

PART II.

SECOND PERIOD—THE MIDDLE AGES.

CHAPTER VIII.

THE ARABIANS.

THE religious fanaticism excited by Islamism, transformed the obscure and nomad inhabitants of Arabia into a conquering nation, who very soon extended their power over a considerable part of Asia, Africa, and Europe. Spain, invaded by the Arabs in 711, fell almost entirely into their hands. After having by force of arms rendered themselves powerful and dreaded, the Arabians acquired also great fame by the culture of art and science within the limits allowed them by their religious code; and in these, for more than four centuries, they maintained an incontestable preëminence.

Unfortunately, as the Koran most absolutely prohibited the dissection of dead bodies, all serious anatomical research was thereby rendered impossible. This was a very great hindrance to the progress of anatomy, of physiology, and, in consequence, of the whole of medical science. The Arabians certainly had the merit of keeping alive the study of medicine in an age of decadence and barbarism; but, apart from the important progress realized by them in chemistry and pharmacology, it may be affirmed that the Arabs contributed but scantily to the development of the healing art; they followed almost entirely in the footsteps of Galen and other ancient, and especially Greek, authors.

One of the characteristics of Arabian medical art consists in the aversion to bloody operations and in the effort to avoid them. A like tendency shows itself also in the sphere of dentistry; the Arabians, even more than their Greek and Roman predecessors, were reluctant to extract teeth, and employed all possible means, in order to avoid the operation.

RHAZES (or more precisely, Abu Bekr Muhammed ben Zacarja er Rhazi) was born in Persia toward the middle of the ninth century, and gave himself up to the study of medicine when about thirty years of age, having previously been a musician. He wrote many works which,

unfortunately, have, for the most part, been lost. Rhazes did not have recourse to the extraction of teeth, save as a last resource when every other attempt at cure had proved useless; which method would no doubt have deserved high praise, had the author been inspired by the principles of conservative surgery, rather than by unjustifiable fears. Caries of the teeth is, according to him, identical with that of the bones. To hinder its progress and propagation to the neighboring teeth, he advises the carious cavity to be filled with a "cement" composed of mastic and alum. We have here a laudable attempt at permanent stopping of decayed teeth, although it is clear that the duration of such stopping, owing to the nature of the materials employed, could not be a long one. Furthermore, he counselled the patient to abstain from the use of acid food or drink and to rub the teeth with powder of gall-nuts and pepper.

To strengthen loosened teeth, he recommended astringent mouth washes and sundry dentifrice powders. Others, partly taken from Galen, are recommended by him for prophylactic purposes and for cleansing and beautifying the teeth.

Against periodontitis and the pains produced by it, he sometimes had recourse to bleeding. He commended, besides, opium, oil of roses, pepper, and honey, and also the scarification of the gums and the application of a leech. If, however, these remedies did not succeed, he applied his theriac, which was composed of castoreum, pepper, ginger, storax, opium, and other ingredients, to the roots of the teeth. If even this method of cure failed, he touched the root of the diseased tooth with a red-hot iron, or sought to provoke its fall by the use of special medicaments, such as coloquintida and arsenic (a substance to which he had recourse, particularly in those cases where there was ulceration of the gums). It is no wonder that such means of cure would sometimes produce, as a final result, the actual falling out of the tooth; and this, as is natural, served to strengthen the belief that the same result could also be obtained with less energetic remedies, but which were supposed to be equally endowed with expulsive virtues.

Rhazes relates an interesting case of regeneration of a whole lower jaw; he, however, observes that the newly formed osseous mass was less hard than the original bone.¹

ALI ABBAS, another great Persian physician (who died in 994), wrote a lengthy treatise on theoretic and practical medicine, one chapter of which is dedicated to the diseases of the teeth. When a molar tooth is affected by caries, and the pain cannot be subdued in any other way, Ali Abbas applies, inside the carious cavity, the end of a small metallic tube, into which he repeatedly introduces red-hot needles, leaving them

¹ Rasis opera, Venetiis, 1508.

in the tube until quite cooled. Should even this have no effect, he tries to provoke the fall of the tooth by the application of asses' milk with assafetida, or, finally, extracts it.¹

He cures epulis, like Paul of Ægina, by excision. As to parulis, or abscess of the gums, he opens it with a lancet or a wooden stylus.

When the dental arch is deformed by the existence of supernumerary teeth, he removes these with an instrument in the shape of a beak.²

SERAPION (Jahiak Ebn Serapion), who lived in the tenth century, and up to the beginning of the eleventh, contributed but slightly to the development of medicine and dentistry, as he was in his writings little more than a mere compiler. He indicates with great precision the number of dental roots, and expresses an opinion that the upper molars have need of their three roots in order to keep firm in spite of their pendent position, whilst two roots alone are sufficient to keep the lower molars in place, on account of the support which they receive from the jaw. Serapion, like Galen, admits the nutrition and continual growth of the teeth—a growth which is produced in the same proportion as the waste due to mastication—and he too makes the dental diseases depend upon an alteration in the nutritive process, either by excess or by defect.

Against dental pains of phlogistic origin, he recommends bloodletting, purgatives, and many local medicaments, reproduced in great part from Rhazes. In cases of persistent odontalgia due to caries, he advises, as an excellent remedy, the application of opium in the carious cavity. To strengthen loosened teeth, he first employs astringents, and if these are of no use, as often happens in the old, he binds the loose teeth together and to the neighboring healthy ones, by means of gold or silver wire.

In Serapion, too, we find many formulas for dentifrice powders, some of which are intended simply for cleaning the teeth, others for special prophylactic or curative purposes.³

AVICENNA. One of the greatest luminaries of medicine among the Arabs was Avicenna (Ebn Sina). He was born in 980 son of a high Persian functionary; he lived a very adventurous life, held some very high places, and died in 1037. Among his works, the most important is the *Canon*, a book which procured him the title of "second Galen" and the still more pompous one of "prince of doctors." A very evident proof of the immense fame which he acquired is the fact that among many oriental peoples Avicenna, even in our own days, is considered the greatest master of medicine.

The anatomy and physiology of the teeth are treated by Avicenna very minutely, but nevertheless he does not teach us, in regard to these,

¹ Haly Abbas Pract., lib. v, cap. lxxviii.

² Ibid., cap. xxxiii.

³ Serapionis practica, Venetiis, 1503.

anything new. Like Galen, Avicenna admits that the teeth continually grow, and as a proof he gives the fact of the lengthening of the teeth, which, owing to the absence of antagonists, are not subject to any pressure or friction.

He gives much good advice with regard to the preservation and cleanliness of the teeth, to which he attaches very great importance; and on this point he remarks that the use of very hard tooth powders must be avoided, as these are liable to injure the dental substance. To this latter are also harmful, says the author, some narcotic remedies, employed against odontalgia. Burnt hartshorn is, according to him, a most valuable dentifrice. To remove tartar from the teeth, he indicates many remedies, and especially dentifrices of meerschaum, salt, burnt shells of snails and oysters, sal ammoniac, burnt gypsum (plaster of Paris), verdigris with honey, etc. Among the substances able to facilitate dentition, he enumerates several oils and fats, besides the brain of the hare and the milk of the bitch, and he disapproves the custom of giving to children, during dentition, hard objects to chew, in the erroneous belief that the biting of such objects is useful in facilitating the cutting of the teeth; he recommends, instead, the gums to be rubbed with the fingers. When the teeth begin to appear, he drops some oil into the ears of the child and covers its head, neck, and jaws with a plaster spread on cotton that has been soaked in oil.

Avicenna minutely examines the various causes of odontalgia, and among them includes also the little worms by which the dental substance was supposed to be gnawed away.

When a tooth becomes the seat of intense pain, accompanied by a throbbing feeling, Avicenna considers that this is due to an excessive accumulation of humors in the root; he therefore advises, as already Archigenes had done, the tooth to be drilled, in order to empty it, and afterward to introduce into it appropriate remedies.

According to Avicenna, he who has a loosened tooth and desires to make it firm again, must avoid using it in mastication, must not touch it with the fingers, nor move it with the tongue; besides this, he must speak as little as possible, and make use of astringent remedies.

To remove a tooth, Avicenna made use of either the forceps or the "eradicating remedies," in which he, too, had full confidence. Like the greater part of his predecessors, Avicenna is of the opinion that the extraction of a firm tooth must be avoided as much as possible, as it may give place to an injury of the jaw, or become harmful to the visual organ, or bring on fever. On this point he remarks that, if an aching tooth appears to be sound, it is not always necessary to perform its extraction in order to cause even the most rebellious odontalgia to cease; in certain cases he obtained a complete cessation of the pain after having

simply shaken the tooth without completing its extraction; which according to him was due to the double reason that by shaking the tooth a resolution of the morbid matter stagnating under it is provoked, and the action of the medicaments that are afterward made use of is thus favored.

Among the eradicating remedies, the author enumerates white arsenic, orpiment, coloquintida, tithymallus, the fat of frogs, and others. He remarks, however, that before using them it is advantageous to detach the gum all around.

Against the supposed worms in carious teeth, he praises fumigations made with the seeds of the hyoscyamus, garlic, or onion.

Arsenic is used by him not only for the above-mentioned purpose, but also for the cure of fistulas and foul ulcers of the gums.

When a tooth has become abnormally long, Avicenna makes use of the file to reduce it to a proper size; and in performing such an operation, he holds the tooth firmly between the fingers, or with a pair of pincers suited for the purpose. As a consecutive treatment, he prescribes frictions with alum, laurel berries, and aristolochia.¹

ABULCASIS. Among the Arabian authors, he who has the greatest importance in regard to dental art is undoubtedly Abulcasis (Abul-Casem-chalaf-ben-Abbas). Whilst Avicenna was one of the greatest physicians, Abulcasis was one of the greatest surgeons; and very justly he has been called the genius of Arabian surgery.

Abulcasis had his birthplace in Alzahra, a small Spanish village, five miles from Cordova; from this he derived the name of Alzaravius, by which he is also known. Historians are not agreed upon the date of his birth. According to the most probable opinion, he was born about the year 1050 and died in 1122 at Cordova, a city which, on account of its celebrated school, was then a most important centre of scientific and literary culture.

Among the works of Abulcasis, the one which brought him the greatest fame was the treatise *De Chirurgia*. It is divided into three books, in the first of which he speaks of all the diseases which can be treated by cauterization; in the second are described all the operations which are performed by cutting, perforating, or extracting (wherefore, obstetrics is also included in this book); in the third, lastly, the author treats, region by region, of fractures and luxations.

Chapters XIX, XX, and XXI of the first book have reference to diseases of the teeth and gums. As these chapters are very short, we are pleased to give here an almost literal translation of them:

“When in the lower part of the gums, or in the palate, there appears a little tumor, which afterward becomes purulent and opens and changes

¹ Avicennæ opera in re medica, Venetiis, 1564.

into a fistula, against which no medical remedy is of any use, it is necessary for thee to take a cautery corresponding in size to the aperture of the fistula, and after having heated it, to introduce it there and to keep it applied there until the cauterizing iron reaches the bottom of the said fistula and beyond. This thou shalt do once or twice, and then shalt use fitting medicaments until a complete cure is obtained. This is attained when suppuration ceases. Otherwise one cannot do less than uncover the bone and extract that part of it which is diseased.”¹

“When through excess of moisture the gums become flaccid, the teeth loose, and of no use are the remedies employed by thee, thou shalt lay the patient’s head on thy lap, and after having applied to the tooth, where it borders on the gum, the end of an appropriate little metal tube, in this thou shalt quickly introduce the cautery of which mention will be made in the following chapter; and thou shalt prolong the application as long as suffices to let the patient feel the heat right in the root of the tooth. This thou shalt repeat as often as thou shalt think necessary. Then the patient shall keep salt water in the mouth for an hour. By effect of such a cure, the corrupted moisture will dry up, the gums will regain their tone, and the tooth its firmness.”²

“When toothache depends upon cold, or if there exist some worm in the tooth, and the medicaments are of no use, recourse must be made to cauterization, which in such cases may be performed in two ways, viz., either by means of butter or with a cautery. Desiring to use butter, some of it must be warmed in an iron or copper spoon; a little cotton must then be wrapped around the extremity of a probe, dipped into the boiling butter, and then immediately applied to the tooth, keeping it there in contact until it has cooled. This must be repeated several times, so that the action of the heat reaches right down to the root of the tooth. If thou preferest, thou canst use cold butter, applied to the aching tooth by means of a little tuft of wool or cotton, upon which thou shalt lay a red-hot iron; prolonging the application of this until the heat has reached the very root of the tooth.

“To perform the cauterization directly with the iron, thou must first rest on the tooth a small tube of iron or copper, designed to preserve the neighboring parts from the action of the heat, and which must, therefore, be of sufficient thickness. Through such a tube thou shalt apply on the tooth a cautery of the shape given here below, and shalt keep it there until it is cooled. This thou shalt do several times. The pain will cease the same day or on the morrow. It is, however, necessary that

¹ Abulcasis de Chirurgia, lib. i, cap. xix, p. 47; Latin translation by Channing with the Arabic text in front, Oxford, 1778.

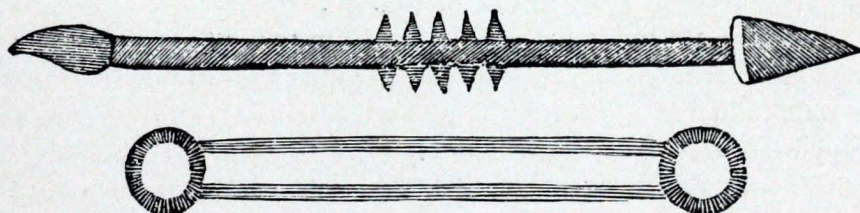
² Cap. xx, p. 47.

after the cauterization the patient should keep his mouth, for an hour, full of good butter. The shape of the cautery is as follows (Fig. 34): Thou canst perform the cauterization with one or other of its two extremities, as is most convenient."¹

In regard to epulis, Abulcasis prescribes that after catching hold of the little tumor with a hook or a vulsella its complete excision should be performed. This done, one must wait awhile, until the hemorrhage ceases, and then either a little "zegi" pulverized,² or other drying and styptic powder, must be applied on the part. If the epulis recurs, which very often happens, the excision must be repeated and this followed by cauterization, since after this latter the evil will not return.³

Abulcasis is the first author who has taken into serious consideration dental tartar and who has recommended that a scrupulous cleansing of the teeth should be performed. The chapter relating to this, "On the Scraping of the Teeth," is very interesting and is worthy of being here reproduced.⁴

FIG. 34



Abulcasis' dental cautery and the tube through which it was applied, in order to preserve the neighboring parts from the action of the heat.

"Sometimes on the surface of the teeth, both inside and outside, as well as under the gums, are deposited rough scales, of ugly appearance, and black, green, or yellow in color; thus corruption is communicated to the gums, and so the teeth are in process of time denuded. It is necessary for thee to lay the patient's head upon thy lap and to scrape the teeth and molars, on which are observed either true incrustations, or something similar to sand, and this until nothing more remains of such substances, and until also the dirty color of the teeth disappears, be it black, or green, or yellowish, or of any other color. If a first scraping is sufficient, so much the better; if not, thou shalt repeat it on the following day, or even on the third or fourth day, until the desired purpose is obtained. Thou must know, however, that the teeth need scrapers of various shapes and figures, on account of the very nature of this operation. In fact, the scalpel with which the teeth must be scraped on the inside is unlike

¹ Cap. xxi, p. 49.

² Zegi was the name given by the Arabs to blue vitriol.

³ Lib. ii, cap. xxviii, p. 181.

⁴ Lib. ii, cap. xxix, pp. 181 to 183.

that with which thou shalt scrape the outside; and that with which thou shalt scrape the interstices between the teeth shall likewise have another shape. Therefore, thou must have all this series of scalpels ready if so it pleases God."¹

The work of Abulcasis is, so far as we know, the first book in which are found figures of dental instruments. We do not know, however, how far such figures are exact, that is, to what degree of faithfulness they represent the instruments which Abulcasis really employed as the original figures of the book of Abulcasis were copied and recopied by successive transcribers of the work. And that such copies have been very often unfaithful may be deduced from the fact that not unfrequently figures of surgical instruments are found in the book which do not at all agree with the verbal description which the author gives of such instruments.

In the edition by John Channing, we find at the end of the chapter on the scraping of the teeth two series of figures. The first series is found under the Arabic text, and is composed of the fourteen figures reproduced as Fig. 35; the other series, existing under the Latin text, has only twelve figures, as shown in Fig. 36.

As Channing has made his translation from two different Arabic copies of Abulcasis,² among the corresponding figures of which there exists a very notable difference, he, for the greater part, had to follow the plan of reproducing the figures of both codices. But besides this numerical difference, there is also a considerable difference in the shape of the instruments represented. We must, therefore, ask ourselves which of the two series of figures is to be regarded as the more faithful representation of the instruments used by Abulcasis. Most probably the first series. In it we find figured some scrapers which have a certain resemblance to those actually in use; besides this, the figures of the first series seem to be drawn with greater accuracy than those of the second. Among other things it may be noticed that the handle of each instrument (excepting the last two) is furnished with a row of prominences, which, it is almost certain, were designed to afford a better grip in holding the scrapers during the operation.

We now consider the chapter on the extraction of teeth.³ The author begins by saying that it is necessary to use all possible means to cure an attack of odontalgia, and to be very slow in deciding to extract a tooth, as this is a very noble organ, the want of which cannot in any way be perfectly supplied. When there is no way of avoiding extraction and the

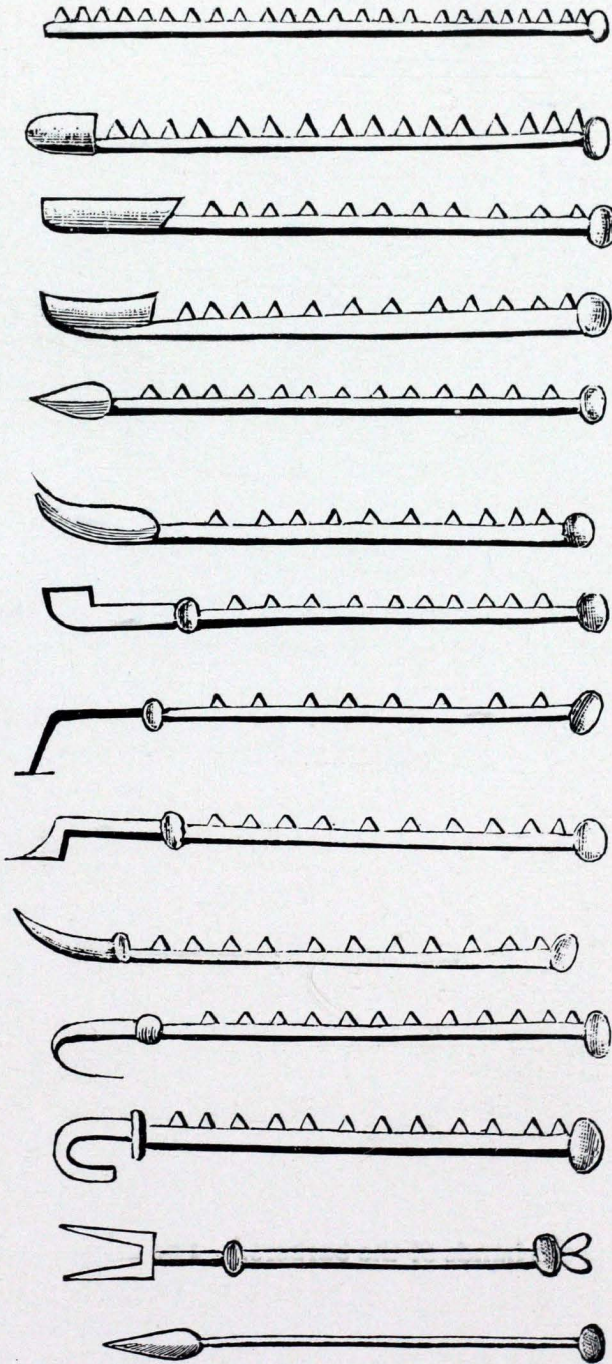
¹ This great Mahommedan surgeon was, it seems, very religious. His book begins with the words: "In the name of the merciful God, Lord perfect in goodness," and almost every chapter ends with "If God so wills," and the like.

² These two manuscript codices are found in the Bodleian Library at Oxford.

³ Lib. ii, cap. xxx, p. 185.

patient is obliged by pain to submit to this, it is necessary first to ascertain which is the aching tooth, as very often the pain deceives the patient,

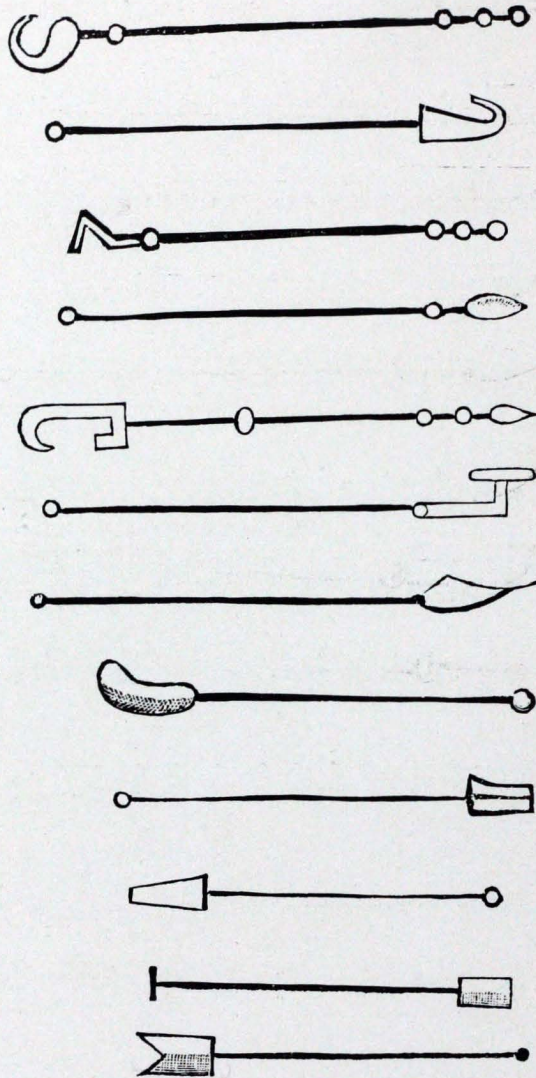
FIG. 35



Set of fourteen dental scrapers (Abulcasis).

so that he may indicate as the seat of the pain another tooth which is perfectly sound, and desire it to be extracted; after which, naturally, the pain does not cease, if not when the diseased tooth is also extracted, as

FIG. 36



Twelve dental scrapers as represented in another manuscript codex of Abulcasis.

often happens in the hands of the barbers.¹ The aching tooth having been well ascertained, it is necessary to detach the gum from the tooth, all

¹ The Arabic word used by the author means more precisely "those who apply cupping glasses." Channing has translated it by *tonsores*, barbers.

around, with a sufficiently strong scalpel. Then either with the fingers or with a light pair of forceps the tooth must be shaken very gently, until it is loosened. Then the surgeon, keeping the head of the patient firmly between his knees, applies a stronger pair of forceps and extracts the tooth in a straight direction, so as not to break it. If it is not possible to draw it out, one of those elevators must be taken which the author advises for the extraction of roots (as may be seen afterward), and by insinuating it under the tooth the surgeon must endeavor to extract it. When the tooth is corroded and hollow, it is necessary to fill the cavity with lint, compressing it hard inside with the end of a probe,¹ so that the tooth may not break under the pressure of the instrument. In all cases, the operator must take great care not to break the tooth, for if this happens the re-

FIG. 37

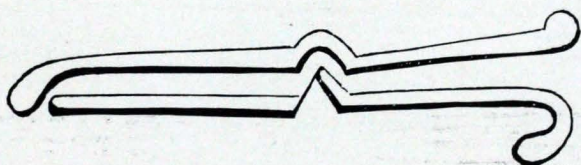
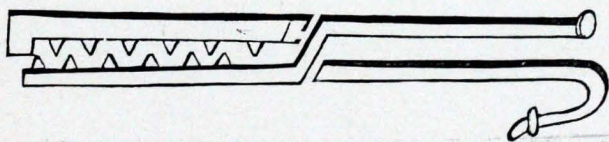


FIG. 38



Forceps for loosening the tooth previous to extraction (Abulcasis).

maining part will give the patient still greater suffering. It is necessary, therefore, to avoid acting like the ignorant and foolish barbers, who in their temerity do not observe any of the above-mentioned rules, and therefore very often cause the patients great injuries, the least among which is the breaking of the tooth, the root being left in the socket, or else the taking away, together with the tooth, of a piece of the maxillary bone, as the author often happened to see. After the extraction the patient must rinse his mouth with wine, or with vinegar and salt. If, as often happens, hemorrhage is produced, a little powdered blue vitriol must be applied inside the wound; and if this is not sufficient, the part must be cauterized with a red-hot iron.

The small forceps (Figs. 37 and 38) to be used in loosening the tooth must have the handle shorter than the jaws and be sufficiently strong not to bend when pressure is put upon the tooth.

The large forceps (Figs. 39 and 40) with which the extraction must

¹ An advice already given by Celsus.

be performed should be made of very good Indian or Damascene iron, and have the handle longer than the jaws; these, moreover, on the inside must be toothed, or striated after the manner of files, so that they may have a perfectly firm grip, without slipping.

From the foregoing quotations and on examining the annexed figures, it very clearly appears that the extraction of teeth was performed by Abulcasis with excessive timidity and in a manner which must have been torturing to the poor patients. These had to undergo, first of all, the detachment of the gums, then the prolonged shaking of the tooth either with the fingers or with the forceps, then the attempt at extraction by means of a stronger pair of forceps, but, so far as can be seen from the figure, very little fitted for the purpose; and finally, in many cases, fresh maneuverings to extract the tooth with an elevator.

FIG. 39

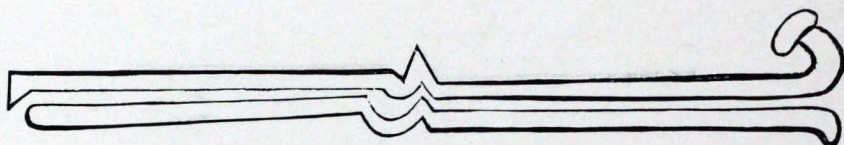
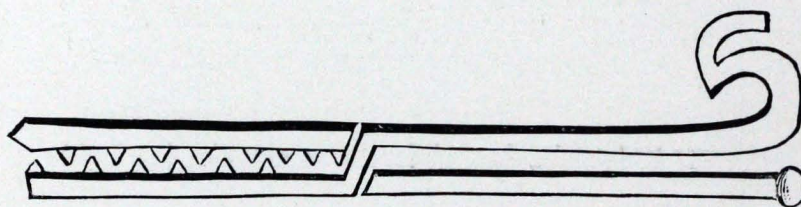


FIG. 40



Forceps for performing the extraction after the tooth has been loosened (Abulcasis).

Nothing better, in truth, could have been done with such imperfect instruments. But it is possible that even then there perhaps existed, for the extraction of teeth, other instruments, so shaped as to be able to act with greater force. Abulcasis himself¹ alludes to the existence of dental instruments not mentioned by him. It is probable, therefore, that the barbers, in spite of the scorn with which Abulcasis overwhelms them, used, for the extraction of teeth, forceps far more suitable than those described by him. These individuals, certainly unfurnished with a scientific education, must have had, however, a great practice in the extraction of teeth, being perhaps almost the only ones to whom recourse was had for this operation. They performed it very quickly, as may be argued from the words of Abulcasis himself. It is no wonder, therefore, that not unfrequently the work of these *fatui tonsores*² was the cause

¹ Lib. ii, cap. xxxi, p. 191.

² Silly barbers.

of more or less serious injuries, but for the most part it had the advantage of not making the patients suffer excessive torture.

Another very interesting chapter is that which treats of the extraction of dental roots and fragments of the maxillary bone.¹

FIG. 41

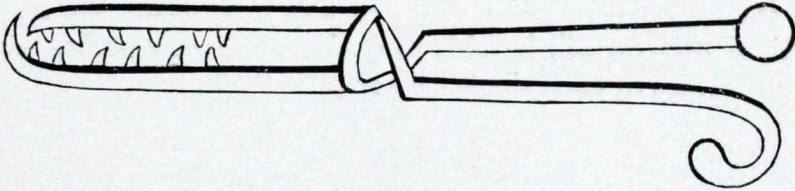
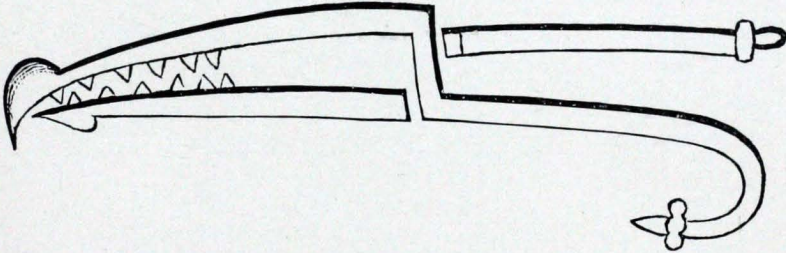


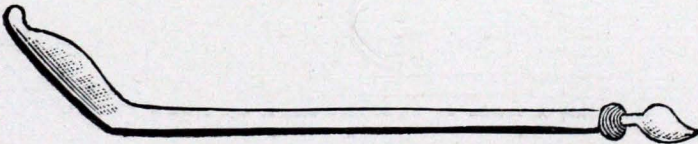
FIG. 42



Forceps for extracting the root when the tooth breaks in the extraction. These figures are evidently very badly drawn, as are most of the figures to be seen in Abulcasis' work.

When, says the author, on extracting a tooth, this breaks, so that the root remains in the socket, it is necessary first of all to soften the part, by applying for a day and a night, or for two days, some cotton wool well smeared with butter; then attempts must be made to extract the root with a pair of forceps, the jaws of which are like the beak of a pheasant or stork.

FIG. 43



Elevator to be used when the extraction of a root by means of the root forceps proves impossible (Abulcasis).

If this is not successful, it is necessary to remove with a scalpel the whole of the gum which covers the root; then under it must be insinuated a small elevator having the shape here below represented.

If not even in this way can the end be attained, recourse must be made

¹ Lib. ii, cap. xxxi, p. 187.

to one of the following instruments, choosing that which in every particular case seems to be the most suitable.

Besides these, says the author, use may be also made of some of the instruments which serve for the removal of tartar.

It is precisely in this chapter that Abulcasis speaks of the great variety and multiplicity of dental instruments; which, he says, cannot, like other kinds of instruments, be all enumerated and described. He then adds that a skilful surgeon will be able to devise new instruments, according as the peculiarities of each single case require them.

FIG. 44



FIGS. 45, 46, 47

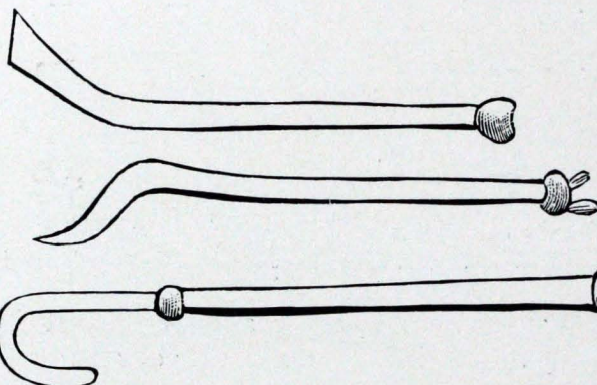
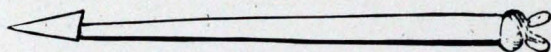


FIG. 48



Elevators (Abulcasis.)

For the extraction of a splinter or necrosed fragment of the maxillary bone, the same instruments must be used which serve for the extraction of dental roots; but also a pair of forceps may be used (Figs. 50 and 51).

It will be necessary to grip with them the osseous fragment firmly, so that it cannot escape whilst it is being extracted. The part shall then be medicated with fitting remedies.

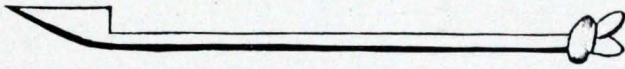
Whenever it is thought proper, the bone must be scraped and all the diseased part of it removed.

When a tooth is irregularly placed, or projects above the level of the others,¹ a deformity ensues which is particularly displeasing in women. The way of correcting this varies according to the nature of the case.

¹ Lib. ii, cap. xxxii, p. 193.

It consists sometimes in the simple extraction of the misplaced tooth. But when there exists an intimate (osseous) union of the irregular tooth with another one, it is necessary to operate for the resection of the former with an instrument of the following shape, that is, like a small axe:

FIG. 49



An instrument like a small axe, for resecting irregularly situated teeth (Abulcasis).

The operation must be performed in many days, not only on account of the hardness of the tooth, but also in order not to shake any of the neighboring teeth.

In other cases, the deformity, consisting in one tooth projecting above the level of the others, may be corrected with a saw.

The instrument must be made entirely of Indian iron, and the operation, like the preceding one, is to be carried out in several days, that the fall of the tooth may not be provoked by excessive shaking. The file (Fig. 55), too, must be used to destroy the edges and points of broken teeth, that they may not injure the tongue, or give any trouble in speaking.

FIG. 50

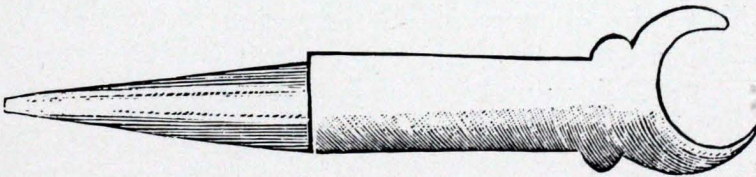
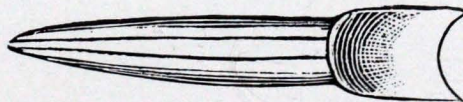


FIG. 51



Forceps for extraction of splinter or necrosed fragments of the maxillary bones (Abulcasis).

When, in consequence of a blow or fall, one or more teeth have become loose so that the patient cannot bite his food with them, if the use of styptic remedies has been found of no use, it will be necessary to bind and make such teeth firm by a gold or silver wire. Gold is to be preferred as being unalterable, whilst silver in a few days turns green. Having chosen, therefore, a suitable gold wire of perfectly uniform consistency, it must be passed at its middle part between two firm teeth, that is between the two nearest on one side to the loosened tooth or teeth; then, by binding tightly around the sound tooth and each of the loosened teeth the two

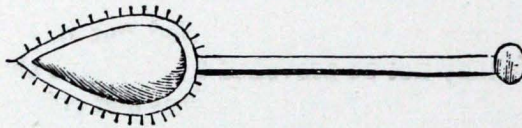
lengths of the wire and crossing them in the dental interstices so as to form a kind of network, the sound and firm tooth of the opposite side will be reached, and this too must be wound around in a mesh, as it were, of the said network. Then, turning back, the same operation must be repeated, but inversely, until the point of departure is reached. All this must be done with much skill, so as to render the loose teeth completely unmovable. When the wire is tied, this must be done near the dental roots, so that the knot may not get untied; then with a pair of

FIG. 52



A dental saw (Abulcasis).

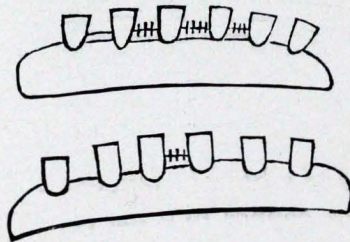
FIG. 53



Another dental saw (Abulcasis).

scissors the remaining part must be cut off and its two ends joined and twisted with a pair of pincers, hiding them between the sound tooth and the neighboring loose one. Such a ligature should remain in place during a whole lifetime; and in case it should come undone or the wire should break, it will be necessary to renew the operation. The following figure represents the ligature described:

FIG. 54



Ligation for steadying teeth in cases of blow or fall (Abulcasis).

"Sometimes, when one or two teeth have fallen out, they are replaced in the sockets and bound in the aforesaid manner and remain there. The operation must be carried out with great delicacy and ability, by skilful hands."

As may be seen from the above quotation, in the days of Abulcasis

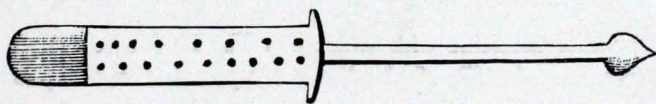
replanting was already performed, although it is probable that the ligature was then left permanently.

The author says, next, that the vacancy left by fallen teeth can be filled up with artificial ones, made of ox bone, they also being fixed in the manner above described; and he adds that they will be found not only of advantage from the esthetic but also from the functional point of view.

Speaking of the cure of the ranula,¹ Abulcasis says that when the tumor, examined by the clear light of the sun, appears brown or black, hard and insensible, it is not to be operated, it being then of a cancerous nature. If, instead, it is whitish and full of liquid, it must be seized with a hook, and by means of a fine scalpel extirpated. The hemorrhage must be combated with powdered blue vitriol. After the operation mouth washes must be used of vinegar and salt.

In cases of fracture of the lower jaw² it is not only necessary to cure the fracture itself according to the rules which the author prescribes for the various cases, but it is also necessary to pay attention to the teeth and with a gold or silver wire, or a silk thread, to tie, in the manner already described, those teeth which in consequence of the wound have become loose, but the consolidation of which may be hoped for.

FIG. 55



A dental file (Abulcasis).

MESUE THE YOUNGER, a disciple of Avicenna, is of opinion that when a tooth is the seat of violent pain, this may easily propagate itself to the other teeth; and therefore advises, if the pain does not soon cease, to extract the tooth affected, without delay. This operation, however, must not be performed, says the author, whilst the pain is at its height, but rather when it is somewhat lessened, otherwise, the extraction of the tooth may result in a syncope sometimes ending in death, or else be the cause of intense inflammation and of suppuration, which, also, may, in certain cases, place the patient's life in danger. He recommends an infinite number of remedies against odontalgia; in these, however, there is nothing new to us. As to the removal of a tooth, this may be obtained in three different ways, that is, with the forceps, with eradicating remedies, or by cauterization. In order to cause a tooth to fall out by the use of acrid, eradicating substances, the author advises to proceed in the following manner: The tooth is first freed, by means of a scalpel, from the surrounding gum; the eradicating remedy is next applied to the root of

¹ Lib. ii, cap. xxxv, p. 197.

² Lib. iii, cap. iv, p. 545.

the tooth, every needful precaution, however, being taken that it may not injure the neighboring teeth. Cauterization, when practised to produce the exfoliation of a diseased tooth, may be performed, according to Mesue, either with a small red-hot iron, passed through a little metal tube in order to protect the neighboring parts, or with the heated kernel of a nut, or with a grain of burning incense.¹

To cure a dental fistula, Mesue cauterized it to the very bottom with a cautery in the form of a probe, or extracted the tooth, which by reason of its diseased root was the cause of the fistula; and when the bone was likewise affected, he laid bare the carious part, which he then scraped.²

¹ [In connection with the practice of applying medicines to the teeth or upon the gums, with the object of rendering the operation of tooth extraction less difficult, the use of arsenical compounds as an ingredient of these topical applications is of peculiar interest. In an Italian translation of the writings of Johannes Mesue, published at Venice in 1521, the following interesting reference to the use of arsenic appears:

"The son of Zachariah Arazi compounds a medicine to assist the extraction of the teeth. R—Pyrethrum, colquintida root and the bark of the mulberry root, the seed and leaves of almezeron, huruc, and yellow arsenic, milk of alscebram or pieces of it, ground very thoroughly with vinegar; then pour some of it over bdellium and halasce, of each, equal parts, dry and dissolve in strong vinegar and make trochisi of it, and with them anoint the roots of the tooth from hour to hour; this facilitates the extraction of it.

"There is also another medicine with which one fills the decayed tooth and breaks it: R—Seeds of almezereon and milk of alscebram compounded with liquid pitch, and fill with it the decayed tooth. Another one: R—Bauras, bark of the willow, of each, one part; yellow arsenic, two parts; compound with honey and place it upon and around the tooth and immediately extract it.

"The fat of the green frog which lives upon the trees breaks teeth which are anointed with it the same as when you anoint them with milk of alscebram or titimallo, and similarly also the milk of celso with yellow arsenic."

In this connection it is also interesting to note that the ancient Arabian medical writers referred to the red sulphide of arsenic or realgar as sandarach. The term Sandarach was clearly used by these writers to designate two different medicaments—one the gum-vernix, exudate of the Juniper tree, and which we now know as Sandarach gum. They also apply the term to red arsenic, as above stated. Avicenna clearly distinguishes between the two kinds of Sandarach, and says with regard to the gum-vernix or Juniper Sandarach that it is the best of all known remedies for toothache. While, as shown by Dr. Guerini, many of the medicaments used as topical applications to facilitate the extraction of teeth were wholly without any possible effect of that character, it cannot be doubted that the application of arsenical preparations, such as those referred to by Mesue, could not fail to set up an arsenical necrosis about the roots of the tooth, rendering it loose and easy of removal, but necessarily with the disadvantage of producing a dangerously extensive necrosis of the tissues.

Mesue Vulgar.—Impresso in Venitia per Cesaro Arrivabeno Venitiano a di vinti octubrio, mille cinquecento e vintiuno.

Delle Medicini Particulare, Libro Quarto, Capitolo XLI.—E. C. K.]

² Joannis Mesue opera, Venetiis, 1562.

AVENZOAR. The last of the great Arabian physicians was Avenzoar. He was born at Peñaflor, near Seville, in 1070 and died in 1162. He became famous by his very valuable work on medicine, entitled the *Teisir*. It is strange, however, that in this book there is hardly anything about the treatment of dental diseases. Against caries and looseness of the teeth the author limits himself to recommending bloodletting either from the ranine or the basilic vein. Apart from this, he speaks neither of operations nor of remedies for diseases of the teeth.¹ Probably at the time in which Avenzoar wrote, that is, in the first half of the twelfth century, doctors in general did not occupy themselves with the curing of teeth at all, this being abandoned entirely to barbers and other persons. This would sufficiently explain why this author is so silent in regard to dental diseases.

But what can have been the reason for doctors refusing thus contemptuously to occupy themselves with so important a branch of therapeutics? In every age there have been a great number of ignorant persons, who either in good faith, or else for imposture, have practised, within a more or less limited circle, the art of healing, usually dedicating themselves to some particular class of diseases. Even in our days, notwithstanding the superabundance of duly qualified doctors, there is, especially in certain countries, no small number of quacks, secretists, bone-setters, chiropodists, and the like. It is, therefore, not to be wondered at that in times when dentistry was still in its infancy there should have been persons more or less ignorant who undertook tooth drawing and the concoction and sale of specifics against odontalgia. The doctors, on their part, under the pretext of being unwilling to have anything to do with these individuals, found it very convenient to dispense with the cure of dental diseases and with the extraction of teeth, this operation being sometimes too difficult for them, on account of their want of practice, besides being almost always very painful, and considered, even from the most ancient times, capable of eventually producing evil consequences, among which, in some cases, even the death of the patient.

But perhaps this was not the only reason for the fact above mentioned. In the middle ages the extraction of one or more teeth was some times inflicted as a punishment; for example, for having eaten flesh during Lent,² or on those found guilty of felony, for having refused to contribute sums of money demanded from them by their liege lord. Now, as this punishment was carried out on the guilty ones by the executors of public justice, it is only natural that doctors should have refused to practise an operation which would have degraded their profession by bringing it down nearly to the class of the hangman.

¹ Sprengel, *Geschichte der Chirurgie*, Part II, p. 279.

² Linderer, *Handbuch der Zahnheilkunde*, Berlin, 1848, ii, 403.

CHAPTER IX.

THIRTEENTH TO FIFTEENTH CENTURIES.

BRUNO OF LONGOBUCCO. After the Arabian period, the first author whom we must mention is Bruno of Longobucco, of the school of Bologna, who lived in the thirteenth century and wrote a treatise on surgery, which gave him a certain renown.¹ This book, however, contains but little about diseases of the teeth. The author shows himself a great friend of the actual cautery, and advises its use in the cure of dental caries and of various diseases of the gums. He says nothing about the extraction of teeth; instead, he recommends, as a means for making a diseased tooth fall out, that the milky juice of the tithymal be applied around its root after having been reduced to the consistency of paste by the addition of flour.²

LANFRANCHI, of Milan, another writer of the thirteenth century, who acquired great fame by his book *Chirurgia magna et parva*—partially translated into German, more than two centuries later, by Otto Brunfels—also shows himself very timid in the sphere of dentistry, and to combat dental pains he recommends, by preference, the use of narcotics. He is not at all favorable to the extraction of teeth; and especially that of the molars is considered by him a very dangerous operation.³

TEODORICO BORGOGNONI (1205 to 1298), known also under the name of Teodorico of Cervia, is according to Hæsar the first author who made mention of sialorrhea following mercurial frictions. Worthy of note, too, is what he says in regard to fistulas of the gums, or, in general, of the maxillary region. He advises that in every case of this kind special attention be paid to the state of the dental roots; when there is a discharge of ichorous pus, the roots are certainly affected; and then the diseased teeth must all be extracted as soon as possible.⁴

JOHN GADDESSEN, an English doctor who flourished at Oxford in the first half of the fourteenth century, wrote a very curious medical book, taken the greater part from Pliny and the Arabian writers and entitled *Rosa anglica: practica medicinæ a capite ad pedes* (English rose: the practice of medicine from head to foot). In his time many strange methods of cure were in use, sometimes simply ridiculous, and others even filthy;

¹ Bruni *Chirurgia magna*.

² Sprengel, *Geschichte der Chirurgie*, Part II, p. 280.

³ Sprengel, loc. cit.

⁴ Sprengel, loc. cit.

and the *Rosa anglica* furnishes us with not few examples. In order to make a tooth fall, Gaddesden advises the application of dried crow's dung reduced to powder, or else to annoint it with the fat of a green frog. This last means would be quite infallible and would make the tooth fall out on the spot. It had such power that if peradventure an ox in grazing chews a little frog with the grass, its teeth will all fall out on the instant! We do not know whether the author himself believed in the marvellous virtues of the fat of green frogs. It is certain, however, that he enumerates this among his "secrets," and says that he has gained much money from it through the mediation of the barbers.

Other absurdities of the same kind are the following: The brain of the hare can, by being rubbed on the gums and jaws, serve for two important purposes, since it has not only the virtue of facilitating dentition, but also of making teeth grow again to those who have lost them! The brain of a partridge applied to a carious tooth makes it fall in pieces!

The treatment of odontalgia embraces, according to Gaddesden, both general and special means of cure. To the former belong purgatives, bloodletting, scarifications of the labial and sublingual mucous membrane, leeches, the application of scarified cuppings under the chin. The special means of cure are represented by a great number of plasters, powders, and ointments, in the composition of which almost constantly hyoscyamus and pyrethrum take part. When odontalgia depends on caries, the author advises, among other things, the use of a red-hot iron. Against the supposed worms of carious teeth he counsels fumigations with the burnt seeds of hyoscyamus or of leeks. In cases of dental fistulas, it is necessary to cauterize the fistulous tract, to extract the diseased tooth, and if the bone be also affected, to scrape it. To clean the teeth: Gaddesden recommends several dentifrices; some of which are composed of pulverized cuttle bone, either with addition of meer-schaum, pumice stone, burnt hartshorn, in different proportions and combinations, or used quite alone; others are made with myrrh and alum.

Since Gaddesden affirms the existence of means capable of promoting the fall of any tooth, we should suppose that he says nothing about instrumental extraction, or at least that he considers it entirely useless; for if in order to make a tooth fall out, it be sufficient to smear it with frog's fat, why should there ever be any need to have recourse to the very painful extraction by means of the forceps?

However, this is not so; the author treats of instrumental extraction as a very important operation, without being at all afraid of being reproved for contradicting himself. Besides, to anyone who thus reproved him he perhaps would have answered, without being disconcerted, that it is not always possible to have the fat of frogs or the dung of crows in readiness.

The extraction of a tooth is only justifiable, says Gaddesden, when all the remedies employed against odontalgia have proved useless and when, on the other hand, the pain has its seat in the tooth itself and not in the nerves or gums. Before undertaking the operation, however, the patient must be prepared for it with an evacuant cure, that is, by injections and purgatives. For the operation itself the author recommends the same rules given by Celsus, and says, besides, that the head of the patient ought to be held firm by an assistant. In certain cases, the extraction can be performed, better than with the forceps, by means of an instrument in the form of a lever, broad at one end, narrow and sharpened at the other. But when a tooth is very firmly seated, its extraction is always dangerous; therefore, in such a case, Gaddesden recommends, before having recourse to the operation, the use either of acrid substances, such as the milky juice of the euphorbiaceæ (for example, of the tithymal), or else of a red-hot iron; and this, for the purpose of promoting the fall of the tooth, or of rendering it, at least, so far movable that it can be extracted without any difficulty.

GUY DE CHAULIAC, the greatest surgeon of the middle ages, was born about 1300, in a little village on the confines of Auvergne, which still preserves the name of Chaulhac; he died in 1368. This author immortalized his name by a work which even up to the eighteenth century was, as it were, the official code for the teaching of surgery. Guy wrote his *Chirurgia magna* in barbarous Latin—such as was then used by the learned; but his book was soon translated into French, Provençal, and afterward also into Italian, English, Dutch, and Hebrew. E. Nicaise, who, in 1890, gave to the scientific world a very valuable new edition of Guy de Chauliac,¹ and who made very accurate researches on all that regards this author and his work, has succeeded in finding in the libraries of Europe and America as many as thirty-four manuscript copies of the *High Surger*.² The survival of so many copies, in spite of all the destructive agencies which have been in action during more than 500 years, is a very clear proof of the wide diffusion which this work obtained even before the invention of printing.

Guy's work was printed for the first time in 1478, and the editions that have been published since then in various countries are in all about 130.

This book is very important for our subject, since we may gather from it very clearly the condition of dentistry in the fourteenth century; but, on the other hand, we see from it, with equal clearness, that this branch

¹ La Grande Chirurgie de Guy de Chauliac, chirurgien maistre en médecine de l'Université de Montpellier, composée en l'an 1363, revue et collationnée sur les manuscrits et imprimés latins et français par E. Nicaise, 1890.

² Of these copies, twenty-two are written in Latin, four in French, two in Provençal, three in English, one in Netherlandish (Dutch), one in Italian, and one in Hebrew.

of the healing art had not made any progress from the time of Abulcasis to that of Guy de Chauliac (about two centuries and one-half), and that this most famous surgeon did not contribute anything worthy of note to the development of dentistry.

On the anatomy and physiology of the teeth Guy de Chauliac expresses himself very briefly: "Teeth are of the nature of bones, although they are possessed of sensibility, due to some nerves which the third pair sends to their roots. The number of these latter may vary from one to four, according to the different teeth. The uses of these organs are well known."¹

Worthy of being recorded are the names which Guy gives to the different kinds of teeth. After having said that these latter are generally thirty-two, but sometimes only twenty-eight, he adds, that the sixteen teeth of each jaw are divided into: *deux duelles*, *deux quadruples*, *deux canines*, *huit maschelières*² et *deux caisseaux* (in the barbarous Latin: *duo duales*, *duo quadrupli*, *duo canini*, *octo molares* et *duo caysales*). So that the two middle incisors were then called *duales*; the lateral incisors were called *quadrupli*, because, together with the middle ones, they formed a series of four teeth. Guy gives the name of *caysales* (*caisseaux*) to the last two molars; but Joubert, one of the translators and commentators of Guy de Chauliac, tells us that the molars in general were called in Languedoc *caisseaux*: "Les cinq molaires sont appelées en Languedoc *caisseaux*, parce qu'elles servent à casser les choses dures, comme les noix et semblables." In regard to the canines of the upper jaw, we learn that they were called *oeillères* (eye teeth), because their root was believed to reach near the eye.³

According to Guy de Chauliac, *les dents sont engendrées non seulement en l'enfance, ains aux autres ages*.⁴ And this passage was commented by Joubert in the following note, which we reproduce textually:

"En Languedoc, près de Pezenas y a une gentil femme, nommé Mademoiselle de Lobatiere, dès long temps vieille édentée, à laquelle (comme tesmoignent beaucoup de gens très-dignes de foy) environ l'an 70 de son age, sont sorties cinq ou six dents nouvelles. Le conciliateur tesmoigne avoir veu, à qui les dents perdues devant l'an 60 ont été derechef engendrées, moindre toutes fois que les premières et plus foibles."⁵ (In Languedoc, near Pezenas, there is a lady named Mademoiselle de Lobatiere, who having been for a long time old and toothless (according to

¹ Nicaise, *La Grande Chirurgie de Guy de Chauliac*, Second Chapitre: De l'Anatomie de la face et de ses parties, p. 47.

² Here, as elsewhere, is preserved the old orthography of the text.

³ Nicaise, p. 711.

⁴ Teeth may be produced not only in infancy, but also at a later age.

⁵ Nicaise, p. 205.

the testimony of persons well worthy of belief), at about the age of seventy got five or six new teeth. The Conciliator¹ testifies to having seen teeth grow anew—smaller, however, and weaker than the first—in persons who had lost them before the age of sixty years).

In regard to the pathology and therapy of the teeth, Guy but rarely abandons the footsteps of the Arabian writers. Following the example of one of these, Ali Abbas, he admits five or six dental maladies: pain, corrosion, congelation, and *agacement* (teeth set on edge), limosity or fetidness, fall or loosening.² As to the cure, this is divided into universal and particular. The former includes, before all, hygienic rules, and then purgatives, bloodletting of the cephalic vein or the veins of the lips or tongue, revulsion, obtained by means of cupping glasses, friction, etc., and the remedies for curing the rheums of the head, or for throwing out the phlegmatic humors (pyrethrum, mastic, and the like).

The hygienic rules are the following: Not to eat food apt to putrefy, such as fish and milk foods; to avoid food or drink either too hot or too cold, and especially the rapid succession of cold and hot, or *vice versa*; not to bite hard things, nor to eat viscous food, such as figs and confectionery made with honey; to avoid certain foods which are known to be bad for the teeth, such as leeks; not to clean the teeth too roughly, but to rub them with honey and burnt salt, to which, very advantageously, may be added some vinegar.

Before speaking of the special methods of cure of single dental affections, Guy observes that operations on the teeth are *particular* (proper) to barbers and to "dentatores,"³ to whom doctors have abandoned them. But it is safest of all, says he, to have such operations performed under the direction of doctors. These, however, to be in a position to give advice in regard to diseases of the teeth, must know the various methods of cure which are suited to these diseases, that is to say, mouth washes, gargles, masticatories, fillings, evaporations, anointments, rubbings, fumigations, cauterizations, sternutatories, instillations into the ears, and manual operations.

Lastly, Guy notes that the "*dentator*"⁴ must be provided with all the appropriate instruments, that is, with "*rasoirs, rapes, spatumes, droits et courbes, eslevatoires simples et à deux branches, tenailles dentelées, et diverses esprouvettes, cannules, deschaussours, tarières, aussi des limes, et plusieurs autres nécessaires a cette besogne*" (in Latin: *rasoriis, raspatoriis, et spatuminibus rectis et curvis, et levatoriis simplicibus*

¹ Pietro of Albano (1250 to 1316), the writer of many books, among which one bearing the title of *Conciliator differentiorum philosophorum et præcipue medicorum*, is often quoted by Guy de Chauliac and by many others under the name of Conciliator.

² Nicaise, p. 505.

³ *Appropriatæ barbitonsoribus et dentatoribus.*

⁴ In one Latin manuscript of 1461 instead of *dentator* we already find the word *dentista*.

et cum duobus ramis, tenaculis dentatis, et probis diversis, cannulis, scalpis et terebellis, et etiam limis."¹

Whilst Abulcasis bitterly declaims against the barbers, because they, in spite of their ignorance, permit themselves to perform operations on the teeth, and especially to extract them, Guy de Chauliac speaks in quite a different tone. He recognizes that such operations are *particular*, which is as much as to say, in modern language, that the practice of dental surgery constitutes a *specialty*. Guy, it is true, expresses his desire that dental operations be performed, for greater security, under the direction of doctors, but he does not use one word of blame or contempt against the *dentatores*, thus leaving it to be understood that, according to him, their art had every good reason to exist. Besides, from the enumeration of the surgical instruments which Guy says are necessary to them, we can easily argue that the *dentatores* of the fourteenth century were not, as at the very first one might be led to believe, mere "tooth-pullers," but that, at least, the best among them cured teeth as well as the scanty knowledge and means of cure then available enabled them to do.

In the chapter on odontalgia,² Guy de Chauliac distinguishes between the pains, the point of departure of which is in the tooth itself, and those resulting from disease in other parts, for example, from apostema³ of the gums; in these latter cases, in order to cause the pain to cease, it is necessary to cure the part from which the pain is derived, taking into account the nature of the disease and its causes.

When the pain is situated in the root of the tooth or in its nerve, it is necessary, says the author, to distinguish whether it is caused by an accumulation of morbid matter, or whether it is, instead, a simple pain *without matter*. Besides, it is necessary to distinguish, in the first case,

¹ Nicaise, p. 506. To make clear the meaning of these names, the following must be noted: The *rasoirs* (*rasoria*) were instruments with one cutting edge alone, which were used in performing any kind of incision. *Raspatoria* (*râpes*, *i. e.*, rasps) signified almost certainly scrapers, not rasps. The *spatumes* were instruments with one or two cutting edges, of various shapes, but usually small. *Esprouvettes* (Latin, *probæ*) were the sounds or probes. *Scalpra* means scalpels, but in this case has especially the meaning of *déchaussoirs*, gum lancets. *Terebelli* (French, *Tarières*) are the trepans or perforators.

² Nicaise, p. 507.

³ By the word *apostema*, Guy de Chauliac, and many other writers, indicate every pathological condition in which the normal elements of the tissues are separated from one another, by a humorous or gaseous gathering, or by any phlogistic or neoplastic formation. The word signifies, in Greek, *removal*, just like the Latin word *abscessus*. In fact, these two terms were often used as synonyms; but at other times the word *apostema* had a wider meaning, and included, besides the abscess, the phlegmon, the furunculus, the anthrax, erysipelas, herpes, and other dermal affections, especially the pustulous ones, edema and other serous gatherings, subcutaneous emphysema and other gaseous gatherings, glandular tumefactions, cysts, benignant and malignant tumors.

whether the matter producing the pain is hot, cold, or windy; and also, in the second case, it is necessary to ascertain if the pain is of a warm, cold, dry, or humid nature. As may be seen, the principles and subtle distinctions of the pneumatic school were then in full vigor.

The treatment must vary according to all the aforesaid cases; but the means of cure advised by Guy de Chauliac do not present any special interest, as they are almost entirely taken from Galen and from the Arabian authors, and especially from Rhazes, Ali Abbas, and Avicenna.

On coming to speak of the looseness of teeth,¹ Guy says that this may depend on various causes: that is, on a fall or a blow; on humidity, which softens the nerve and ligament;² on dryness and lack of nourishment of the teeth; and lastly, on corrosion of the gums.

The looseness of teeth, which depends on dryness or want of nutrition, as in the old and in consumptive people, is incurable. In other kinds of looseness, astringents are useful; but it is also well that the patient should speak but little, that he should not touch or move the loose tooth, nor use it in masticating. In cases of corrosion of the gums, this disease must be cured.

If looseness of the teeth follows a blow, it is well, first of all, to let blood, and then to use astringents and excitants. When all this is of no avail, Guy advises that the loose teeth be tied to the healthy ones with a little gold chain,³ after the manner of Abulcasis. And if, says he, the teeth fall out, they may be replaced with teeth of another person, or with artificial teeth of ox bone, fixing them in their place with a fine ligature; and, he adds, that such teeth are serviceable for a long time. Here are the precise words of the text: "Et si les dents tombent, qu'on y mette des dents d'un autre, ou qu'on en forge d'os de vache, et soient lisez finement, et on s'en sert long-temps."

This extremely concise manner of treating dental prosthesis, summing all up in some thirty words, is in strong contrast with the usual fulness of explanation and methodical accuracy of Guy de Chauliac, to whom, very justly, could be given the title of founder of didactical surgery. Such a strange contrast cannot be explained, unless by admitting that Guy considered dental prosthesis as foreign to the general plan of his book, that is, as something which did not directly concern surgeons, and for which, therefore, a mere allusion ought to be sufficient. Without the

¹ De la dent esbranlée et affoiblie, Nicaise, p. 509.

² "De l'humidité qui amollit le nerf et le ligament."

³ Evidently the author speaks of a "little gold chain," because, as he is not versed in the practice of dentistry, he does not know that it was a simple gold wire which was used for keeping loose teeth firm. A small chain as thin as a thread could not be possibly made, and would even then be excessively weak.

slightest doubt, dental prosthesis was practised neither by doctors nor surgeons, but by the *dentatores*.

Abulcasis, too, certainly for the same reason, is extremely brief in speaking of artificial teeth, but, on the other hand, he very minutely describes the process of ligating loose teeth. Guy omits this description entirely, and only alludes briefly to this therapeutic practice. From this it is easy to perceive that whilst Abulcasis considered this operation within the province of surgeons, Guy de Chauliac was disposed to exclude it from the field of general surgery, considering that this, too, like the other dental operations, belonged to the *dentatores*. In his days, in short, dentistry had become much more clearly specialized than it was in the days of Abulcasis.

After having spoken of the looseness of teeth, Guy de Chauliac goes on to treat of caries, in a short chapter, entitled "De la Pourriture, des vers, de corrosion et pertuifement des dents."

The method of cure, he says, is double, viz., universal and particular. The general treatment embraces the hygienic and therapeutic means already mentioned. As to the particular or local treatment, it consists, first of all, in washing the teeth with aqua vitæ or with a vinous decoction of mint, salvia, melissa, pepper, or pyrethrum. Then it is necessary to fill the carious cavity with gallia¹ and root of cyperus,² mastich, myrrh, sulphur, and camphor, wax, ammoniacum, asafetida and the like. As may be seen, Guy does no more than mention the substances used in his days for the filling of carious teeth, and does not tell us what various combinations were formed with the said materials, nor the proportions in which they were used. In short, he does not give us any formula for the composition of a filling mass, and from this may be inferred, without fear of error, that this operation also was never performed by him, consequently it, too, was not practised by doctors and surgeons, but rather by the *dentatores*.

When the aforesaid means of cure—that is, the mouth washes and the filling—are of no use, Guy advises the margins of the carious cavity being taken away with a scalpel and file, so that alimentary substances may not be retained inside it. However, here are his words, which seem especially to refer to cases of interstitial caries:

"Si ces choses n'y valent rien, la dent soit esbuschaillee avec un ciseau et lime,³ e qu'on luy fasse un passage, à ce que la viande ne s'arreste

¹ This name was first given to medicaments containing gall-nuts, then, by extension, also to compound remedies not containing such substance, and to which was given the name of *alip̄tæ*, v. Nicaise, p. 677.

² According to Nicaise, the *Cyperus esculentus* (in French, "souchet") is here referred to.

³ In the Latin text: *Buccelletur cum scalpro et lima*.

au trou." If advantage is not even derived from such an operation, recourse must be had to cauterization, or, if necessary, to extraction.

Even Guy de Chauliac believes in the worms of the teeth, and against these he recommends the usual fumigations. He advises that the seeds of leek, onion, and hyoscyamus be mixed with goat's tallow and made into pills of a dram each in weight, one of which is to be used for each fumigation: "Si dans le trou il y a un ver, apres le susdit lavement,¹ la dent soit suffumiguée avec une graine de porreau et d'oignon et semence d'hyosciamé, confits avec suif de bouc; et qu'on en fasse des pilules chacune d'une drachme et qu'on y en employe une à chaque fois."

In the following chapter Guy treats "De la limosité et laide couleur des dents." Here, too, he recommends, before all, the general hygienic rules above mentioned. Besides, he advises the mouth being rinsed with a vinous decoction of wild mint and of pepper, and then the use of the following dentifrice:

"℞—Cuttle-bone, small white seashells, pumice stone, burnt stag's horn, nitre, alum, rock salt, burnt roots of iris, aristolochia, and reeds. All these substances must be reduced to powder together, or each one separately." Use may also be made of a liquid dentifrice thus prepared:

"℞—Sal ammoniac and rock salt, half a pound of each; saccharine alum, one-quarter of a pound. These to be reduced to a powder and placed in an alembic of glass, so as to obtain a liquid, with which the teeth must be rubbed by means of a little scarlet cloth."

If these means of cure are of no avail, on account of the presence of hardened limosity (tartar), this must be removed by scraping it away with appropriate instruments. "Et si cela ne profite, à cause qu'il y a là des limosites endurcies; soient rasclées avec des rapes et spatumes."²

Against the setting of teeth on edge (*endormement et congelation des dents; stupor et congelatio dentium*), Guy de Chauliac recommends hot wine or aqua vitæ, to be kept in the mouth; or the teeth to be rubbed with roasted salt; or the application to them of hot roasted walnuts and filberts and similar things which convey heat; or lastly, masticating substances, which possess heating properties, such as the portulaca (purslane) and its seeds.

The chapter on the extraction of teeth and of dental roots is a simple summary of what Abulcasis says on this subject; some passages of this author are copied word for word.

Whilst the Arabian surgeon treats rather lengthily of the deformities of the dental arches, and the methods to be employed in correcting these,

¹ Here lavement means mouth wash, not injection.

² Cum raspatoriis et spatuminibus radantur.

Guy de Chauliac almost entirely neglects this subject and limits himself to saying that if any tooth has become abnormally lengthened, it is necessary to reduce it to the right length with the file, but operating "wisely," so as not to loosen it:

"S'il y a quelque dent augmentée outre nature, soit égalisée et applanie sagement avec la lime, que ne soit ébranlée."

Guy strongly throws doubt upon the efficacy of supposed eradicating remedies. In regard to this he says: "The ancients mention many medicaments, which draw out the teeth without iron instruments or which make them more easy to draw out; such as the milky juice of the tithymal with pyrethrum, the roots of the mulberry and caper, citrine arsenic, aqua fortis, the fat of forest frogs. But these remedies promise much and operate but little—*mais ils donnent beaucoup de promesses, et peu d'operations.*"

From the book of Guy de Chauliac we can gather a very important fact, which is worth mentioning here; that is to say, that some surgeons of that period made use already of anesthetic inhalations, especially for amputations. Here is what Guy says:¹

"Some prescribe medicaments which send the patient to sleep, so that the incision may not be felt, such as opium, the juice of the morel,² hyoscyamus, mandrake, ivy, hemlock, lettuce. A new sponge is soaked by them in these juices and left to dry in the sun; and when they have need of it they put this sponge into warm water and then hold it under the nostrils of the patient until he goes to sleep. Then they perform the operation."

It seems that the narcosis thus obtained was sufficiently intense, since Guy also speaks of the means used to awaken the patient. These consisted in applying another sponge, soaked in vinegar, under the nose, or in dropping into the nostrils and ears the juice of rue or fennel.

Guy lets us know that other surgeons made the patients go to sleep by giving them opium to drink; but he decidedly disapproves of such a practice, as he has heard of patients who through this have died.

VALESCUS OF TARANTA (called by the French authors Valescon or Balescon de Tarente or Tharare), professor at the University of Montpellier at the beginning of the fifteenth century, wrote a valuable treatise on medicine and surgery, entitled *Philonium pharmaceuticum et chirurgicum, de medendis omnibus humani corporis affectibus*. As to the diseases of the teeth, he especially follows Guy de Chauliac, but treats the

¹ Treatise vi, doctrine i, chap. viii: "Des membres qu'il faut amputer," etc., Nicaise, p. 435.

² According to Joubert several solanaceæ had this name, among others *Solanum nigrum* and *Solanum somniferum* (*Physalis somnifera* L.), which probably corresponds to the *Strychnos hypnoticus* of Dioscorides.

subject at greater length, profiting by what has been written on the subject by all the ancient writers, and especially the Arabians.

Among the many remedies which he recommends against toothache, here are some:

“R_y—Wild mint, pyrethrum, white pepper, myrrh, two drams of each; let these be pulverized and made into a paste with the pulp of raisins or with white wax and with some turpentine; and let this mass be divided into small balls as large as filberts, of which one must be masticated at a time, with the aching teeth.”¹

Another masticatory is composed of origanum, pyrethrum, cinnamon, and ginger, made into a paste with the yolk of an egg cooked under the coals.

To calm dental pains, the vapors of a decoction of wild lavender, marjoram, rue, chamelea, and melilot are often efficacious. As to fumigations, they can be made not only with vegetable substances (onion or mustard seed, rue, etc.), but also by burning scrapings of the hoof of an ass. The fumes may be made to reach the aching tooth, by means of a funnel. Here are the words of the author: “Fiant suffitus ex rasura ungulæ asini, et fumus recipiatur per infundibulum.”

Decayed teeth may be filled, according to Valescus, to satisfy four different indications: To calm or prevent pain, to prevent any further spreading of the caries, to kill the worms, and to sweeten the breath. He advises that the carious cavities should be filled up with powdered nigella, pepper, myrrh, salt, and theriac; or else with pyrethrum, gum ammoniac, and opium; or else with celery seeds pulverized, opium, and hyoscyamus; or with the cast-off skin of serpents boiled in vinegar; or with gallia and cyperus. The filling with these last two substances are especially suitable, according to the author, to preserve the teeth from further spreading of the caries: “Si gallia et cyperus cavis dentibus applicentur, dentes ulterius non corrodentur.”

To kill the supposed worms of the teeth, Valescus counsels three different methods, of which the first consists of the usual fumigations with seeds of hyoscyamus, onion, leek, colocintida; the second consists in filling the carious cavity with a mixture of myrrh and aloes; and lastly, the third, in applying inside the cavity the milky juice of the tithymal, or the juice of the persicaria.²

In regard to tartar of the teeth—which he calls *materia lapidea*, i. e., stony substance—Valescus says that it must be removed little by little, either with iron instruments or with dentifrices partly cleansing and partly

¹ Valesci Philonium, etc.; Francofurti MDXCIX, cap. lxiv, De dolore dentium, p. 195 et seq.

² Plant belonging to the order of the Polygonaceæ.

styptic. After the tartar has been removed, it is necessary to wash the teeth often with white wine and to rub them with roasted salt.¹

Valescus, too, like the majority of ancient writers, is not at all favorable to the extraction of teeth. He says that recourse must not be had to this operation except when a tooth is the cause of most violent pain and every remedy has been of no avail. But the reasons which he gives in support of this opinion are very plausible; and whilst most of the authors who preceded him showed themselves adverse to extraction, because they considered it dangerous, he does not allude in the least to such dangers, but wishes extraction to be avoided, if possible, "because the teeth, even when they are in some parts corroded, yet nevertheless, after the pain is calmed, aid mastication and besides render the others firmer."²

This author agrees with Galen in considering the teeth as bones, but he is of opinion that they differ from the other bones in more than one respect; that is, first of all, on account of their sensibility; secondly, because, whilst the other bones are formed in the uterus, the teeth are formed outside the uterus; and lastly, for a reason which cannot but appear very strange to us, that is: "The bones are produced by the sperm and menstrual blood, whilst the teeth are produced by the blood in which there has remained the virtue of the sperm."³ This passage gives us an idea of the state of embryological knowledge of those days!

PIETRO OF ARGELATA (or of La Cerlata), professor of surgery at Bologna (died in 1433), wrote a treatise on surgery in six books, in which diseases of the teeth are also taken into serious consideration. He speaks of a great number of dental instruments, which, however, are the same as those enumerated by Guy de Chauliac. His methods of cure do not offer anything very new, being for the most part identical with those of Avicenna and Abulcasis. He considers cleanliness of the teeth of the greatest importance; shows what great injury is done by dental tartar—which by him is considered a very important sign of the bad state of the teeth—he counsels the removal of it by means of scrapers, files, or the use of strong dentifrice powders; and to make the teeth white, he even advises the use of aqua fortis.

He says nothing in regard to the filling of decayed teeth; he, however, counsels the cleansing of the carious cavities with aqua fortis, or even,

¹ "Materia lapidea paullatim abradatur ferro et dentifriciis partim mundificativis, et partim stypticis. Deinde colluantur dentes sæpe vino albo, et fricentur sale torrefacto." Cap. lxxvii, *De colore dentium præter naturam*, p. 202.

² "Quoniam, licet ex parte corrosi sint, attamen dolore sedato masticationem iuvant, et alios firmiores reddunt." Appendices, p. 205.

³ "Ossa fiunt ex spermate et sanguine menstruo; dentes autem ex sanguine, in quo remansit virtus spermatis." Appendices, p. 205.

in some cases, the widening of them, in order to render them shallower and therefore less liable to retain alimentary residues.

Pietro of Argelata cured dental fistulas by means of caustics and arsenic. He counselled simple palliative means of cure for hard epulides of a cancerous nature. In regard to soft, benignant epulides, he was little favorable to excision, as this might cause hemorrhage; he preferred ligating the tumor; or he repeatedly cauterized it with boiling oil or other caustics, until he caused it to fall.¹

BARTOLOMEO MONTAGNANA, who taught surgery in the University of Padua and died in 1460, recommended, as an excellent anti-odontalgic remedy, a mixture of camphor and opium. In his days, faith in the pretended eradicating virtues of certain substances was being gradually lost; but, on the other hand, a tendency now arose to neglect, in regard to the teeth, the conservative principle, to which the ancients had held so jealously; and little by little the extraction of a tooth began to be considered an operation of small or no importance, that could be performed with the greatest indifference. Montagnana himself considers the extraction of a tooth as the best means of curing odontalgia, whilst the ancients did not have recourse to it, saving as a last resource. Notwithstanding this, if the caries was not deep, he preferred to extraction the use of caustics and a red-hot iron.²

GIOVANNI PLATEARIO, a professor at Pisa in the latter half of the fifteenth century, cauterized carious teeth with a small piece of kindled ash wood, or with a red-hot iron, and held that cauterization was more effectual when, before performing it, the carious hollow had been filled up with theriac.³

He, too, made the administration of purgatives or bloodletting precede the extraction of a tooth. Plateario has, however, the merit of having introduced the sitting position for operations on the teeth, whilst preceding surgeons made the patient lie in a horizontal position, or held his head steady between their knees, as may be read in Abulcasis and in other writers. Besides, he recommends taking care, when the extraction of a tooth had to be performed, that the surrounding air should be pure; perhaps because he thought that when operating in a place where the air was tainted, complications might more easily arise, on account of contagious substances reaching the inside of the wound; or perhaps because he judged, not without reason, that certain accidents, such as syncope, could more easily happen, and were more dangerous in a tainted atmosphere than in the midst of pure, vivifying air. After the operation,

¹ Petri de Largelata chirurgiæ libri sex, Venetiis, 1480.

² Bartolomæi Montagnanæ Consilia, Venetiis, 1497.

³ Johannis Platearii Salernitani practica brevis, Lugduni, 1525.

he prescribed astringent mouth washes. Against dental worms, whose existence no one at that period doubted in the least, Plateario recommended various remedies, chiefly under the form of fumigations; and among these latter, those performed with burnt opium. Against ulcerations of the gums and mouth he commended the use of wine and aromatic substances. An excellent remedy was also, according to him, lime dissolved in very strong hot vinegar, and mixed, after complete evaporation of the liquid, with a fourth part of orpiment.

GIOVANNI OF ARCOLI (in Latin, *Joannes Arculanus*), professor at Bologna and afterward at Padua (who died in 1484), wrote a commentary on a celebrated book of medicine, which Rhazes had dedicated to the glorious King Almansor, great patron of science and art.¹

In this most valuable work of Arculanus there are several chapters relative to diseases of the teeth; and this subject is treated rather fully and with great accuracy.

The author, first of all, treats of the anatomy and physiology of the teeth; he, however, falls into many errors, for instance, in regard to the number of dental roots. ("The first six teeth of the upper jaw have only one root; the first six of the lower not more than two; the molars of the upper jaw have three; those of the lower generally only two in like manner; the *neguezid*² of the upper jaw have four roots, but the two lower *neguezid* have only three.")

According to him there is not the least doubt that the teeth grow during the whole lifetime, thus repairing the continual waste caused by use; and among other proofs he adduces that, whilst in the old all other organs shrink and waste away through lack of nourishment, the teeth, on the contrary, show very frequently an increase in length.

For the preservation of teeth—considered by him, quite rightly, a matter of great importance—Giovanni of Arcoli repeats the various counsels given on the subject by preceding writers, but he gives them as ten distinct canons or rules, creating in this way a kind of decalogue of dental hygiene. These rules are: (1) It is necessary to guard against the corruption of food and drink within the stomach; therefore, easily corruptible food—milk, salt fish, etc.—must not be partaken of, and after meals all excessive movement, coition, bathing, and other causes that impair the digestion, must also be avoided. (2) Everything must be avoided that may provoke vomiting. (3) Sweet and viscous food—such as dried figs, preserves made with honey, etc.—must not be partaken of. (4) Hard things must not be broken with the teeth. (5) All food,

¹ Joannis Arculani commentaria in nonum librum Rasis ad regem Almansorem, etc., Venetiis, 1542.

² This Arabian word was used to indicate the last molars.

drink, and other substances that can set the teeth on edge must be avoided. (6) Food that is too hot or too cold must be avoided, and especially the rapid succession of hot and cold, and *vice versa*. (7) Leeks must not be eaten, as such a food, by its own nature, is injurious to the teeth. (8) The teeth must be cleaned, at once, after every meal, from the particles of food left in them; and for this purpose must be used thin pieces of wood somewhat broad at the ends, but not sharp pointed or edged; and preference should be given to small cypress twigs, to the wood of aloes, of pine, rosemary, of juniper, and similar sorts of wood which are rather bitter and styptic; care must, however, be taken not to search too long in the dental interstices and not to injure the gums or shake the teeth. (9) After this, it is necessary to rinse the mouth, using by preference a vinous decoction of sage, or one of cinnamon, mastich, gallia, moschata, cubeb, juniper seeds, root of cyperus, and rosemary leaves. (10) The teeth must be rubbed with suitable dentifrices before going to bed, or else in the morning before breakfast. Although Avicenna recommended various oils for this purpose, Giovanni of Arcoli appears very hostile to oleaginous frictions, because he considers them very injurious to the stomach. He observes, besides, that whilst moderate frictions of brief duration are helpful to the teeth, strengthen the gums, prevent the formation of tartar, and sweeten the breath, too rough or too prolonged rubbing is, on the contrary, harmful to the teeth and makes them liable to many diseases. As a dentifrice, he recommends a mixture of two parts of honey to one of the best sugar; or the ashes of the burnt head of a hare; or burnt salt made into an electuary by the addition of honey. To use the last two dentifrices, a quantity about equal in volume to a filbert must be wrapped and tied inside a thin, loosely woven piece of linen cloth, and with this the teeth must then be rubbed. Finally, theriac, too, is considered by him a very good dentifrice. According to Arculanus, dental pains are sometimes situated in the very substance of the tooth, at other times in the nerve, and at others in the gums.

The dental substance may become painful, owing to bad "complexion" (*viz.*, constitution), without there being any morbid matter in it. When, however, such matter exists, it may proceed from the head or from the stomach, and in certain cases it gives rise to an apostema of the tooth; in other cases it corrodes the latter; and at other times generates (!) in it a worm, which in its turn corrodes the tooth.

In regard to the diagnosis of dental pains, it is necessary first of all to examine the state of the gums, that is to say, to observe whether these, in the aching spot, appear healthy, or whether, on the contrary, they are discolored or tumid, sanguinolent, suppurating, or the seat of corrosion or putrefaction, or if, when pressure is put upon them, an exit of matter

is produced. In such cases it may be considered that the gums are the seat of the pain. But if none of these symptoms are observed, and if, on comparing the gums of the aching spot with the other gingival regions, no difference is observed, this means that the cause of the pain exists either in the substance of the tooth itself, or else in its nerve. In this latter case the pain is usually very violent, and principally localized in the root of the tooth, but also extending along the jaw, and the tooth itself is often, as it were, benumbed. When, however, the pain is not situated either in the gums or in the dental nerve, but in the very substance of the tooth, this latter is very often corroded (carious), and very often in the hollow there exists a worm; and this may be deduced from the fact that during the intervals of calm the patient sometimes feels a peculiar sensation, the movement of the worm in the diseased tooth; when, however, these signs are wanting, we shall find at any rate that the whole tooth is painful in the direction of its length, instead of the pain being localized in the root of the tooth and radiating along the jaw.

When the cause of the pain resides in the gums the extraction of the tooth is neither necessary nor beneficial, but is, on the contrary, always harmful, since, in spite of the loss of the tooth, the cessation of the pain is not obtained; when the pain is situated in the tooth itself, the removal of the latter always makes the pain cease; lastly, when the dental nerve is the seat of the evil, the removal of the tooth sometimes takes away the pain, at other times it does not.

Among the many anti-odontalgic remedies, Arculanus enumerates pepper mixed with tar, pepper with asafetida, mustard seeds with asafetida, and the like. When a tooth is to be cauterized, it is necessary to protect the healthy teeth with bits of cloth dipped in rose water or else with some kind of paste. Sometimes it is useful to drill the tooth with a small trephine so that the cautery may act more deeply, thus giving better results.

In regard to the filling of decayed teeth, Giovanni of Arcoli says that, in the choice of the substances to be used, the *complexion* (constitution) of the teeth must be taken into consideration; and according as this is cold or warm, it is necessary to perform the filling with substances which are, by their own nature, warm or cold, thus acting in opposition to the dyscrasia of the tooth:

"Eligantur calida aut frigida secundum opportunitatem, in contrarium dyscrasiæ dentis."

As to the quality of the complexion, this might be deduced, says the author, from various signs, among which the color of the gums, these being red in the warm and humid complexion, yellowish in the warm and dry, brownish in the cold and dry, and whitish in the cold and humid complexion. When, however, the complexion does not show any distinct

characteristic, and varies but little from the average, Arculanus advises the teeth being filled with gold-leaf: "*Ubi non fuerit multus recessus a mediocritate, impleatur cum foliis auri.*"

Although Arculanus is the first writer who alludes to the filling of teeth with gold, nevertheless it is by no means admissible that he was himself the inventor of gold filling. His words do not at all sound to us as the announcement of a new discovery, as the enunciation of a new fact, in which the author himself had had, at least, a part, be it great or small. Nothing of all this; the advice as to filling the teeth, in certain cases, with gold leaf is given quite impersonally, and is found, as if it were a point of minor importance, at the end of a long paragraph, which includes various other counsels in regard to the filling of teeth, one of which is, that this operation should not be performed with too great violence.¹ In short, the writer does not show the least intention of putting in evidence the aforesaid fact, or of giving to it any special importance. We must, therefore, hold that gold filling had already been in use for a long time among dentists, and that Arculanus simply mentions what was done by the dentists of those days. (See note page 164.) It is evident, on the other hand, that he had no special competence in dental art, when we consider that he was even ignorant of the exact number of dental roots. Naturally, the question here arises: At what period did gold begin to be used for the filling of teeth? But unfortunately history has not, up to the present, furnished us any evidence which may lead to the solution of this problem.

For the eradication of a tooth Arculanus gives three very precise indications: (1) When the pain resists every other means of cure. (2) When there is any danger of the disease spreading to the neighboring healthy teeth. (3) When the tooth is troublesome in speaking and in masticating.

Before extraction, the patient must be prepared for it by bloodletting, purgatives, and narcotics; and the operation must be commenced by separating the gums from the tooth.

Arculanus admits, like many of his predecessors, that the eradication of a tooth may be effected not only by the forceps and other suitable instruments, but also by other means. One of these would be the use of the actual cautery, repeatedly applied inside the hollow of the tooth, if this is decayed; or, in the contrary case, made to act all around its root

¹ "Regimen autem implendo dentem corrosus est, ut impleatur in causa calida cum frigidis, et in frigida cum calidis. Secundo, ut non impleatur cum labore et vehementia addente in dolore, et ex propriis est gallia cum ciperis aut cum mastiche, et eligantur ex suprascriptis, calida aut frigida secundum opportunitatem, in contrarium dyscrasie dentis, sed ubi non fuerit multus recessus a mediocritate impleatur cum foliis auri." Cap. xlviii, p. 195.

(neck). The fall of the tooth might also be obtained with potential cauteries and especially by the application of boiling oil, or of a grain of incense heated to the melting point.

It is plain that Giovanni of Arcoli has simply copied these things from preceding authors, since if he had made a trial of the pretended eradicating means, he would soon have verified their inefficiency.

Against hemorrhage of the gums, Arculanus recommends arsenic, lime, gall-nuts, alum, and oil of roses. But, says he, the surest remedy is the red-hot iron; and still more effectual, cauterization by means of red-hot gold.

Giovanni of Arcoli's work is not only noteworthy because it mentions gold filling for the first time, but also because in it are given the drawings of three dental instruments, among which the pelican (here called *pulicanum*). According to Carabelli, the first author who has mentioned the pelican was the Dutchman Peter Foreest; according to Geist-Jacobi, instead, it was the German Walter Ryff. But both these statements are false, because as we have just now said, the pelican was already named and designed (not very well, it is true) in the book of the Italian Giovanni of Arcoli, who died in 1484, that is, even before either Walter Ryff or Peter Foreest came into the world. Neither does Giovanni of Arcoli say one word that might imply that he was the inventor of the pelican, and so we are led to believe that in his days this instrument had already been in use for some time. In the text he only says: "The teeth are to be extracted with suitable instruments, whose figures may be seen in the margin."¹

We here reproduce the three figures alluded to, with the relative indications. The first (Fig. 56) represents the pelican; the second (Fig. 57) is a pair of curved forceps, which seems, in those days, to have been the instrument most commonly used for the extraction of teeth, since this figure is accompanied by the very generic indication "shape of the forceps for extracting teeth;" finally, the third (Fig. 58) represents the forceps used for extracting dental fragments (roots), and which from the long and straight shape of its jaws, was called "stork's bill" (*rostrum ciconiæ*).

ALESSANDRO BENEDETTI, of Verona, who lived from 1460 to 1525, and taught medicine at Padua, was, for his times, a man of uncommon scientific merit; but to the development of the dental art he did not contribute anything very worthy of note.

He relates that he once abstained from buying a slave simply because

¹ In the Venetian edition (1542), however, all the figures which Arculanus inserted in his work are found in the beginning of the book, in a single table, together with the indication of the use to which each single instrument was destined.

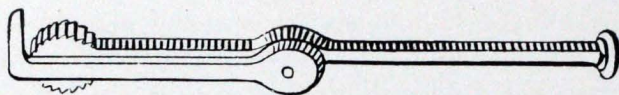
the teeth of the latter were like those of wild beasts, a thing which he considered as a bad omen.

According to him, toothache is a disease proper to man, no other animal being liable to it.

To keep free from odontalgia, there is, says he, a very simple means, which consists in rubbing the teeth once a year with the blood of a tortoise.

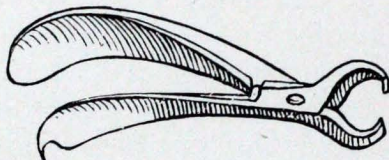
This is the first writer who has noted the harmful effect which mercury has on the gums and teeth, whether this remedy be used internally or externally, that is, by friction.

FIG. 56



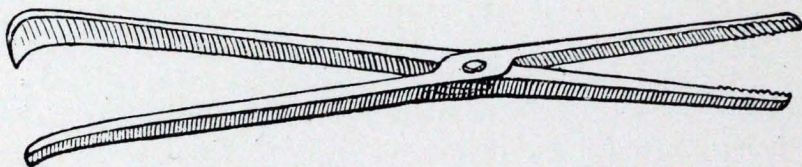
The pelican as represented in Giovanni d'Arcoli's work. Forceps pro extrahendis dentibus pulicanum dicta.

FIG. 57



Dental forceps (Giovanni d'Arcoli). Forcipum pro extrahendis dentibus forma.

FIG. 58



The forceps called "stork's bill," as represented in Giovanni d'Arcoli's work. Forceps pro extrahendis fragmentis quod Rostrum Ciconiæ dicent.

Benedetti recommends that before proceeding to the extraction of a tooth an accurate diagnosis should be made, so that it may not happen that, by mistaking for true odontalgia a pain localized in the gums or in the jaw, a sound tooth be drawn, under the belief that it is the cause of the pain; for, this happening, not only would the pain continue, but there would be, in addition, the loss of a sound tooth, and also the disadvantage of the neighboring ones becoming less firm, for want of support.

This author, too, attributes great importance to dental worms, believing them to be one of the principal and most frequent causes of odontalgia. To kill them he recommends the usual fumigations and several

other remedies, among which the juice of the leaves of the centaury or of the peach tree, but especially applications of *aqua vitæ*.

When it is thought well to have recourse to opium to calm toothache, he advises this to be used with the utmost prudence; and on this point, he relates having witnessed a fatal case, in the person of a gentleman of Padua, by the incautious use of this remedy.

In extraction Benedetti repeats all the precautionary measures recommended by the ancients, and he, too, advises that recourse should not be had to this operation, if not as a last remedy, that is, when every other means of cure has been found useless.¹

GIOVANNI OF VIGO. The celebrated surgeon Giovanni of Vigo (1460 to 1520), speaking of abscesses of the gums,² says that the abscess must be first brought to maturity by fitting remedies, if it has not ripened spontaneously, then it must be opened with a lancet, and lastly, to cleanse the diseased part and to aid cicatrization, honey of roses or Egyptian ointment must be used. This latter is thus composed of: "℞—Verdigris, rock alum, *ana* two ounces; honey of roses, one ounce; plantain water and pomegranate wine, *ana* two and one-half ounces. The whole to be made to boil, and to be stirred with a small rod, until the mixture is reduced to the consistency of honey."

For the cure of old fistulas he employs not only the above-mentioned Egyptian ointment, but also arsenic and corrosive sublimate.

Giovanni of Vigo is very brief in speaking on the treatment of dental caries, doubtless because he attributed little or no value to the numerous methods of cure recommended by his predecessors. The treatment advised by him is, however, very noteworthy. He says that by means of a drill, file, scalpel, or other suitable instrument, it is necessary to remove the whole of the putrefied or corroded part of the teeth, and then, to preserve it, to fill the cavity with gold leaf.

This clear and simple manner of speaking of gold filling as a cure for caries makes us suppose that Giovanni of Vigo was not at all a stranger to the practice of dentistry, as we must think of many preceding writers, but, on the contrary, that he was not less skilled in dental operations than he was in the other branches of surgery. Again, history tells us that Giovanni of Vigo was surgeon to the Roman court; so it would have been strange, indeed, if the Pope, if the haughty prelates, accustomed as they were to all kinds of refinement and comfort, should have intrusted the care of their teeth to lowborn barbers and quacks, whilst they could dispose of the services of so eminent a surgeon.

¹ Alexandri Benedicti Veronensis de re medica opus, lib. vi, de affectibus dentium.

² Opera domini Joannis de Vigo in chyrurgia. Lugduni, 1521, lib. ii, tract. iii, cap. xiv, fol. 40.

It may, however, be seen from the very book of Giovanni of Vigo,¹ that in his days doctors and surgeons were, in general, little skilled in dental matters. Speaking of the extraction of teeth, he says: "For this operation there is need of a practised man, and, therefore, many medical and surgical authorities have expressed an opinion that this operation should be left to expert barbers and to the itinerant quacks who operate in public places. He, therefore, who desires to perform this manual operation in the best manner will derive great advantage by frequenting men who are expert in performing it and by seeing and impressing well on his memory their manner of operating."²

[¹ The editions and translations of Vigo seem to have been endless. A French translation of his treatise on the wounds caused by firearms is said to have fallen into the hands of Paré, and had an inspiring influence upon the barber's boy.—C. M.]

² Lib. v, cap. v, *De doloribus dentium*, fol. cxvii to cxix.