though certainly not at a possible sacrifice of life itself. Secondly, it is not ordinarily an operation attended with very grave results. It is not often that the mortality tables of the Registrar-General are increased by untoward results in dental surgery. The wound caused by ex-

traction is in its nature comparatively slight, and easy of reparation. There is no large mass of tissue to be united,—no structures likely to take on extensive inflammation,—no deleterious influence, in fact, bears upon the general system capable of producing the great mortality of many surgical operations. In many of the capital operations, for example, the chances of recovery are extremely small, and indeed in some they are almost reduced to *nil*. The difference then lies in this, that in many surgical operations fatal results are *expected* to occur in certain proportions; while in tooth-extraction such a result may almost be said never to happen. A patient, yielding himself to the doubtful result of returning to life under chloroform in the one case, only throws away so many chances as he might have possessed from the peculiar nature and attendant mortality of the operation itself; while in the other case, the mortality being *nil*, he makes, in inhaling chloroform, an unconditional and unqualified surrender to the possibility of death. The value of the man's life, in the one case, is but as 1 in 2, 3, 4, or 5, and so on; whilst in the other, it is equal to that of the average of the community to which he belongs. Now, putting aside the consideration whether a man has any moral right to trifle with the destinies of human existence, we say, viewing the subject in this double aspect, viz.—the value of any given life under the two kinds of operation, and the brief duration of pain sought to be escaped from,—that it is not justifiable in such an operation as tooth-extraction, to resort to an agent to produce insensibility, which may result in the loss of life. It is this conviction, we have no doubt, which has ever pre-

vented the general adoption of etherization in dentistry. If a man undergoing an operation knows that his chances of life are small, and that the severity of the accompanying pain is such as to diminish even the few chances he has, then he may, perhaps, in the *absence of better means*, legitimately resort to chloroform; but on the other hand, if his chances of life are equal to those of the general community, and the accompanying pain of the operation is of but brief severity, he may not legitimately yield himself to such an anæsthetic agent. The circumstances attending the loss of a thigh may warrant the risk of life by anæsthesia; but to say that the circumstances attending the loss of a tooth should be put on equality with the *possible loss of life*, is an anomaly, at which we recoil.

But, apart from the dangers of chloroform, its employment in dental surgery is attended with several inconveniences. Of these, for example, I may mention the *restlessness of the patient*, unless the anæsthesia be pushed to the imminently dangerous degree of perfect relaxation; and, even in the state of relaxation, it is difficult for one person to keep the head immoveable, and, at the same time, to operate. This inconvenience is especially felt in long and difficult cases, when the operation is unavoidably rather complex. Now, the nicety and perfection of the dental art depend, as all know, upon the precision with which the instruments are applied. If there be much motion or restlessness on the part of the patient, that precision is apt to be greatly interfered with. The skill of the operator may be perfect, the application of his instruments most exact,—but a restless, unmanageable, semi-conscious patient may frustrate all. Such a state of

restlessness would be obviated, were the patient in full possession of voluntary power, but at the same time insensitive to pain. And this is precisely the condition which is attained under the new anæsthetic means I now advocate.

Another source of inconvenience to the dentist is from the anatomical structure and relations of the upper and lower jaw, or, in other words, from the firm closure of the mouth of the patient when under chloroform. Many a chloroform-dentist's thumb doubtless bears upon it traces of this inconvenience, in the form of indentations from the teeth of patients, who, in their wakeful moments, have no remarkable momordial propensities. Some dentists, unwilling that their patients should become their tormentors, take the precaution of placing a piece of soft wood in the patient's mouth before inhalation. But even then, the space acquired is less than the natural cavity of the open mouth. The possession of voluntary power is here again of immense advantage over the *brute force of the bit.* And having this advantage also, combined with insensitiveness to pain, under my method, I have the full space of the oral cavity for dental manipulation.

All persons, again, admit the impropriety of the operator being the administrator of the chloroform. A second person is thus required to do what, under my method, can better be done by the operator himself. In all these respects—the preservation of perfect composure, the patency of the mouth, and other circumstances—the anæsthetic use of cold in dental surgery is greatly preferable to chloroform.

Is dentistry, then, to form an exception to the use of anæsthetic agents? To the use of such as have hitherto prevailed, we say most decidedly—yes. But we speak very differently, though as decidedly, in regard to *local* anæsthesia. I have been long impressed with the conviction that some obtunding agent, capable of only a local application, might be found for the purpose of painless tooth-extraction. From the moment that I found chloroform in dentistry contraindicated by moral sense, I instituted a series of experiments with various substances, hoping to find one competent for the desired object. Of all the diversified agents which, for the last few years, I have thus tested, none have been comparable in their anæsthetic effect, and in their collateral advantages, to *congelation*.

CHAPTER II.

SHOWING HOW COLD PRODUCES INSENSIBILITY.

THERE is no such thing in nature as positive cold. Cold is simply a comparative absence of heat. This universal principle of heat, in different degrees, pervades all things, and when reduced below the pleasurable feeling of warmth, produces a sensation of coolness. The process of cooling is merely the conduction or abstraction of heat; and when heat passes from one substance to another it is said to be conducted. The best conductors are metals and liquids.

Professor Liebig informs us that "all living creatures, whose existence depends upon the absorption of oxygen, possess within themselves a source of heat, independent of surrounding objects. This general truth applies to all animals, and extends to the seeds of plants in the act of germination, to flower buds when developing, and fruits during maturation."* We also read, in the same page, that "the animal body is a heated mass. It receives heat when the surrounding objects are hotter, it loses heat when they are colder than itself."

* Liebig's 'Letters on Chemistry,' p. 317.

Heat expands most bodies proportionately to its increase in quantity; and at the same rate are bodies rendered firm or solid by its removal. The conduction of heat from a part of the body contracts the vessels, arrests the circulation, nervous sensation is thereby removed, and thus a complete anæsthetic effect is produced.

Every person in these climates must have experienced the diminished sensibility of the fingers, for example, when the minute vessels ramifying on the skin, are contracted and rendered bloodless by the severe cold of winter. It is precisely by the same process that the benumbing effect is produced which renders surgical operations painless. It is, in fact, an imitation of a common natural process. Our lessons in this respect have all been taken in the school of nature. And, in so far as our method accords with the ordinary process of a natural phenomenon, it commends itself to our reason in a way which blood-poisoning by inhalation can never do.

When heat is conducted from a part of the body by a surrounding medium, it is restored from within with great rapidity. Hence there is no danger of devitalization when the cooling medium has a limited power, with the surrounding atmosphere at a comfortable temperature, and the body in no way exhausted of its resources for supplying warmth. In corroboration of this fact I may mention a case wherein I applied my apparatus for the space of two long hours, upon the same spot, at the reduced temperature which gives complete numbness. No subsequent uneasiness was experienced, nor the faintest sign of injury apparent.

The temperature of the body is the same in all climates, whether at the equator or poles. The supply is kept up by the difference in the components of food, with a mutual action of the inspired air. It is a notorious fact, that a starving or exhausted man soon yields to the anæsthetic effect of intense cold; and travellers who have passed through greatly reduced temperatures, can truly depict the listless feeling, then the almost irresistible sleepiness which comes over them, and endangers their very existence. So far, I have never attended a patient suffering such extremes, therefore I feel assured that a *frost-bite* cannot become a "*fait accompli*" in my operating-room.

A frost-bitten nose, by the way, is no uncommon accident in severely cold climates, and this change may ensue when the other members of the body are enveloped in furs or other non-conductors. The unfortunate nasal protuberance stands boldly out, depending alone on its own resources, to confront a cutting, piercing, northerly wind. It is soon reduced to a state of anæsthesia; from that, to a dangerous reduction, with ultimate suspension or loss of vitality. All I require for "painless tooth-extraction" is, the insensible stage, not the dead condition.

There are many remarkable facts, and much truly interesting matter, that might come in here; but my space is so limited that I only skim the surface, extracting the "pith and marrow" of a few established laws, with the results that my own experience in the use of congelation may yield.

The application of congelation in dental surgery acts in the following way:—In the first place, the circulation

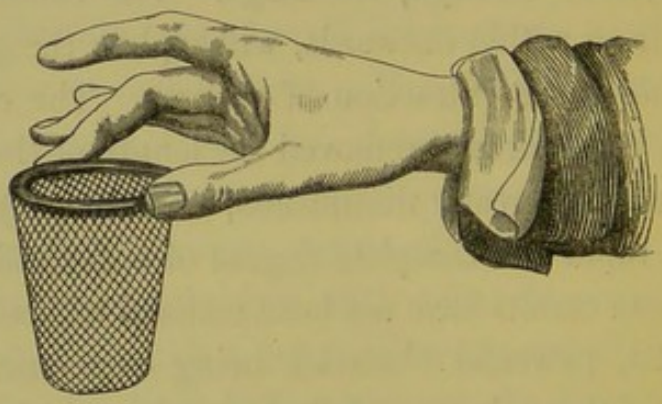
in that portion of the gum surrounding the condemned tooth is partially arrested. Not until the gum assumes a slightly blanched appearance, (*see* Frontispiece,) is the full anæsthetic effect produced. In the second place, the heat is conducted from the two outer sides of the jaw and alveolar process; and by a continuation of the application the heat is still further withdrawn from the periosteum (*see* Frontispiece), lining the socket of the tooth. All these parts are thus rendered insensible. My experience convinces me it is the dislocation of a tooth from its membranous attachments that is the principal source of pain in tooth-extraction, rather than, as is popularly believed, the division of the nerve (*see* Frontispiece) running up to, and through, the fangs. The conduction of the heat from within outwards, will explain the great success attending the extraction of stumps. The crown of the tooth being already removed the length of the conducting medium is greatly diminished, consequently inducing a more rapid and complete degree of anæsthesia.

These results have not been realised without, as already noticed, powerful obstacles being overcome. I specify some of these, because I find they have hitherto been an insuperable difficulty in the performance of other operations where similar circumstances obtained. I refer to the difficulty presented in the application of a conducting medium, on or in a high temperature. The mouth—the seat of dental operations—is one of these high media. It is a chamber, through which passes the air expired by the lungs, at the temperature of the body; also, a considerable flow of saliva issues from the excited glands, bathing the accessible portion of the apparatus placed

over the tooth. Not until I had established the principle of keeping up a given degree of cold continuously and unchangeably in any medium of temperature, did painless tooth-extraction become a possible and practicable art.

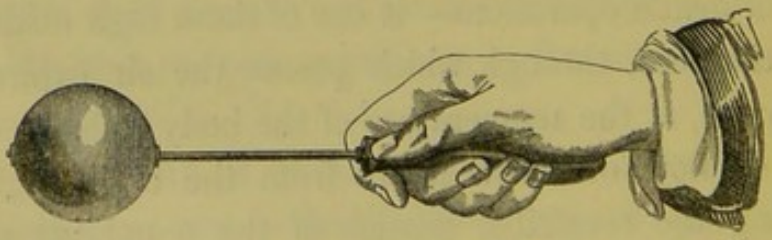
The supposed trouble and difficulties attending the use of congelation have doubtless deterred many from adopting it. The methods hitherto prevalent of inducing insensibility from cold, have been by the admixture of ice with certain saline combinations, enclosed in a net bag, (*see* fig. 1), and applied to the part; or by the appli-

Fig. 1.



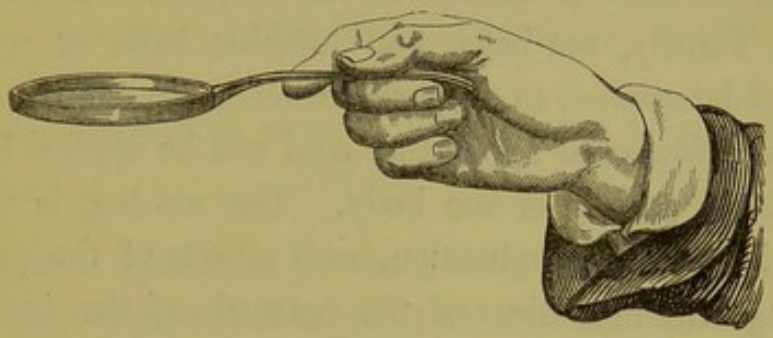
cation of a metallic ball, (*see* fig. 2,) previously buried in the same mixture, and other metallic instruments, such

Fig. 2.



as the flat spoon, (*see* fig. 3,) have been constructed for this purpose, upon the same principle. It is obvious, however, since the conduction of heat from the part of the body to which these are applied is great and rapid,

Fig. 3.



that their temperature is quickly changed from the desired intensity of cold, so that what has been hitherto wanting is a means of *keeping an unalterable temperature* at any given point, without interfering with the rapid conduction of heat. For a long time past I have directed my attention to the attainment of this object, and, I am happy to say, with the desired result. I have invented instruments, by means of which a *continuous supply*, of *unlimited duration* and *invariable degree of cold*, can be kept applied to *any part* of the body. The advantages in my *new* mode of applying cold are seen; first, in the circumstance that the heat which is conducted from the part, instead of being allowed to raise the temperature of the cooling medium, as in the ordinary method, is carried away, and the intensity of cold is preserved at an invariable standard after the necessary graduation has been completed. Secondly, in cases requiring a more lengthened

application, as in deep operations, the amount of heat conducted from the body into ordinary mixtures, or into metallic balls, is sufficient soon to destroy the congealing effect; whereas, by the method I adopt, the same degree of cold can be sustained for any length of time, whatever be the quantity of the absorbed heat. This circumstance makes the state of anæsthesia far deeper and more effectual. Thirdly, net bags, and metallic balls or spoons, cannot be applied to all parts; whereas, by the use of my *new and improved* apparatus, cold can be applied to any accessible portion of the body. The net bag is not an artistic mode of application, as it admits of the passage through the interstices of the network, of the *irritating ingredients*, of which the freezing mixture may be composed; and, when applied to already wounded surfaces, may become a source of injury. Through the terminal portion of my *new apparatus*, deleterious compounds cannot penetrate, and the action of the cold can be nicely adjusted or limited to the amount of surface to be operated upon. A regular and certain action is kept up, instead of an irregular and uncertain one. And many other minor desiderata are accomplished by this *new* apparatus, whereby it is presumed the use of cold, as an anæsthetic, will take an undisputed position in operative surgery.

CHAPTER III.

CURATIVE EFFECTS OF CONGELATION IN MANY AFFECTIONS OF THE GUMS.

THERE is a disorder of the gums, originating mainly from the presence of decayed teeth and tartar, but which may come on as the sequelæ of fever, salivation, pregnancy, &c., commonly known as *scurvy* in the gums; in which the properly directed anæsthetic application of cold often acts as a remedial agent, of greater certainty than those in common use. This disease, most distressing to the patient when it has advanced far, makes itself known by a spongy, turgid, vascular state of the gums. They bleed freely under the brush, and upon pressure discharge a fetid pus, which gives its disgusting odour to the breath, almost debarring the unfortunate victim from society. When the disease is extensive, carious devastation and osseous deposits push the teeth from the sockets; the issuing pus trickles down into the stomach and contaminates the whole system. Occasionally it yields to no treatment, it may be from hemorrhagic diathesis. But no treatment can be successful except the gums be suddenly and perfectly unloaded, to produce contraction of the blood-vessels. Cold astringent lotions, a touch with

the nitrate of silver, or repeated perpendicular and horizontal incisions, are among the means ordinarily employed. Not a word need be written of the disagreeable character of the two latter means. Now nothing has such power of producing vascular contractility as intense cold. Every essential feature of the treatment of this malady is combined in this one agent. It unloads the overcharged vessels, and contracts their dilated calibre; it arrests the progress of the fungoid inflammation, and gives to the spongy tissue firmness and tonicity. And while it destroys the pain of the trivial pressure of the materials of food, renders unnecessary the use of the incising lancet, or the nuisance of lunar caustic.

CHAPTER IV.

CONCLUDING REMARKS.

There is another important aspect in which the advantage of local anæsthesia in tooth-extraction must be viewed, fully to comprehend its true value. Hitherto I have only alluded to its benefits as connected with the *destruction of pain*. But its benefits do not terminate there. It may be equally beneficial in the prevention of a vast amount of *disease*. In no disease, perhaps, is there such *delay* exercised by its victims as in diseases of the teeth. If an individual be troubled with an incessant cough, he at once seeks the aid of his physician: if he be harassed with a pain in the side, he demands a speedy remedy: if a tumour is growing from his body, he sends for his surgeon. The horrors of consumption, of hepatic abscess, or of a deformed frame, stare him in the face; and alarmed at the possible fatal tendencies of the disease, he delays not an hour in seeking relief. Again, except in cases requiring operative surgery, he knows that the remedies are of a kind unattended with little more than inconvenience, and are generally painless. Pills, mixtures, draughts, &c., beyond being repulsive to the taste, do not involve much physical suffering. There is nothing, in

fact, in the cure to deter him from its speedy application. On the other hand, fatal results of diseased teeth are never for a moment suspected. There is a pain, violent it is true—more violent even than the pain accompanying most diseases. But there exists the delusion, which lulls the patient into feelings of security, that the disease is purely local, and limited to the tooth itself. And, as its only effectual remedy, he has the prospect before him of all the annoyance of tooth-extraction. These two circumstances lead to very different courses of conduct in the two cases:—in the one, the remedy is speedily sought; in the other, it is as long delayed. The *physician* is summoned the moment that pain announces an impending danger; the *dentist* is summoned not until the tooth reiterates its claim in unendurable severity. In the one case, the danger is apparent; in the other case, it is insidious, though equally impending. What are the too frequent results of this delay? I reply, a series of constitutional disorders, which are too rarely attributed to this cause. Without any desire to exaggerate the evil consequences of a neglect of early treatment of diseased teeth, it must nevertheless be urged, that a great variety of general diseases are derived from this source. This human machine—which we call body—pervaded as it is by intermingling blood-vessels, nerves, &c., all in the closest relationship, and presided over by general laws, has all its parts in reciprocal reaction and sympathy. Its general derangement disturbs the normal action of its parts: and hence, no circumstance is more accredited than that the teeth, as parts of that machine, do suffer from its general disorder. Again, as this machine is one harmo-

nious whole, its several parts, when out of order, must more or less disturb the harmony of that whole. According to the office the part may have to fulfil, or its vital relationships, will be the greater or less amount of that derangement. Now the teeth happen, in their nervous connections and anatomical position, to be in close proximity to the great centre of sensation and vital force—the brain. In their functions, again, they are intimately related to that great conductor of life—the blood. In the former case, a long-continued pain proceeding from them, cannot fail to affect the cerebral mass; while in the latter case, their disorganization disqualifying them for their important functions in relation to our food, lays the foundation of many fatal diseases from the blood. Hufeland, proceeding upon the principle, argued that good and strong teeth are always a sign of a sound strong constitution and good juices, and went so far as to state that "those who lose their teeth early, have, in a certain measure, taken possession of the other world with a part of their bodies."

Many other general diseases, besides dyspepsia and phthisis, might be enumerated as resulting from disordered teeth, as, for example, various neuralgic affections, epilepsy, ophthalmic diseases, obstinate headache, &c. It is sufficient for our present purpose that, like as a small worm in the intestine may give rise to dropsy in the brain, so a small organ like the tooth may, under certain conditions, be productive of general disease. How then is local anæsthesia in dentistry calculated to avert these evils? Because, we reply, the *dread of pain,* which is the main cause of delay in seeking the remedy, is abrogated.

It is during that delay that the imperious finger of death first places its chilling impress on some vital organ. It is the long period of that delay which so often tends to fill the insatiable grave. But it may he alleged that *chloroform* likewise abrogates that pain, and consequently dismisses that fatal incentive to delay. True, chloroform is fully capable of banishing the pain; yet chloroform has never banished this tendency to delay. Why? Because in the cup it offers to the patient's lips there is poison,—with a consuming flame playing upon its ethereal fluid. Local anæsthesia, free from these dangers, is that alone which can inspire a confidence which will abridge that delay, and in its abridgement prevent the frequently unchecked ravages of disease. Excuse now for putting off the evil hour there is none. The procrastination, which, while it is the thief of time, is in this case the thief also of health, becomes a less pardonable folly. For now that in anæsthetic cold we have an agent which destroys the pain of dental surgery, no plea is left for that Lethean draught, in inhaling which, to save us pain, we may be breathing in the still and unseen ether of another world.

LIST OF CASES.

Case I

Presents a common instance of stump extraction. The figure, exhibits the full-sized stump of an upper lateral incisor. It was firmly set in the jaw, and removed by a pair of forceps. The patient was unconscious of its withdrawal until ocular proof gave evidence of the fact.

Case II

Was the extraction of a lower posterior bicuspid tooth of the left side. The patient (a medical man) came to me suffering acute pain. On examination, I found this a case of inflammation of the lining membrane of the socket, which condition had distressed the patient for seven days. This gentleman, in common with many of the faculty, was extremely chary of his own person. He sat down, however, and I placed the apparatus in action; the tooth and its attachments were completely numbed; I extracted this tooth without the slightest pain, either during the process of cooling, or its removal.

Case III

Was that of a lady, who, from early youth, had been remarkable for the regularity, soundness, and beauty of her teeth. A severe attack of scarlet fever, which generally leaves sad marks upon the constitution as records of its invasion, left, among other sequelæ, its traces upon her once healthy teeth. Several of these, which before were sound and ornamental, rapidly succumbed to destructive caries. In the present instance, this lady came to be relieved from the stump of an upper incisor, which is correctly described in the accompanying woodcut. It was one of the most difficult and rebellious cases of stump-extraction that I had met with for a long period. Repeated gumboil had produced an excessive tenderness of the gums; and the operation of "punching" was the only available mode of extracting it. A sharp-pointed elevator was thrust down the sides of the stump, and considerable force was required to remove it from the socket. The chief cause of this difficulty was manifested after extraction, in the form of an exostosis, or outgrowth of bone, which was impacted in the osseous structure of the socket. The immunity from pain which this patient enjoyed, gave one of the most remarkable evidences I have as yet had of the efficiency of my method of inducing insensibility to suffering.

Case IV.

A little nervous boy was brought to me for the purpose of extracting a never-ceasing tormentor, in the form of a decayed upper molar tooth. I had some trouble with this case, from the extreme excitability of the child; but, when the part was fairly prepared by the apparatus, I removed the tooth without the knowledge of my little patient. He stared with almost hysterical delight upon his prostrate foe.

I may here observe, that I have been particularly successful with children; and especially upon their second visit, when the usual coaxing, bribery, threats, and varied artifices of anxious parents are needless and undesired.

Case V.

This patient had been a great sufferer from indigestion. A succession of alveolar abscesses had rendered the mouth incompetent to perform its important office of preparing the food preparatory to its passage into the stomach. In fact, this lady had become seriously affected by such a wretched state of affairs, and was induced to consult me from her increased suffering, and the importunities of her medical adviser. I found it necessary to extract all the stumps and teeth, sketched in such formidable array at the top of this paragraph. I had some difficulty with the stumps, yet even these I extracted without any suffering; and to this fact the patient can give full testimony.

Case VI.

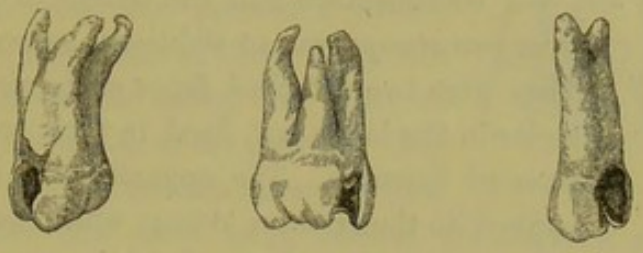
This case was remarkable for the connexion between dental pain and the production of a constitutional malady. Several years back, the patient consulted a dentist, to be relieved of a tooth which had been the source of considerable suffering. The tooth was extracted by a skilful practitioner; but, no sooner was it withdrawn, than the patient uttered the piercing cry so pathognomonic of epilepsy, and slid out of the chair on to the floor. She remained in a convulsed state for a few minutes, but recovered consciousness after a deep sleep of two hours. Nothing whatever could be discovered, either in the state of the tooth or its attachments, to account for the singular occurrence of the fit; which was consequently attributed to the acute pain of the operation,

acting upon a constitution hereditarily predisposed to epilepsy. No return of the fits took place. She again, however, became the victim of a carious tooth. For many months this lady endured excruciating pain, which at last proceeded to such intensity as to disturb the normal action of the senses. Sounds like the booming of artillery seemed occasionally to fall upon her ear, and orbs of every hue at times spread out in long perspective before her eyes. It was, in short, evident to her medical attendant, that the pain of toothache was about to bring on the same calamity as the previous pain of extraction. An operation appeared the only remedy. She was strongly advised to have the tooth removed under chloroform; but the family physician more strongly and successfully objected to it in such a case. This lady was led to consult me, and the result was, that the tooth was removed *without pain*, and *without any return of an epileptic attack*. From a curvature of the fang, this extraction was rendered a much more difficult operation than the former one, and, but for my new method of suspending sensibility in the part, would have been an incomparably more painful one.

Case VII.

This case is somewhat amusing in its history, as the subject (one of the most timid of nervous men) was in the habit of leaving his house with the special intention of having a tooth removed by the "painless mode." When in the act of summoning for admittance, all his resolution evaporated, his hand fell paralysed, and he walked home completely unhinged, and knocked up for the rest of that day. This is no exaggeration of his sufferings, as I had the account from the martyr himself; and indeed it is no uncommon occurrence—as is shown by the frequent and ludicrous tales my patients relate when "all is over." One lucky day the subject in question was accidently caught; and his acute sense of propriety would not admit of a deliberate breach of the laws of good behaviour. He sank resignedly into my operating chair. I extracted the upper wisdom tooth of the left side *painlessly;*

he immediately begged me to remove the corresponding one on the other side, which was also done *painlessly*. He followed this up by soliciting me to apply the cold to an upper bicuspid of the



right side, this tooth was also extracted *painlessly*. All these teeth (shown in the engravings) were firmly set in their respective sockets, and removed without this gentleman feeling any *uneasiness whatever*.

Case VIII

Is one of those unusual and dangerous cases so much disliked by the majority of dentists. The patient was 23 years of age, and exhibited a collection of masticators of the largest and most resistible character. The tooth under consideration was a decayed molar of the upper jaw. Here, as is too frequently our office to record, intense and protracted suffering had worn out all patience and physical strength. I completely numbed the tooth and the parts surrounding; but, upon the first effort to detach it, the crown snapped off with a sharp crack, leaving part of the nerve pulp behind, and exposed. I immediately dissected out the exquisitely sensitive structure before sensation returned. The cold was reapplied. Again and again I tried to move the remaining fangs, but without the faintest sign of success; such was the tenacity of this tooth for its natural habitation. This part of the mouth was reduced below its regular temperature sufficient for anæsthetic purposes, for *two long hours;* which circumstance may at once, and for ever, stand as a contradiction to all idea of devitalization, when the apparatus is carefully applied.

Case IX.

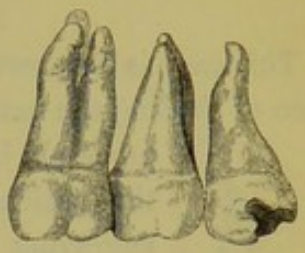
This patient had never submitted to the operation of tooth-extraction; and the circumstance that she sought to be relieved from two *stumps* was an additional source of dread.

They were two detached fangs of the right second molar in the lower jaw, fixed in their sockets with unusual firmness. The apparatus, as usual, was applied to the farthest stump, which was speedily extracted *without the slightest pain*, much to the surprise of the patient. As this lady appeared to possess excellent general health, and was remarkable for an unusual amount of courage, I suggested to her, that she should submit to the extraction of this second fang without its being rendered insensible to pain. Having a secret misgiving in her mind that the pain attendant on "tooth-drawing" had really been vastly overrated by her friends, she consented to my wishes. The "word of command" was no sooner uttered, than the stump was out; but, accompanied by a shriek and a plunge, that was as decisive and practical to her as ludicrous to the bystanders. Her incredulity as to the pain of the operation was (of course) removed, and her full sympathies were aroused. To me it was convincing in more ways than one; for these two stumps were detached portions of one and the same tooth, consequently there were no circumstances (apart from the anæsthesia) to render the extraction of the one more painful than that of the other; and it further showed that moral courage and physical strength do not avail to abolish the crushing pain of tooth-extraction.

Case X.

This case is one of deep interest, from the fact that the lady patient was at the time *enciente*. There was no unusual dental abnormity; but, as is frequent in like conditions, an accompaniment of toothache and acute facial pains causes much local suffering and constitutional derangement. The teeth which

occasioned this disturbance are correctly represented in the engraving. They are three upper molars, drawn in their exact positions as seen in the jaw.



I commenced this operation by removing the first molar of three fangs, and extracted it *without giving any pain*, to the great satisfaction of my patient. The next tooth was the second molar, of two fangs, which also came away *without the slightest pain*. The third, or wisdom tooth, did not require so much force in its detachment, and was extracted without the lady's knowledge of its removal—so complete was the numbing effect produced by my apparatus.

Case XI

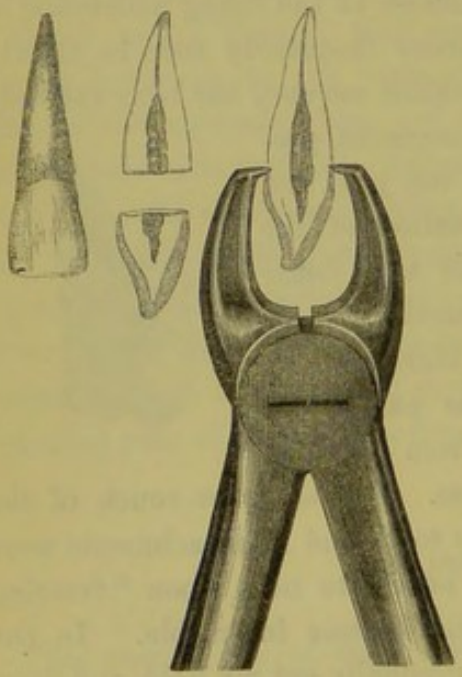
Is an instance of chronic inflammation of the lining membrane of the socket. This condition is more frequently seen in elderly subjects; or those, for whose salvation *mercury* has been the only acknowledged drug. The tooth engraved, presents an old offender from an old jaw, and "shaky" to the fullest application of the term; yet, so exquisitely tender as to debar the sufferer from the power of mastication, or the least enjoyment of food. Here, I may say, that I have given a little pain when applying my apparatus; but, from pressure only, not from the cooling process. The slightest touch of the finger was unbearable, but as the tooth and its attachments were gradually reduced from "fever heat" to near upon "freezing point," the tooth stood firm and became insensible. In the anæsthetic stage I carefully and gradually got my hold, and drew forth the large molar represented above, *without my patient having any knowledge of its extraction*.

Case XII.

This case is interesting inasmuch as it shows that the operation of drilling the nerve-channel (ordinarily an intensely painful process) is accomplished, by congelation, without the patient feeling the slightest uneasiness. The engraving presents one out of a great variety of such cases. It may be observed, that a gold pin is firmly screwed into the crown of an artificial tooth, and with considerable pressure forced up the enlarged cavity in the stump, occupying the exact position of the lost part of the natural organ.

Case XIII.

Nature had been unkind to this fair patient, inasmuch as one out of a goodly array of regular teeth, stood forward in awkward and ungainly prominence; added to this, the tooth had a cavity produced by caries; and a metallic stopping some time before inserted, had discoloured the bone, giving it a blueish tinge, and making the defect more apparent. When this lady consulted me, I recommended the operation of excision (cutting off the crown), and replacing the same by an artificial substitute. This operation was performed *without the slightest pain*, or sensation of jarring during the crash of the cutting instrument.



I show in the engraving, the excising forceps in the act of cutting through the neck of the tooth and nerve pulp. The

second figure, presents the same as divided. The third, is an exact copy of the tooth before the operation.

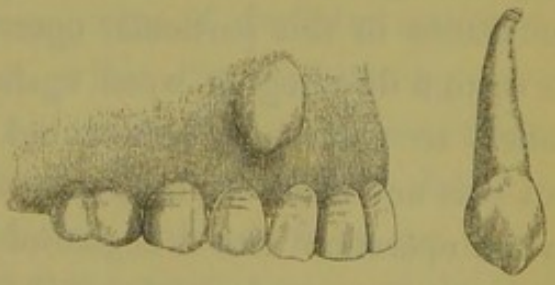
Case XIV

Presents a molar tooth of the upper jaw with spreading fangs, having no other peculiarity than the "fearful pulling" such teeth entail. I extracted this "grinder" from the mouth of a delicate young lady, and, to use her own words, "thought it never would have come out, but experienced no uneasiness or any pain whatever."

If truth is to be heard, let the public listen to those who expect to suffer—or are suffering—pain in the teeth.

Case XV

Is selected from several similar instances of malposition, because, the patient was a little girl twelve years of age, suffering from an affection of the heart; therefore more susceptible of nervous shock, and an unfit subject for chloroform. The engraving shows the canine (or eye tooth) fully developed, but imbedded in the jaw, with its crown perfectly sound, and resting between the fangs of the bicuspis and incisor.



The eye teeth are more frequently retarded in their evolution, as they are generally the last to appear, and have too often insufficient space allotted as their share. The tooth standing alone and excluded from the circle, was so far a distortion as to

push out the upper lip, and give an ugly appearance to that, which now, may be called a pretty mouth.

Here we have no disease, merely an instance of irregular dentition that is by no means uncommon; at the same time of such a character that it could not be remedied by any safe mechanical contrivance. I had some difficulty in getting a fair hold of the tooth with my forceps, and considerable force was exerted in pressing the instrument up far enough for my purposes. I extracted this tooth without giving my little patient the *slightest pain*. The woodcut gives its exact proportions.

The successful issue of such cases as the preceding at once removes beyond the region of doubt, the question of the possibility of producing local anæsthesia for dental operations. They are facts as indisputable as they are grateful in dental surgery.

All the patients, with few exceptions, had previously been subjected to dental manipulations, and, consequently, were in a position to compare the relative amount of suffering under the different modes of operating. Some were, again, of a temperament highly susceptible of pain, and they belonged to that sex which generally manifests less endurance in this particular operation. I have no wish to write a disparaging word against the courage of the ladies, so notoriously undaunted in great emergencies; but it is nevertheless a fact, that men do generally submit to the operation with a degree of stoicism not expected from the more tender and delicate sex.

It will be observed that several of the foregoing cases belonged to that class of dental operations which is generally the most difficult and painful; viz., *the extraction of stumps*. It is not without good reasons that most persons have an insuperable dread of the extraction

of stumps. The difficulty, nay, the frequent impossibility of gaining sufficient purchase to extract them with a single operation, compels the dentist at times to resort to the exquisitely painful application of the elevator, or the operation commonly known as punching, &c., to do the work which the simple forceps cannot accomplish. The mutilation which is thus at times almost unavoidable,—the different steps of the operation, and the greater amount of time occupied,—all render this an operation of far greater dread than the simple extraction of an entire tooth. Now, notwithstanding the essentially more painful nature of the operation of extracting stumps, it is in these very cases that my method presents the most unparalleled success. I have not met with finer or more satisfactory results in all my dental experience, than in the cases of stumps extracted under the anæsthetic influence of cold. It is in these instances, in fact, where the anæsthesia is most complete and certain.

Many other equally instructive cases of stump-extraction might have been added, but those adduced suffice to show that one of the opprobia of dentistry may now be removed. And thus, while the undeviating success which has attended my method of local anæsthesia in the case of stumps is a progressive step in dental surgery, it at the same time removes from the mind of many patients one of the greatest horrors of the dental art.

GLOSSARY.

ALVEOLUS. The bony socket of a tooth.

ANÆSTHESIA. Diminished or lost sense of feeling.

ASPHYXIA. Suspended animation.

BICUSPID. Two-pointed; applied to a tooth having two points. Generally known as the small grinder.

BRONCHI. The wind-pipe; a ramification of the trachea. The bronchial tubes are minute ramifications of the bronchi.

CARIOUS. Caries; ulceration of the bones. Decay of the teeth.

CEREBRAL. Relating to the brain.

CHLOROFORM. A colourless liquid, of a dense oily consistence and agreeable smell; sp. gr. 1·480. Boils at 142°. Chloroform is obtained by distilling a mixture of 1 pound of chloride of lime, 3 of water, and 3 ounces of alcohol, in a capacious retort; about 3 ounces of chloroform pass over.

CONGELATION. State of being congealed, or made solid. That change of fluid bodies which takes place when they pass to a solid state, by losing the heat which kept them in a state of fluidity.

DENTINE. The bone of the teeth.

DIATHESIS. Constitutional disposition.

DYSPEPSIA. Indigestion.

EXOSTOSIS. A morbid enlargement of a bone.

GANGLIONIC. In anatomy, it is applied to a natural knot-like enlargement in the course of a nerve.

GANGRENE. The first stage of mortification, so named from its eating away the flesh.

HÆMORRHAGE. A rupture of a blood-vessel; a bursting forth of blood.

HEPATIC. Belonging to the liver.

IDIOPATHIC. Primary disease, as opposed to symptomatic.

INCISOR. The front or cutting teeth. The incisors cut our food; the molars grind it.

MOLAR. A double, or grinding tooth.

NITROUS-OXIDE GAS. This gas consists of 63 parts nitrogen, and 37 oxygen, by weight. It was first discovered by Priestley, but Sir Humphry Davy examined with great accuracy the properties of the substances concerned in its production. Animals soon expire when wholly confined in this gas; but when mingled with atmospheric air, and received into the lungs, it generates highly pleasurable sensations. It induces a state of great exhilaration—an irresistible propensity to laughter (hence its cognomen "laughing gas"). It rouses every faculty of the mind with a rapid flow of vivid ideas, unusual fitness for muscular exertion, and somewhat resembling the pleasantest stage of intoxication, but no subsequent depression of nervous energy. (What a variety of delightful or pernicious effects might flow from the slightest change in the constitution of the atmosphere we breathe, were there any interposition in altering the proportion of its constituent parts!)

NECROSIS. Literally, mortification. Necrosis and caries are essentially different; for in necrosis the affected part of the bone is deprived of the vital principle. Caries is analogous to ulceration; while necrosis is essentially similar to mortification of the soft parts.

NARCOTISM. A state of unnatural sleep, induced by the effect of narcotic substances.

PATHOGNOMONIC. A term applied to symptoms which are characteristic of, and peculiar to, a disease.

POST MORTEM. An expression employed for the operation of opening and examination of the dead body.

PULMONARY ABSORPTION. Inspiration by the lungs.

PHRENITIS—PHRENSY. Inflammation of the brain.

PSYCHOLOGICAL. Relating to the intellectual and moral faculties.

PHLEBITIS. Inflammation of the veins.

PERIOSTEUM. The membrane which covers the bones.

SULPHURIC ETHER. A highly volatile fluid, obtained by the distillation of alcohol and sulphuric acid. The medicinal properties of ether, when taken internally, are cordial and stimulant.

THERAPEUTICS. A branch of medicine relating to the treatment of diseases.

TRAUMATIC. Belonging to wounds; caused by wounds.

TUBERCLE. A small swelling or collection of a peculiar scrofulous matter.

VISCERA. The intestines.

OPINIONS OF THE PRESS

ON THE FIRST EDITION.

"Mr. Blundell's process so deadens the sensibility that the tooth is extracted entirely without pain."—*The Times.*

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POSTSCRIPT.

All Applications for Instruments, &c., must be addressed to the Author's residence, 29, New Broad Street, City, London; and from whom every information can be obtained, either by letter or personal interview.

Such Gentlemen as require instruction, that they may be more expeditiously qualified in the use of the apparatus, must communicate with the Author by personal application.

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