THE "OPEN BITE" (MORDEX APERTUS CARABELLI): ITS ETIOLOGY AND TREATMENT.*

BY DR. G. LIND, AMSTERDAM.

YESTERDAY when in the discussion of Dr. de Vries' paper I spoke about the retention of open bite with headgear, a headgear which I demonstrated last year in Holland, I thought that I might be able to give you some few interesting points upon the etiology and treatment of the open bite, and Dr. Anema, our President, was kind enough to say I might have a little time this morning for doing so.

Of all the different malocclusions which we dentists meet with in practice I think that malocclusion generally called the open bite takes a special position, not alone from the point of view of treatment but also from the etiology and classification, which justifies us to discuss it separately.

In 1831 the open bite was described probably for the first time in a scientific manner by Carabelli in his "Handbuch der Zahnheilkunde", under the name of *Mordex apertus*, a name which I prefer to use not alone because it is symptomatic, but more because by using this term we avoid confusing it with other kinds of irregularities where the bite can also be "open", but where the conditions are different from the "real open bite".

In "*Mordex apertus Carabelli*," we understand (using the description of Dr. de Nevreze of Paris, which he gave in a paper delivered in Berlin at the International Congress), "a vertical dento-facial irregularity, where the naso-mental distance is greater than normal in proportion to the profile of the patient, caused by a deformity of the jaw itself". This description brings out the real open bite as a deformity of the jaw itself and not of proc. alveolaris alone, as is the case in other kinds of open bite. This last kind of open bite is best described by the Angle nomenclature as infra-occlusion of the anterior teeth. The Angle classification and nomenclature is very practical, although perhaps not absolutely scientific, but for the *Mordex apertus* it would be a little difficult to use it. If we did use Angle's nomenclature, then it would be "an infra-occlusion of the greatest part of the teeth in the mouth where the distance between the two arches is progressive from posterior forward and where the mesio-distal relationship between the first molars, which often do not occlude, gives the class to which it belongs." According to Angle, we understand infra-occlusion to mean "the position of teeth being in non-occlusion caused by either an underdevelopment of the alveolar process or not fully eruption", then you will understand that his nomenclature is rather lacking for this kind of deformity.

The clinical symptoms of *Mordex apertus* are well known; you recognize this deformity as soon as the patient comes into your room. The stupid appearance of the patient, due to the fact that in most cases the lips can hardly be closed, is very typical. The chief symptom, though, is that only the posterior teeth, it might be all the molars but often only the wisdom

*Reprinted from the Transaction of the European Orthodontia Society, Sixth Annual Meeting, London, May 11 to 14, 1913. Edited by the Oester-Ungar. Vierteljahrsschrift für Zahnheilkunde, Vienna.

teeth, occlude, when the jaws are brought together. The distance between the arches is progressive from posterior forward and it is impossible for the patient to bring the incisors together—i. e., the bite is open. Another less important symptom, given the first time by Carabelli, are the small jags on the incisal edge, which you otherwise only see on newly erupted teeth and not on teeth that have been used for a while.

With regard to the cause of this kind of deformity, you will find that the opinions are very different. In trying to find out what the cause might be I think I have read most of the literature on the subject, but almost every author has his own theory.

It is said in the earlier literature, that the cause of the open bite is abnormal eruption of the molars or hypertrophy of the proc. alveolaris in the molar region. One writer claims that the real open bite is always combined with the disarticulation of the mandible. Talbot claims that the only cause is that the rami of the mandible are too short, and there is an in-harmonious development of the mandible. Others claim that the real cause is due to extraction. One molar is extracted and the other is tipped, the distal edge forcing the bite open. Others again claim that it is the bad development of the os incisivum, which is caused by chronic diseases in childhood. Thumb sucking, biting the lips and fingers and other bad habits are also supposed to be direct causes. It is claimed that mouth-breathing is probably a cause, and the explanation is given in this way, that the muscles which keep the mouth open bend the lower jaw downwards and we get the obtuse angle of the posterior margin of the mandible. In the last edition of his book Angle says that the cause of a good deal of open bite, and he includes the Mordex apertus and the infra-occlusions, is absolutely unknown, but for many of the cases he claims that keeping the tongue between the front teeth or other bad habits such as biting the lips or fingers may be the causes. Van Broadus Dalton two or three years ago wrote that the only direct cause of the real open bite which he had been able to find in quite a number of cases was supra-occlusion of the molars, directly traceable to prolonged retention of the second milk molars. Others claim that it develops because the molars are sore and the patient is unable to close the mouth. There are indeed a good many opinions and probably a good many more that I cannot remember.

I was fortunate enough to be able to examine a great number of patients with Mordex apertus, not alone in my own practice but also at the Polyclinic of Zielinsky in Berlin, where strangely enough I found a proportionately greater number of real open bites between the different malocclusions which presented themselves than I found elsewhere.

My conclusions from these clinical examinations, which, to a great extent, are only a confirmation of what others before me have found, were:

1. The Mordex apertus is not very often seen in the deciduous denture. We see it first after the eruption of the first molars, and the deformity increases slowly until the eruption of the second or third molar has taken place.

2. Often this Mordex apertus is complicated with narrow arches and crowded teeth, irregularities which cannot be the direct cause of the open bite, and they are excluded because we often find very great deformities with

arches quite normally shaped and where the proportions between the teeth in each individual arch are absolutely normal, which also is the case between the erupted part of the teeth (the crown), processus alveolaris and corpus maxillæ. In infra-occlusions this is not the case.

3. The Mordex apertus is proportionally more often found in children of the lower classes, and we often find rickets or other constitutional diseases present. In Berlin, where most of the patients who came to the Policlinic were children of the lower classes, and where, proportionally, so many cases of Mordex apertus were found, it also struck me how many typical symptoms of rickets were to be found. (Hypoplasia of the teeth, caput quadratum, pectus carinatum, etc.)

Fig. 1.

4. In all cases of Mordex apertus, I found that the posterior angle of the mandible was more obtuse than normally, according to the age of the patient. This has later been confirmed with examinations on skulls.

5. By examining the masticating muscles I found that the muscles were rather weak, and it was nearly always said that the patients never chewed their food as well as they should. It struck me that the children with Mordex apertus were always unable to exert the same power with the masticating muscles as other children. In the older patients, I found, but not always, hypertrophy of the alveolar process in the region of the molars and in the most cases a tipping linguallly of the lower incisors. Mouth-

breathing, adenoids, chronic pharyngitis, tonsillitis, deviation of septum nasi and also different kinds of bad habits were often, but not always found.

A study of some of these clinical investigations, with a rather extended examination of skulls in different anatomical museums, has led me to consider that the direct cause of Mordex apertus is always a deformity of the lower jaw, which can be either (1) hereditary or congenital; (2) accidental, by which I mean such causes as fractures, macro-glossia, contraction of the soft tissues after operations, etc; (3) last, but not least, lack of development of the mandible caused by deficient mastication predisposed by constitutional diseases in childhood. These, I think, are the chief causes for most kinds of Mordex apertus.

Fig. 2.

You all know that the form of a bone is the expression of the bone function and that the structure of it is made so as to give the highest amount of power to the forces (i. e., the contraction of the muscles) working on it. Normal form and normal structure of the bone have to be considered as the result of the different mechanical stimuli working harmoniously together upon it. You probably all know the researches which von Meyer made about forty years ago on the structure of the femur. Walkhoff, Toldt and others have followed his investigation and have studied the mandible and have endeavored to discover how the structure and the form of the mandible were influenced by the contraction and working of the different muscles.

In the case of the *Mordex apertus*, the only deviation of the bony structure from the normal form that I have found on the skulls, which deviation could be considered as a direct cause of the open bite, is the obtuse angle of the mandible, and this deviation is the result of inharmonious mechanical stimuli during the growth of the jaw. If the lower jaw is to be normal in form, we must have a harmonious working between all the muscles, but if a child does not chew its food well then some muscles are not exercising the same physiological stimuli on the bone which other muscles are, and the result is a difference in the growth of the bone, which results in disharmony.

That bone growth largely depends upon the muscular activity is a fact, and when the masseter and the external pterygoid muscle, the masticating muscles, are underdeveloped we absolutely will have less growth in the re-

Fig. 3.

gion which they stimulate, that is, on the posterior margin and the base of the mandible near the angle, but normal growth where the mylo-hyoid, the digastric and the genio-hyoid muscles are inserted, because their function is not deficient. As Sim. Wallace states in his essay on causation of dental irregularities, does "the growth of the mandible not only takes place by growth beneath the articular cartilage, but also by deposition of bone at the angle and posterior border of the ascending ramus, while it is absorbed on the anterior border of the ramus, and in general is moulded into its ultimate shape by these processes". When studying the normal development of the mandible, you will see that the greatest change in the angle takes place when the permanent molars erupt, which shows why the *Mordex aper-*

tus first manifests itself after the complete eruption of the first molar and becomes greater when the other two molars erupt. The erupting power of the molars really forces the jaws apart.

It is a clinical fact that a tooth elongates when the antagonist is lost, and you might say: "why don't the anterior teeth in these cases do that?" In examining several hundred mandibles in the Anatomical Museum of the University of Amsterdam I found a large number with obtuse angles, and with such a compensatory elongation of the anterior teeth, that they could be brought in normal occlusion though with the upper ones,—those mandibles were mostly heavy and strongly built. But in rachitic jaws no elongation had taken place, therefore the cause, to the non-elongation of the teeth in the case of *Mordex apertus*, may be attributed to a low vitality in the bone caused by constitutional diseases during childhood. The narrow arch in the upper jaw, which often is found as a complication to the *Mordex apertus*, is also typical as a result of rickets. The mouth-breathing, adenoids, chronic pharyngitis, and the different bad habits often found with these patients are to be considered as secondary complications and not as causes.

With regard to treatment. If we want to treat *Mordex apertus* in the ordinary way as put forward by Dr. Angle, we elongate the teeth until they are in occlusion, but in this way we do not improve the facial outlines. You can all see that these patients have inharmonious faces,—the naso-mental distance is greater than normally,—and since with this kind of treatment we have to get the alveolar process to grow exceedingly high, especially in the region of the incisors, the retention of the teeth in normal occlusion is often very difficult. Then not alone does it take a long time before the structure of this new-formed bone is quite normal, but the bad habits which often follow *Mordex apertus* are not so soon forgotten and they can really produce an open bite again. It is quite true, as stated by Dr. Angle, that the treatment is very long and difficult, and we never can be assured that our treatment will not be a failure.

As in a case of *Mordex apertus* the upper jaw can be quite normal, and the relationship between the erupted part of the teeth, the alveolar process and corpus mandibulæ could be normal also, then the logical way to treat this deformity would be to bend the mandible at the angle until the teeth are in normal occlusion, and the facial outlines corrected. For this purpose I have constructed a bandage which, in the few cases (young children) where I have been able to use it, has proved to be of extreme value. The illustrations shows best how this bandage is constructed.

The chin cap must fit perfectly and has to go as far back toward the angle as possible. The head-gear can either be made of linen straps as shown here, or of aluminum bands (whichever is preferred). The cushion on the front of the head must be soft and has to be as broad as possible but care must be taken that it comes below the hair margin, otherwise the hair will fall out, as a result of the pressure exerted by the elastic band in the front. The two straps going down at the angle only serve to keep the chin cap in place, and are not elastic.

My treatment of a case of *Mordex apertus* is therefore divided into two parts. First I correct the different irregularities in the ordinary way with

the Angle appliances. Often a small extrusion of the upper front teeth is needed, as an underdevelopment of the os incisivum, which really aggravates the opening, is often found as a complication.

Then I construct my bandage, the manipulation of which is very simple. The elastic band in the front, which is not to be used too strong, bends the mandible over the occluding molars which serve as a fulcrum. The straps at the angle which only exert a dead power, prevents the ligaments at the articular joint from being stretched. The bandage (which of course will have the most value in the treatment of young children, as soon as an open bite seems to develop), has to be worn at night only, otherwise the elastic in the front might hurt the eye sight.

The occluding molars will of course be depressed a little, as they have to serve as a fulcrum, and it will be advisable to let the patient wear the bandage one, perhaps two years, after the treatment is finished, as a retaining appliance.

DISCUSSION.

The President said the question of the open bite was a very interesting one and it was well known that the condition was very difficult to treat. If something really practical came out of Dr. Lind's work, orthodontists would be very grateful to him.

Dr. de Vries said he had not used a headgear of the sort shown by Dr. Lind, but the one Dr. Law and he had been using had much the same superior attachment. They had been using a wire frame but were also making leather frames. The chin piece extended from behind the angle and covered the entire chin, extending over the mental protuberance. One rubber was attached at the angle and the other at about the region of the first bicuspid tooth. The method of having a posterior elastic force had greater influence in the bending of the mandible than an anterior force of the kind shown. The apparatus shown by Dr. Lind was a very good one.

Dr. Quintero said Dr. Lind's apparatus seemed to be very practical and he was sure that very good results could be obtained from it. He had not had many cases in his own practice, but there was one which he thought it would be interesting to describe from the standpoint of etiology. It was the case of a young girl of about eighteen or nineteen who had an almost normal occlusion. Her anterior teeth began to separate, and little by little she got an open bite. She was examined very carefully and the X-rays showed that her wisdom teeth were growing and were more or less impacted and were touching on the second molars and elongating them, and that naturally prevented her from closing her mouth. After extraction of the second molars she had to wear a headgear of the type described by Dr. de Vries, and after a short time everything came back into perfect order. He was not at all an advocate of extraction, but he believed there were a few very rare cases where it was necessary to extract a tooth or two, as in the case he had mentioned.

Prof. Chiavaro said with regard to the question of *Mordex apertus* being hereditary, he should like to have some further information on the subject. He believed more in mechanical forces. He had seen some three or four cases of open bites in children, in the temporary teeth, and he thought the treatment should be divided into treatment for temporary teeth and treatment for permanent teeth, and the latter should be divided into two sections, one for young children and another for old patients. He had had a case similar to that reported by Dr. Quintero in a gentleman twenty-one years of age, who came from a good family. The patient stated that while he was young he could close his teeth but that since the eruption of the third molar he had been unable to do so. It therefore seemed that the eruption of the third molar might act so as to open the angle of the mandible. In the next case that came before him he should try something to assist Dr. Lind's headgear, i.e., a vulcanite capping piece over the occlusal surface molars, which would act as a fulcrum, and surely would be of assistance in bending the mandible. Probably not every

one had noticed that the mandible often is bent after extraction of the first permanent molars.

Dr. Hans Hecht said that in the most cases of open bite which he had had to treat in his own practice, the molars were usually found elongated. It was only by the use of a headgear and rubber straps that the molars could be depressed and the bite closed, and he was sure that Dr. Lind's bandage would serve that purpose. He believed oftentimes open bite came into existence with the eruption of the wisdom teeth.

Mr. Boelger said his rather limited experience of the subject appeared to show that the majority of the cases of open bite were due to the causes put forward by Professor Chiavaro. The eruption of the permanent teeth seemed to have a great amount to do with it, because there was a great difference between the percentage of cases in temporary teeth and in permanent teeth. With regard to the wisdom teeth causing the opening in the anterior teeth, the same thing seemed also to take place when the second molar came into occlusion; by elongation, it seemed to have the tendency to prop the mouth open and the result was a deformity. With regard to the treatment, he felt inclined to rely more upon the apparatus shown by Dr. Lind than on the apparatus described by Dr. de Vries, because he thought that with a pulling force on the front part of the jaw the fulcrum should be left free and the fulcrum was the back part where the molars occluded with each other.

Dr. Harwood said that he did not quite understand why the teeth in the open bite, in very young patients, did not elongate as other teeth do which have lost their antagonist.

Dr. Weinberger said Dr. Younger had found it necessary to produce an open bite artificially for a child. The child had four lower incisors, four upper incisors, and the first molar of the permanent teeth. The lower incisors commenced to be abraded by touching on the upper and there was a slight amount of irregularity. In trying to correct the irregularity Dr. Younger found he could not do so on account of the closed bite. He therefore placed two gold caps over the temporary molars, so as to enable the first permanent molar to erupt a little more, which it did in about three weeks, and then the regulation was continued.

Dr. Rubbrecht said he had seen a few cases of open bite of the kind described and had always noticed an under-development of the upper jaw as well as of the lower jaw. The upper teeth were also in infra-occlusion. He wished to ask Dr. Lind how he was going to correct the deformity by the headgear, because it seemed to him to be quite necessary to bring about development in the upper jaw as well as in the lower jaw by intermaxillary force on the teeth.

Mr. Malcolm said that with regard to the etiology of the open bite it had struck him that it might be caused through some interference with the muscles which closed the mandible. Such a condition might be produced by infantile paresis. For instance it could be imagined that there was some weakness and that the closure of the mouth took place more by the action of the pterygoids, and the closure of the mouth would take place mainly with the condyle in the forward position. Another point that had struck him was that with normal mastication the muscular force of itself would be sufficient to depress the teeth which were in supra-occlusion; at any rate if the muscular force were normal, then those teeth would be forced down into normal occlusion if the theory with regard to the forces of mastication was correct. It was well known that the teeth did not become forced down, or very rarely, if ever, and therefore it would seem that there was something wrong with the muscular apparatus of mastication. He knew from experience that teeth could be depressed in their sockets. If there was a very great opening of the bite and force was applied, say in a person eighteen or twenty years of age, the teeth might be very much depressed and much mischief obtained. Before applying any strong elastic force for any period it would be advisable to see if there was room to accommodate the roots of the molars which were in contact.

Dr. Lind, in reply, said he formerly used an appliance like that which Dr. de Vries and Dr. Law used in Berlin but he now preferred this kind, because with the latter the power was obtained just where it was wanted and it was easier to bend the mandible. With regard to Dr. Quintero's remarks, he quite understood that it was easier to bend the jaw

when teeth were extracted, as in this case. If it seemed advisable for the patient to wear the bandage during the day he should advise the use of the headgear described by Dr. de Vries. He did not quite agree with Prof. Chiavaro in his proposed method of treating open bite. Sauer used the same method with vulcanite plates between the molars about twenty-one years ago, and Schmidt (Luebeck), also seemed to have used it, but although he had never tried it, he did not see why it was necessary. It was claimed by Prof. Chiavaro that it gave a fulcrum, but the molars themselves were a fulcrum and no new fulcrum was required. It must also have a bad influence on the ligaments of the joint. If he understood Mr. Boelger rightly, he claimed that the permanent teeth caused the open bite. He himself thought the permanent teeth erupted normally but the mechanical stimuli to the growth of the lower jaw had not been sufficient in the earlier years and the lower jaw had not its normal shape. It was well known that the lower jaw, from the embryological stage, was growing more and more downward in the posterior region, but that growth was chiefly caused by mechanical stimuli, and if the stimuli were not there, there could not be a normal development of jaw. If the molars erupted in a jaw with a short ramus necessarily there must be an open bite; otherwise the points of the roots would come out through the lower border. With regard to Dr. Anema's mention of Dr. Case, Dr. Case claimed that the direct cause was mouth breathing, that the patient had to keep the mouth open and a bending resulted. That, however, he himself did not think was right, because if the action of the masticating muscles was normal then the bending would not occur. He thought, the cause was to be found in the weak masticating muscles and insufficient growth of the jaw in the region of the angle. With regard to heredity, most cases were not hereditary, but he was sure some of them were. Why should the *Mordex apertus* not as well be hereditary as the abnormal mandible by the Habsburgers? He himself also had a case which was absolutely congenital. The physician who had assisted with the delivery of the patient told him that the lower jaw at birth was abnormally shaped.

THE LIGATURE JACK.

BY LLOYD S. LOURIE, D.D.S., CHICAGO, ILL.

THE "ligature jack" is intended to take the place of the regular jack screws, having the advantage of giving a lighter pressure and a pressure that is continuous.

It consists of a bar with a hook sliding in a split tube (Fig. 1). Tied from the hook on the bar to the hook on the tube, is a ligature (silk or grass-line), the shrinkage of which forces or rather pulls the bar out of the split tube. The knot of the ligature should be tied in the hook on the tube, to avoid causing the bar to bind in the tube.

Fig. 2 shows one of the appliances which was used for unlocking an impacted lower third molar. Fig. 3 shows the change in the position of the molar. The end of the sliding bar engages a pit or groove drilled in the third molar. This should be made large enough to allow the tooth to tip without binding on the end of the bar. The shrinkage of the ligature exerts such a light and even pressure that the patient need not be conscious of it, nor the anchor teeth strained in the least. Ligatures need not be changed oftener than once in two weeks, and three or four months is sufficient time to entirely unlock impacted third molars.

Fig. 4 shows one of the appliances as used for the expansion of the deciduous arch. The position of the hooks and the length of the split tube