and always diminish the chances of recovery. From its superficial position the trochlear bursa is more likely to be involved than the articulation, the latter being by no means so directly exposed to injury as the flexor brachii muscle and the trochlea. The coraco-humeralis may or may not be involved.

The seriousness of the injury will always depend upon its extent ; but it is of more serious import than is laceration or contusion of most of the other muscles of the body, as its structure renders it prone to take on fibroid and ossific changes ; in either case—its action being mechanically interfered with—permanent inability to extend the limb is the result.

The great danger arising from the involvement of the trochlea is the establishing of inflammatory changes in the cartilage, leading to ulceration and attrition of the trochlear surface.

Causes.—Are usually *direct violence*, as anterior or lateral blows, or kicks ; animals running away and coming in violent contact with fixed prominent objects ; tripping up with heavy loads or while going down hill and striking the point of the shoulder violently on the ground or against kerb-stones ; striking the shoulder against embankments in leaping ; horses cannoning against each other in galloping, racing, etc., and violent straining, usually brought about by inordinate attempts to move extraordinary weights, especially if all the force is brought to bear upon one shoulder as it is in *cross-drawing* (traction).

Extensive injury is likely to be inflicted upon this muscle in the foetus by the employment of great traction at parturition.

Symptoms.—Are those of ordinary shoulder lameness, with thickening and great pain on pressure in the course of the muscle ; inability to progress in a forward direction, the toe being dragged ; excessive lameness when the weight is placed on the limb, and, if the triceps muscle is involved, knuckling over of the fetlock joint ; the animal backs with moderate ease, and turns fairly well to the side of injury, but with pain and difficulty to the opposite side, as the muscle is an adductor. After a time, atrophy of the scapular and scapulo-ulnaris muscles is sure to take place to a greater or less extent.

Treatment.—Antiphlogistic at the outset, followed by blisters, and, above all, if the lameness does not pass off, the insertion of setons along the course of the muscle.

(*To be continued.*)

THE EXTRACTION OF THE MOLAR TEETH OF THE HORSE.¹

By Professor THOMASSEN, Veterinary School, Utrecht.

EVULSION of the molars is often a most difficult operation, requiring on the part of the operator two good arms, prudence, and at times much patience.

¹ Translated from the *Recueil de Médecine Veterinaire*, 15th June 1889.

The difficulties offered by the operation and the resistance of the teeth to extraction vary with the age of the subject, the position of the teeth, and the degree of alteration that they have undergone.

In young horses, where the tooth is deeply encased in its alveolus, its evulsion demands a much greater mechanical force than in animals of more advanced age. In proportion as the animal becomes older the resistance diminishes.

The extraction of the anterior molars is more easy to execute than that of the last.

The alveolar walls of the upper jaw being less thick than those of the lower, and the encased part in the alveolus being shorter, the molars are not so solidly fixed in the former. Against these advantages, we believe we ought to point out that the crown part of the teeth of the upper jaw is broader, which renders the seizure of the teeth more difficult. Besides, it seems to us that the operator is less free in his actions in the case of the upper jaw, and more impeded by the incisor teeth of this part.

On account of alterations which the teeth or the alveolar walls have undergone, the tooth may be loosened to such a degree that its extraction scarcely requires any effort, or may even be effected with the fingers. In other cases the hypertrophied dental root may have increased in volume to such an extent that the extraction of the tooth has become altogether impossible, the alveolar canal being too narrow to allow it to pass.

Irregular wear may render extraction very difficult, indeed even impossible. That is especially the case when one has to deal with dental tables of a chisel shape, as we shall afterwards see.

Before entering upon the operative procedure, let us examine at the outset in what cases extraction of the molars may be indicated. We may enumerate them as follows :—

1. An abnormally prolonged persistence of the temporary molars.
2. Dental caries.
3. Dental fistulæ.
4. Periostitis, ostitis, and alveolar caries.
5. The presence of superfluous molars (7th molar).

A difficulty in mastication in young horses of the age of two-and-a-half to four years results generally from an anomaly in the dentition of one of the anterior molars. We find the crown of some of the temporary teeth detached on one side, while on the other the outcuts with which it is provided are still strongly adherent, occasioning during mastication a movement that causes the animal acute pain. The shell, in part detached, is easily removed, often with the fingers; in other cases, when the resistance is greater, one will make use of pincers or any kind of nippers with which the tooth can be seized, or of a piece of iron flattened like a chisel, which one strives to place under the free border of the tooth, and to which one can apply some sharp blows.

Among the anomalies requiring evulsion of the permanent teeth, caries is certainly the most common.

Dental Caries.—In consequence of their peculiar construction the molars of the upper jaw are the most frequently attacked with caries. As the first cause we ought to admit a predisposition resulting from a defect of structure—an absence of density in certain teeth, which

explains why one sees ordinarily the teeth attacked in pairs, that is to say, the two corresponding teeth of the same jaw, frequently the fourth molars.

We cannot consider dental caries as identical with that of bone. In dental caries the formation of granulation tissue as well as purulent detritus is absent. In the tooth it is a case of a process of decomposition—of a putrefaction, especially of the dentine, provoked by the introduction of putrid matters and micro-organisms into the canaliculi of this structure. To the destructive action of the bacteria there comes to be added probably that of acids, products of fermentation.

We may consider the excavations between the folds of enamel at the free surface as the ordinary point of departure. The putrid materials enclosing the micro-organisms penetrate into the canaliculi by which the ivory is traversed in the whole of its length, and lead to the destruction of the walls of these canaliculi, in such a way that several soon become confluent, and end by forming a canal, whose opening on the grinding surface of the tooth shows itself under the form of a black point of the size of a pin's head or larger.

At this stage the diagnosis of the disease is still extremely difficult.

The alteration will constantly gain ground. The cavity will gradually increase, this being favoured by the mechanical action of the *débris* of the food with which it is constantly filled, and which exercises during mastication a certain pressure.

The enamel at the bottom of the *cul-de-sac* in the superior molars will ultimately suffer destruction under the action of the altered aliments, and a direct communication will be established between the grinding surface of the tooth and the cavity of its root. The alimentary matters will be able to penetrate into the pulp cavity, and hence there will soon result a purulent pulpitis and a subsequent alveolitis.

In the most favourable cases the cement of the root is detached from the alveolar periosteum; in consequence of the suppuration the tooth is completely loosened, and ends by falling out.

The periostitis and the ostitis arising in consequence of the contact with irritant substances may produce necrosis of the bone, and a communication will then be established between the alveolus and the large cavities, either nasal or maxillary. A dental fistula is thus formed.

Dental caries is indicated at first, as in the majority of dental affections, by a difficulty of mastication; these symptoms are so well known that we need not enumerate them. The first characteristic sign will be the discovery of the presence of a cavity filled with fodder, which, if we succeed in extracting a part, exhales a fetid odour. It may be, however, that this canal, although putting the alveolar cavity in communication with the buccal cavity, has not yet attained dimensions permitting the extraction of the food. In this case the fingers which have been in contact with the diseased tooth retain only slightly the characteristic odour. In percussing the teeth with any instrument whatever the animal will evince pain.

Frequently the gums around the carious tooth are swollen, and even externally the bone may be the seat of a hot and painful tumefaction.

In veterinary practice extraction of the tooth is always indicated, both because we can form a diagnosis only rather late, and because complete disinfection, which ought to precede the stopping of the cavity, is scarcely realisable.

The disease has a tendency to progress, and may provoke at length incurable complications, even after the evulsion of the diseased tooth.

Dental Fistula.—Dental fistula may exist in either jaw. The disease reveals itself by symptoms so different in the two cases that we consider it right to treat of them separately.

Dental Fistula of the Upper Jaw.—As we have remarked, dental fistula may arise as the result of caries. After the bottom of the *cul-de-sac* formed by the enamel has been perforated, the foreign matters may set up a pulpitis, an alveolitis, and a necrosis of the bone, whence there results a communication with the nasal cavity or with the maxillary sinus.

In this manner one or several *internal* fistulæ may form, communicating with the nasal cavity when they start from the first three molars, and with the sinus in the case of the last three. The fistula starting from the fourth molar may open on the exterior of the face.

In horses of advanced age, fistula generally develops in another manner. When the tooth is worn to such a point that the enamel is absent from the centre of the grinding surface, and only exists at the periphery, it will be excavated in the form of a cup. The loss of substance at the central part constantly progresses, and soon a communication is established between the buccal cavity and the alveolus. Generally this anomaly is seen in the fourth molar, which, as we have said in speaking of caries, is often less resistant than the other molars.

In other cases the *débris* of the food insinuates itself between the teeth and the alveolar walls, giving rise to an alveolar periostitis and ostitis. This defect is observed more frequently in the lower jaw, as we shall afterwards see.

Internal fistula of the upper jaw is revealed at first by a unilateral nasal discharge of a fetid material, mixed sometimes with alimentary *débris*. The submaxillary lymphatic glands of the corresponding side are engorged. An osseous tumefaction may arise in consequence, and the skin and cellular tissue are often the seat of a serous infiltration, so that they retain, for a moment, the impression of the fingers.

By percussion of the sinus, one may discover a dull sound, due to the accumulation of morbid products in these cavities, or to the presence of vegetations on the mucous membrane that lines them.

The osseous tables may be thinned to such a degree that they bend under the pressure of the fingers.

In view of these symptoms a careful examination of the buccal cavity, and specially of the molars, is recommended. As long as the external lesions are still absent, which happens pretty often, it may be that one ascribes the symptoms denoting a chronic catarrh to quite another cause, and that one even suspects the existence of glands.

In young horses, where the canal perforating the tooth may be still very fine, and, moreover, filled with fodder, the existence of the dental

fistula may escape the practitioner's attention. It may even happen that there is difficulty in finding the internal opening after trepanation of the maxillary sinus.

A serious complication which may ultimately arise is hypertrophy of the inferior turbinated bone.

Dental fistula is a grave condition of which one does not easily obtain a cure, and which we ought to consider incurable when the opening between the two cavities has attained a certain extent, and in old horses where several teeth are attacked.

Radical treatment ought to begin with the extraction of the tooth involved. Afterwards, attention must be turned to the secondary lesions of the nasal fossa or the maxillary sinus, of which it is very difficult in inveterate cases to obtain the recovery. Extirpation of the turbinated bone attacked may be indicated.

Dental Fistula of the Lower Jaw.—As we have just seen, dental caries is almost always the primary affection in cases of fistula of the upper jaw. In the case that we have now to consider the dental affection is almost always secondary.

The disease generally begins with a periostitis and ostitis of the maxillary edge in consequence of a traumatism, which is denoted by a painful tumefaction of more or less extent.

The roots of the second and third molars reach almost to the edge of the inferior maxilla, so that they may be very soon involved in the inflammatory process. That explains why fistulæ of the lower jaw are seen almost exclusively in the two molars mentioned.

In the case of ostitis of the part corresponding to the four other molars, this complication is less to be feared, because their roots are further removed from the maxillary border. In consequence of a superficial necrosis of the bone, perforation of the skin will soon occur. Little by little the opening of the skin retracts, forming merely a narrow fistulous tract which allows the escape of a sanious and fetid purulent matter.

With the sound one can follow this canal as far as into the alveolus, and in inveterate cases it even passes between the internal or external face of the tooth and the alveolar wall into the buccal cavity.

It may happen that the horse does not show any difficulty in mastication, and that the presence of the fistula is not manifested by any notable symptom beyond the agglutination of the hairs around the opening, so that it may exist for some time without the owner being aware of it.

In other cases the tumour continually grows in volume, mastication becomes more and more difficult, and the animal exhales a fetid odour from the mouth.

In consequence of a suppurative alveolitis the tooth is in this case completely loosened. It acts then as a foreign body and excites the inflammatory process.

These fistulæ of the lower jaw are almost always curable.

The extraction of the tooth is the most certain means of obtaining prompt recovery.

Alveolitis and Alveolar Caries.—Primary ostitis and alveolar caries, that is to say, those which do not develop in consequence of dental caries, result generally from the passage of alimentary *débris* between the teeth and the alveolar walls. These remains of fodder implanted

in the dental interstices soon decompose, provoke at first a periostitis and an alveolitis, and afterwards caries of the bone.

Every day they are buried more deeply, and they end by penetrating as far as the bottom of the alveolus.

This accident is produced when a free space remains between two or more molars. This is observed in horses of very advanced age, where, in consequence of wear, the dental crown gradually diminishes in volume, so that the molars, in place of being in close contact by their crowns, leave a more or less extensive space between them. In view of the age of these animals this pathological state has not a great practical importance.

This dental anomaly is occasionally produced in young horses of from four to five years, as we have had occasion to observe, and an early diagnosis is then of greater interest.

In the majority of cases it affects the fourth molar of the lower jaw. Different circumstances explain this predisposition, viz. :—

1. The dental table of the upper jaw exceeds that of the lower jaw in breadth, and consequently the ranges of the upper arcade are further removed the one from the other than those of the lower arcade. The superior molars form a species of curve whose convexity is external, while the inferior are placed almost in a straight line, and hence by the lateral movements of mastication the forage exercises a lateral pressure on the latter. From this it results that lesions of the gums of the lower jaw by the forage are more frequent.

2. The divergent direction, in the form of a fan, of the encased part of the last three molars of the lower jaw favours the formation of a space between the crowns, especially of the fourth and fifth molars.

3. The fourth molar is specially predisposed, because its crown is less developed, that is to say it is less voluminous than its neighbours. Exceptionally the disease arises in consequence of a vicious position of one molar, either from its deviating outwards or inwards, or from irregular wear, especially in the case where the dental tables end by intercrossing like scissors.

Symptoms.—The difficulty experienced by the animals in mastication, even at the outset, is generally greater than that seen in the other dental affections. Eventually they reject the whole of the forage, whether hay or green food, in the form of half crushed balls, and can take only mash and a little crushed oats.

On examining the mouth we shall find between the proximal faces of two molars, ordinarily between the fifth and the fourth, or at the lateral or median face of the latter, a small quantity of enclosed forage which one cannot withdraw with the fingers. These remains of food give off a fetid odour, which communicates itself to the fingers as in dental caries.

Sometimes one discovers towards the maxillary border, externally, a more or less pronounced tumefaction corresponding to the alveolus attacked, which denotes that the alveolitis has already invaded the bottom of the cavity.

It goes without saying that the space around the tooth will continually grow in size in consequence of the pressure constantly exercised by the *débris* of insinuated forage, to which more is being added, and eventually the tooth will be completely loosened.

An early diagnosis in this case is of the highest importance. By

the extraction of the tooth, or of the two teeth, one will prevent the emaciation of the animal, and, besides, one will be able to arrest in its march the destructive process when the alveolar walls are invaded.

By examination of the extirpated tooth one can convince oneself of the depth to which the alimentary *débris* is insinuated into the space left by the destroyed periosteum, and then by their adhesion to the tooth. Generally the carious alveolar margins are detached some days after the removal of the tooth.

From the first days after the operation the horse takes his food freely, as we have recently been able to convince ourselves in a five-year old horse in which we had extirpated the fourth molars of the lower jaw. After the cicatrization of the wound all difficulty completely disappeared.

Superfluous Molars.—A supplementary molar is ordinarily situated at the back of the mouth, in the lower jaw. Its presence is revealed by a difficulty of mastication caused by a strong protuberance furnished by its posterior part, which does not come into use.

One finds this worn tooth in the form of an inclined plane with a polished surface, and pointed at the summit.

An attempt to level it might be made with the curved scissors of Günther.

In the few cases in which we have had occasion to observe it the tooth was always extirpated, some strokes of the gouge being previously given so as to loosen it. It can then be removed with the hand. The laxation of this tooth is easily effected, because its inferior part is always very short. Even when it is loosened the extraction of such a tooth may be pretty difficult, if in raising it out of its alveolus it comes into contact with the upper jaw. It suffices to incline it inwards after having made the jaw to deviate as far as possible.

The Operation of Evulsion.—Evulsion of molar teeth may be executed in two ways, viz. (1) by the method of punching (*repoussement*) and (2) by the method of extraction. It is the latter that will engage our attention exclusively. As we have said at the outset, extirpation of the teeth in the horse frequently offers great difficulties, which are even sometimes said to be insurmountable.

Putting aside cases where the tooth is already completely loosened in consequence of the alteration that it has undergone, we predicate as the first condition, if the operator does not wish to be exposed to the risk of failure, that he should be armed with an appropriate instrument.

Many very different instruments, some very complex, have been recommended. We cite: Garengot's key, Plasse's forceps (1832), the forceps of Wendenburg (1836), of Pillwax (1850), of Gowing (1851), of Bouley (1856), and of Günther (1858). The least practical and the most complicated instrument is certainly Brogniez's odontagogue key (1842).

The instruments which are most in vogue are the nippers or forceps of Günther. Their great inconvenience for the practitioner is that they require at least four principals and two accessories, according to the tooth that one wishes to extract. Primitively Günther used fourteen different models.

According to the position of the teeth to be extracted, one will require an instrument acting as a lever of the first or of the second order.

The use of a lever of the first order is indicated for the last three teeth, and that of the second order for the three others.

For the extraction of the three or even four posterior molars we have had the forceps represented in Fig. 1 constructed. It has a length of 55 centim. (about 22 inches), and is provided with two jaws 19 centim. (about 7½ inches) long and 2 centim. ($\frac{4}{5}$ inch) thick. Its mouth is provided on the two surfaces that come into contact with the tooth with small pyramids of tempered steel.

The great advantage of this forceps consists in the length of the mouth which remains open even when the instrument is closed to a distance of 3 centimetres, thus permitting it to be adapted by causing it to glide at the side of the molars, without requiring to exceed the level of the dental table.

The operator could then introduce the hand with the instrument in order to assure himself of the exact adaptation to the affected tooth. With the instruments generally employed one is exposed to the risk of bruising the hand placed between the instrument and the molars of the opposite side. Some instruments by their thickness even render the introduction of the hand totally impossible, in the case of the fourth or following molars.

Moreover, the dental tables may, after they have been separated as far as possible by means of the balling iron, remain so close that the instrument comes into contact with the molars of the opposite jaw

FIG. 1.

FIG. 2

when one wishes to employ it as a lever of the first order. That happens, for example, in the case of a scissors-shaped set of teeth.

The forceps once adapted, the screw is tightened as far as possible, so that it will not relax its hold. The tooth is then made to oscillate by means of lateral movements of the instrument, in order to loosen it as much as possible. These movements must not pass certain limits, in order to avoid a fracture of the tooth or a fissure of the jaw. This step of the operation requires some practice on the part of the operator. It is necessary to continue this manoeuvre for ten minutes before attempting extraction, at least in the cases where the teeth are firmly adherent.

The support A, which is 8 centim. ($3\frac{1}{5}$ inches) broad, and has the annular part covered with caoutchouc, is afterwards adapted. After having elevated the branches of the forceps as far as possible, it is slipped up until it rests on the second molar.

We have often made use of a simple piece of wood of the size of a finger, slipping it between the instrument and the first molar, which serves as a fulcrum.

In this way one has a two-armed lever with which one can develop an enormous force, such as no tooth can resist.

Recently the forceps shown in Fig. 3 was recommended by the German veterinary surgeon Frick (*Zeitschrift f. Thiermedizin*, 1889). It also has a length of 55 centim. It is termed an *universal forceps*,

FIG. 3.

because that it can be used for all the teeth of both jaws. With or without the prolongation, etc., one can make of it a lever of the second or of the first order. It is for extraction of the first molars especially, that is to say as a lever of the second order, with the prolongation A, that we recommend it. Lately we used it to extract a third molar.

For the extraction of the last three molars the instrument is in our opinion too heavy, that is to say its thickness prevents the introduction of the hand.

In turning the screw V, the branch B turns and causes the two fluted lips to approach. The other bar is fixed to the ring P.

The great advantage of Frick's forceps is that it never loses its hold, not even when one has to deal with a tooth whose crown is very much shortened.¹

We pass over with silence the subsequent care required after the operation, whether in the case of a simple dental affection, caries of the bone, or dental fistulæ.

The method of "punching" seems to us to be indicated only in cases where the crown of the tooth is altogether absent, or where there is hyperplasia of the radicular part of the tooth.

¹ The forceps is sold by Hauptner of Berlin, at the price of 32 marks (about 30s.).