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Biologic Orthodontic Therapy and Reality

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(Continued from Vol. VI, No. 2)

Biting Plate and Inclined Plane

The splints cemented on the upper incisors (or similar working appliances) to correct (nivellisate) the compensation-curve, as well as the cemented, biting-splint still used on the lower front teeth for the purpose of bringing forward, out of lingual occlusion, the maxillary front teeth, must, concluding from the material at hand, cause severe damage to all the tissues concerned. The moving force is the chewing force, which is absolutely an unbiologic remedy particularly because it works instantaneously and the patients try, by strong and frequent biting, not only during the meals but also at other times, to get rid of this disturbing hindrance as quickly as possible. And yet these methods are still recommended by Korkhaus, in his textbook,[33] as well as in one of his latest articles,[39] and he is the most outstanding supporter of "biological" therapy in Europe. The picture shown in both of these quoted works is reproduced in Fig. 112. The unavoidable strong tilting, resulting from this kind of movement, is indicated by arrows. By some authors this kind of procedure is even used and recommended for the treatment of real Class III cases! (Also by Korkhaus.) Fig. 112, II, shows the splint for the nivellisation of the compensating curve, (Korkhaus, Fig. 234).

To correct the *symptoms of Class III* in Class I cases, I, too, use a biting

plane, and the effective force is also the chewing force. But the alignment of the upper teeth proceeds gradually in periods of active treatment which are of short duration and these are followed by long intervals of rest, thereby effectively preventing the creation of a pathological angle of inclination, as well as severe tissue damages. This bite plane, which is quite the same whether used for the correction of single teeth or of all the four front teeth, is a detachable caoutchouc-splint which incloses *all* teeth of the lower jaw and carries, in the front, small inclined planes of soft gold, adapted individually to the postion of each single upper tooth. The buccal sections

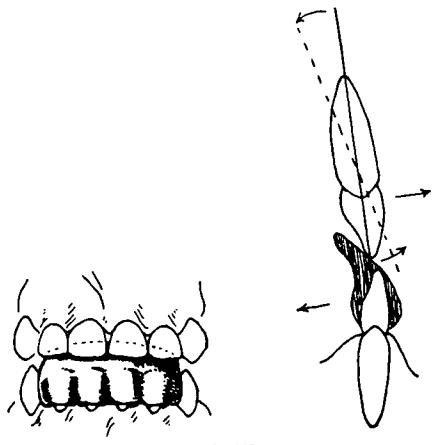

Abb. 442.
Silberschiene mit schiefer Ebene zur Progeniebehandlung im Wechselgebiß.

Abb. 234.
Aufbißfläche an den oberen Schneidezähnen.

Fig. 112
I. Inclined plane for the alignment of the upper front teeth. (Korkhaus, Fig. 442.)
II. Biting splint for the nivellisation of the compensating curve. (Korkhaus, Fig. 234.)

of the splint are so thick on the occlusal aspect that all the upper buccal teeth occlude at the same time as the front teeth strike on the inclined planes. In order to apply force on the front teeth for a very limited space of time, the buccal teeth are eliminated from occlusal contact by grinding the splint, using blue paper as an indicator. The front teeth are now pushed forward by the biting power for a distance that equals the double thickness of the blue paper, and an automatic stopping of the movement which effects a resting interval, is brought about just as soon as the buccal teeth have again found occlusal contact by the minute yielding of the front teeth. This generally occurs in one day—very often after some hours. Every two to

three weeks this process with the blue paper (articulating) is repeated, until the splint is perfectly ground off, so that the buccal teeth of the upper and lower jaw find normal occlusal contact again. In reaching this stage, the alignment of the front teeth has been obtained.

This process, which only requires frequent cleansing of the splint and the teeth during the day, as well as after every meal, secures slow movement of the front teeth, thereby avoiding too severe tissue damages and eliminates the establishing of a pathologic angle of inclination. The formation of spaces between the front teeth is also avoided. The normal ability to bite during the whole time of treatment is also afforded the patient. By the possibility of detaching the splint, control over the relations of the upper

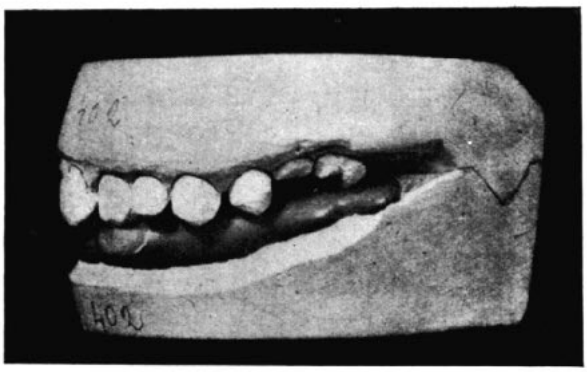

Fig. 113
New principle of the inclined plane.

and lower front teeth is provided, which is not at all possible if splints are cemented on the front teeth. By individual adjustment of the single inclined planes, rotations can also be managed, and their position can always be changed by revulcanisation according to the exigencies of the case. Such a splint is shown in Fig. 113.

In Fig. 114 we see, before and after treatment, a clinical case complicated by a decalcification of the teeth. This case is the more interesting as only three teeth were in lingual occlusion, while the left central incisor was in normal position and had, therefore, a normal angle of inclination. The three incisors, brought into alignment by the splint, exhibit the same (or a less pronounced) angle of inclination as the left central, which proves that the movement, performed slowly, was effected without marked tilting.

Alignment of High Standing Canines

Just as the usual biting splints and biting planes (in the use of which the full chewing force is acting without interruption until the desired effect

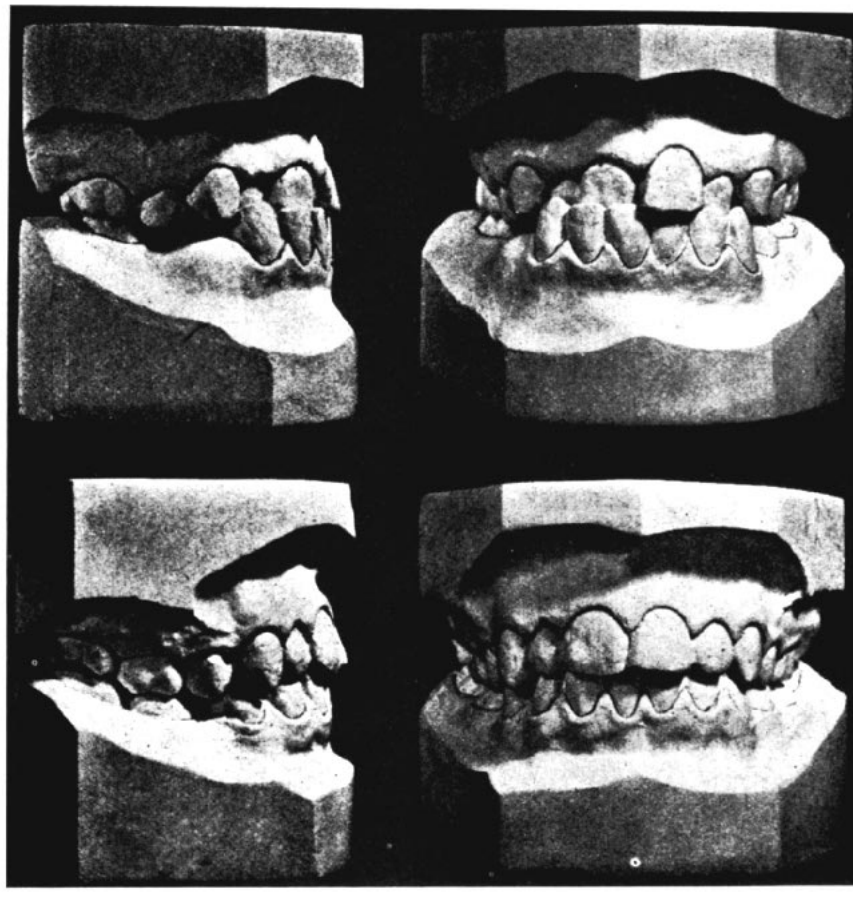

Fig. 114
Clinical case, treated with the inclined plane shown in Fig. 113. Upper models, before treatment. Lower models, after treatment.

is attained) cannot be considered as biologic procedures, so the same opinion must be held concerning the "elongation" of high standing or impacted cuspids by *continuous force* of rubber ligatures, springs or any other appliances working on similar principles. In this category, as already mentioned,

belongs the procedure of elongating the bicuspids by the continuous force of a spring from a labial or lingual archwire, in order to nivellisate the compensating curve. These two methods are also in use and recommended in Korkhaus' books,[33] (Figs. 227 and 249).

In all previously treated cases of high-standing, viz., impacted and surgically freed canines, which years ago were brought down into the line of occlusion by the continuous traction of rubber ligatures and which are now available to study for controls, death of the pulp has been ascertained. In some cases this occurred after twelve to sixteen years. In two of these cases, which suddenly presented grave clinical symptoms, after fruitless root canal treatment, the resection of the apex was performed by a surgeon. In one of these cases this repeated operation also had no success and extraction was necessary.

The modus procedendi, maintained by myself for many years, consists in applying, whenever possible, a space retainer after having gained the necessary room, and then leaving to nature the alignment of the canine, assisted only by serviceable lip-exercises. If the alignment proceeds too slowly, viz., if it cannot be performed by self-movement because the canine stands too far mesially over the lateral incisor or too far distally over the first premolar, then a correspondingly distally or mesially directed traction by rubber ligatures (punched from rubber dam) adjusted to the lower denture, is brought into effect, but this is used but one to three times *each week, during the night only.* This most gentle force, working over long intervals and only lasting for a few hours, is quite sufficient. It is, however, a trial of patience for the physician and the patient. But impatience to attain success is the principal cause of our failures. The pace of movement by continuous rubber-traction, not to speak of the continuous effect of a spring, which is quite the same no matter how gently adjusted, is much too strong and must strangulate or break the vessels which enter the apex. Such teeth offer, clinically, vital reaction for years, but die at last without exception—as far as my observations go.

Head Cap

The damages, always unavoidable by all of our procedures, will be reduced in a high degree or even eliminated entirely by leaving it to nature to carry out the intended movements and by managing only the possibility for these movements. In this way rotations of the front teeth, especially of the upper ones, will occur spontaneously in most cases after the removal of the responsible cause (lack of space), no matter whether this space was gained by spreading (expansion) or lengthening of the jaw. I have already

Fig. 115
A malocclusion simulating a Class II case. This was treated exclusively with a head cap and traction bar. Previously published in the Int. J. Orth. 1934, p. 764.

given examples for it in the Int. Journ. Orth., 1934, p. 763 and 764. Unintentionally the rotated upper teeth came nearly to alignment spontaneously during the distal movement of the buccal teeth by the headcap and traction bar, (Fig. 115). Two years after the finished treatment, without any retention, the mesiodistal relation is still ameliorated, while the condition of the front teeth, still slightly rotated, remains unchanged.

For the treatment of similar cases, which form a great portion of our practice-material and which deal with a forward wandering of the buccal teeth producing space-reduction for the front teeth, especially the canines,

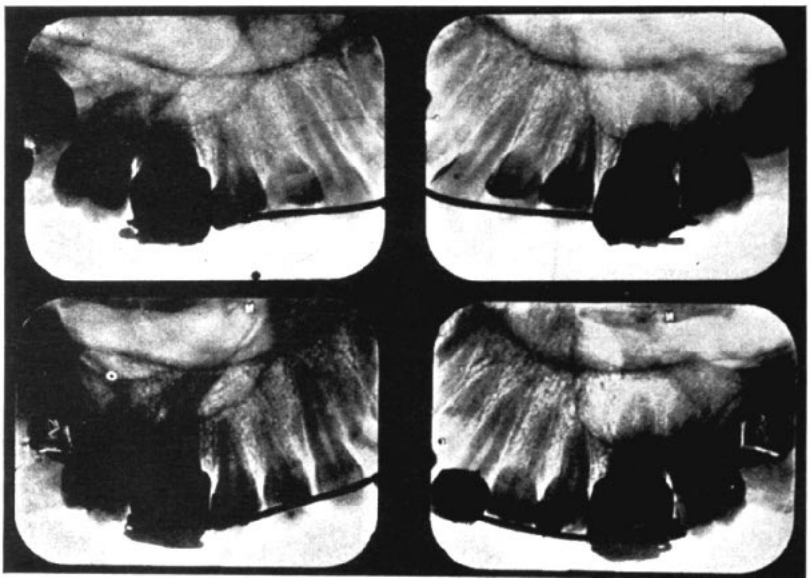

Fig. 116
X-ray pictures to Fig. 115; above before, below after treatment; no tipping of the molars has taken place.

and also in the treatment of Class II cases in which we carry the upper teeth backward rather than the lower jaw forward this procedure is, in my opinion, most recommendable. It has been practiced by myself and by many of my pupils for several years.

The X-ray pictures also prove that this kind of treatment does justice to the constantly repeated demand of Strang, enunciated in his last article,[56] (p. 32 and 33), "that the mere tipping distally of the tooth crowns is not sufficient" but "crown and root movement, coincidentally, is the factor that alone will meet the new requirement" (the gaining of correct axial position).

Thus we see, in contradistinction to Figs. 95 and 96, in Fig. 116, (the X-ray pictures to Fig. 115), that the distal movement of the molars was performed without tipping, which means without approach of their apices to the apices of the second bicuspids.

In Fig. 117 we see another Class II case, which was treated by one of my pupils in the usual way (with intermaxillary elastics) for one and a half years without success and was at last treated exclusively with the headcap up to the point where correct relationship of the buccal teeth was brought about. The canine and the front teeth, on account of the existing spaces

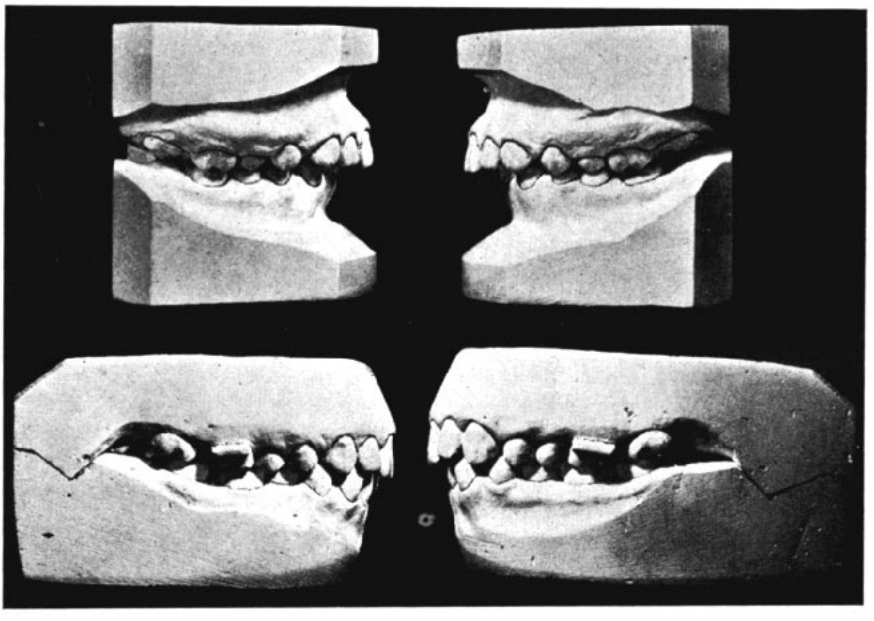

Fig. 117
Class II exclusively treated with the head cap, after 1½ years of vain endeavour to treat it in the usual way with intermaxillary elastics.

between the canines and first bicuspids, had to be brought to alignment by the aid of appliances. For retention, an arch, being in contact with the front teeth and (by means of spurs soldered to the arch) also with the tubes, was worn twice a week during the night. In Fig. 118 we see the X-ray pictures to Fig. 117, after completed treatment. No tipping of the molars had occurred.

Fig. 119 shows another case treated, by a former pupil, exclusively with

the headcap until space was obtained for the left canine; on the right was normal occlusion. To retain the space, the $\overline{4|4}$ were connected by a lingual wire resting against the front teeth and having a spur attached to it which was in contact with the distal border of the lateral incisor. The alignment of the canine was left to nature, as this usually occurs spontaneously, especially if this movement is encouraged by suitable lip exercises. Should that

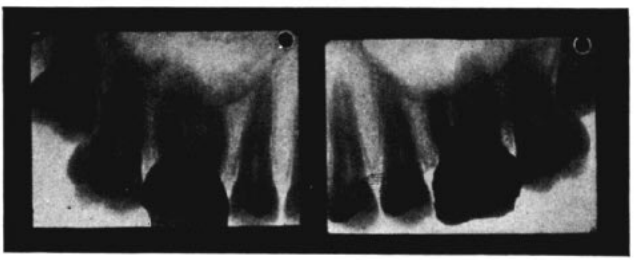

Fig. 118
X-ray pictures from Fig. 117, after treatment; no tipping of the molars.

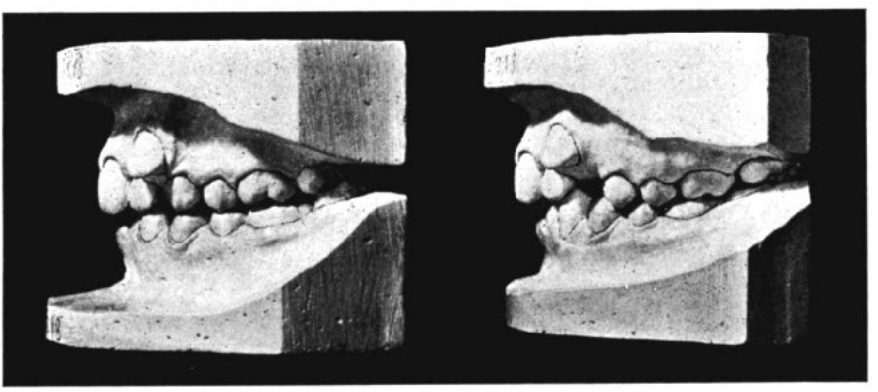

Fig. 119
Space gained for the left canine by the exclusive use of the head cap. Left before, right after treatment just before applying retention.

not be the case after a reasonable time (six months to one year), then the correct position will have to be attained by active measures, such as rubber bands attached to the lower denture and worn about three times a week but *only during the night.*

The X-ray pictures placed at my disposal are worthless as they do not illustrate the tipping or non-tipping of the molars because the X-ray apparatus was not focussed to harmonize with the direction of the septi.

In Fig. 120 we see one of the latest of Class II treated by myself with

the headcap exclusively. The profile demanded the backward movement of the upper teeth. The treatment has progressed so far that correct relation of the buccal teeth on the right has been attained. On the left, the distal movement has retarded somewhat. The force will now be applied more on this left side. Finally, the upper right cuspid must be rotated by an appliance if this does not occur spontaneously in the meantime. Enough room is present for this movement (little gaps in front and behind the cuspid). The

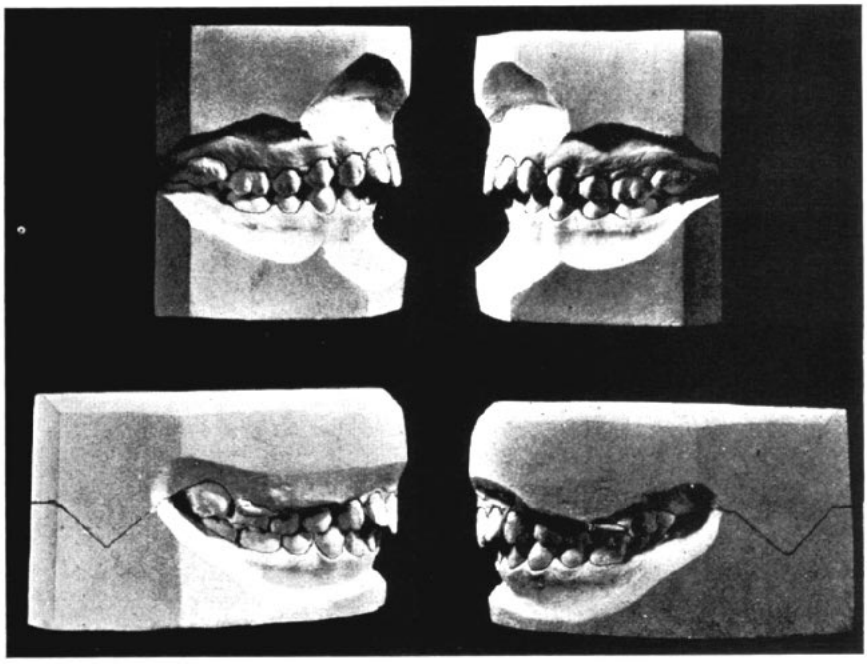

Fig. 120
One of the last cases of Class II treated exclusively with the head cap; upper models, before treatment. Lower models, during treatment.

correct interlocking of the canine was gained by universal movement without any influence of active force.

Fig. 121, the corresponding X-ray pictures to Fig. 120, shows that the distal movement of the molars was performed without tipping and that the co-movement of the bicuspids to distal was effected almost without any spaces appearing between them. The force was therefore somewhat too strong or it may be that the time interval for control was too great (ten weeks) in order to diminish the force in due time.

This method has the special advantage that the second and the first

premolars *go distally without forming the slightest gaps.* Between the first premolar and canine there is sometimes a space, but this by no means corresponds to the extent of the distal movement of the first premolar, a sign that the canine, under the influence of the traction of the ligamentum circulare, has gone along, too. The canine must be moved backwards for the remaining distance by active force which is obtained by applying the lightest of *intra*maxillary rubbers. This traction, too, has to work only at night and its mesial component on the molars is counteracted by the rubbers of the headcap.

The force necessary for the distal movement has been measured correctly and the treatment may be regarded as right, if there is *not the slightest gap* between the buccal teeth, if the molars *do not tilt* but remain *absolutely upright* and maintain their full functional possibility—that is, remain perfectly *insensible.* If something fails in one of these moments, the force is too

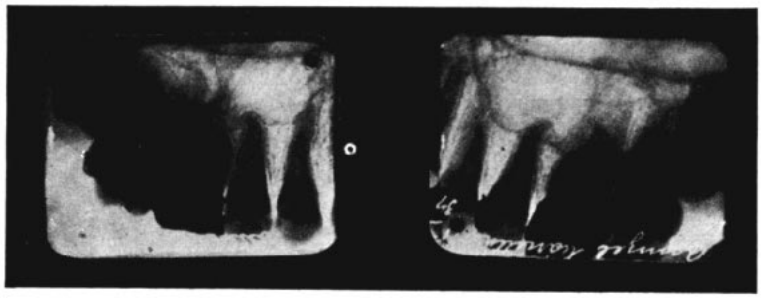

Fig. 121
X-ray pictures of Fig. 120; showing no tipping of the molars.

strong and has to be reduced accordingly. Sometimes it was sufficient or necessary to use the headcap only every other night, because the movement was too quick.

The support of the effect of the headcap and traction-bar by using intermaxillary elastics during the day is not permissible for two reasons: First and above all, the distal movement of the molars proceeds too quickly and spaces are formed between the buccal teeth so that these must then be moved distally by the help of appliances and we have deprived ourselves, thereby, of the great advantage of their co-movement; and there is the possibility and probability of tilting the molars. Second, there is danger of influencing the lower jaw to move mesially, which we like to avoid.

The appliance has to be fixed always to the first molars and brings with it distally also the second molars. If the distal shifting is not brought

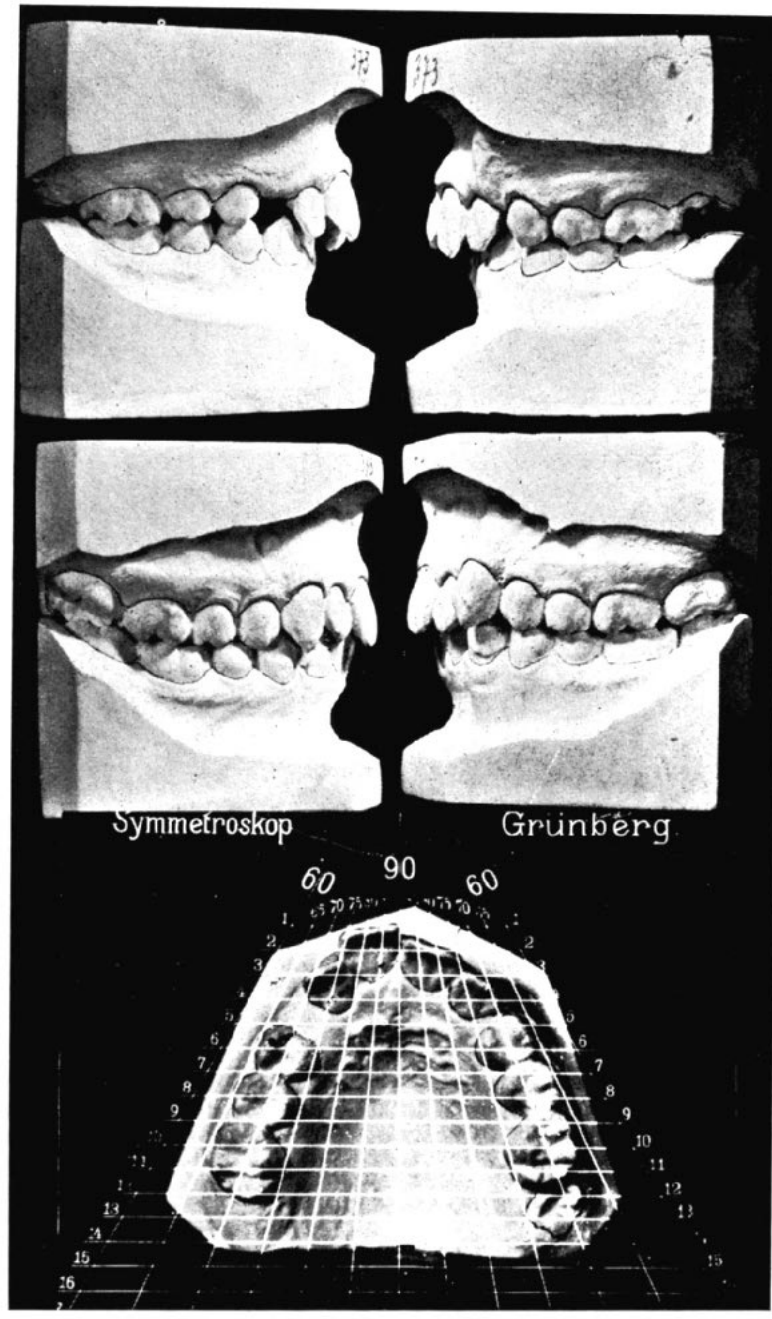

Fig. 122
Failure in the use of the head cap. For details see text.

about in this way, *which sometimes happens,* (see Fig. 122), the treatment is not a success. Several of my colleagues have had the experience that the distal movement does not proceed even if the bands are transferred to the second molars. I am not able to explain why, in spite of the diminished resistance, even the second molars in the course of many months did not yield. The third molar teeth were surely not the reason for it; they were always high up in the tuberosity.

As far as the observations up to today go, the upper third molars did not become impacted by these distal movements and have erupted already in many cases without any difficulties and without any annoyances to the patients.

In the case of a unilateral anomaly, as in Fig. 119, the spur on the archwire on which the traction-bar has to lie is not soldered centrally but shifted to the side of the anomaly, and placed between the lateral incisor and canine teeth. On the normal side, the rubber band is replaced by an inelastic cord. This cord is adjusted with sufficient length so that the bar is not pulled obliquely by the traction of the rubber band, but occupies a position parallel to the frontal plane. By this transferring of the spur to the side of the anomaly, the effect of the force is here increased, while it is reduced on the normal side. The tendency for any distal movement of the normally standing molar is further prevented by connecting it with the canine.

A condition for an exact effect is the correct location of the archwire within the crevice of the lips (not high labially), the right position of the elastics which should be parallel to the occlusion plane, a tight fitting of the headcap, which covers the front of the head and reaches deep to the neck, *and such a length to the traction bar* that it does not overlap the width of the face, whereby its dislocation during a side-posture of the patient is prevented. If, at such a breadth of the bar, the rubber bands press upon the cheeks, a flat cushion of cotton-wool, which is sewed on the headcap, is placed between the cheek and rubber bands. During the day the archwire is removed and placed in a corresponding form of plaster for two reasons: 1. To control the archwire so that it is not distorted or if so, to be able to rebend it (which is essential with patients living far distant or abroad) and 2. To prevent, thereby, the archwire from being lost or put elsewhere.

If, sometimes, the patients cannot stand the light pressure of the headcap during the night, the apparatus may be worn during the day for a few hours.

My own experiences and those of my pupils, in regard to distal shifting in the lower jaw by means of the headcap are, on account of the exceedingly

rare necessity for this movement, too small to permit a convincing judgment. There are, however, some cases now under treatment in which the distal shifting is in process in the lower, as well as in the upper jaw. In these cases the headcap is worn alternately, one night on the upper jaw and the next night on the lower jaw.

This kind of treatment finds scientific justification by the verification of my statement (1912) by several authors (Häupl, Adami, McCrae, Noyes) that the fibres of the periodontal membrane or of the ligamentum circulare become strengthened and increased in number by stimulation, thus increasing their power of resistance (see deductions on p. 30, Vol. VI, No. 1).

The supposition may be justified that the co-moved teeth, not influenced by direct appliances, do not suffer the same heavy damages as the *directly-fluenced* ones, but nothing definite can be said about it, because such teeth have not been examined. The great advantages of the co-movement of the buccal teeth and the most favorable influence on the front teeth make superfluous any further argumentation against all the methods advised for the distal shifting of the molars (Housset,* Nevrezé**).

As already mentioned, the distal shifting of the molars, and therewith the co-movement of the buccal teeth, *does not* always *succeed*. The plan of treatment strictly prescribed by the diagnosis cannot be carried out, and the result, if the diagnosis was correct, is at any rate to be regarded as defective or as a failure. Only one illustrative case will be given here. In Fig. 122, I, the starting models are shown; in Fig. 122, II, the final models. On the right side there was an edge-to-edge bite; on the left there were full Class II relations. The space for the right canine is reduced and that for the left was completely closed. The occlusal view which, for symmetry-comparison, was put under the Grünberg Symmetroscope, shows that the unequal closing of the gap for the canines was caused partly by a forward wandering of the buccal teeth and partly by a lingual wandering of the front teeth. The forward movement on the left side was absolutely stronger than on the right (compare lines 5 and 12 in Fig. 122, III), if we consider that the right lateral teeth, too, have wandered forward up to the edge biting position.

While the relatively small distal shifting on the right side had been performed within a few months by the headcap without any spacing between the teeth, and the alignment of the canine followed spontaneously, yet not the slightest change had taken place on the left side in spite of the use of intermaxillary rubber elastics during the day, which were finally applied for the support of the intended distal shifting. The space for the left canine

*Orthodontie Francaise, Vol. X, p. 59, Edition de la Province Dentaire, Lyon, 1935.
**Orthodontie Francaise, Vol. X, p. 319, 1935.

could at last be attained only by the labial movement of the front teeth. The space gained, however, is not sufficient and the left canine stands a little labially and rotated. A further forward-pushing of the front teeth, in order to gain the full space for the canine, was not permissible, for the lower jaw had normal form and size. The upper front teeth, after removal of the retention, would have tilted to the lingual, in order to accommodate themselves to the size of the lower jaw, or they would have rotated in some way, and the cosmetic result would have been, in any case, far behind the achieved one.

Age for Treatment

On the basis of the knowledge which we have obtained from these experiments, much greater emphasis must be placed upon the following methods of procedure: Preventive orthodontia; performing as much treatment as possible while the deciduous teeth are in position; and using the myofunctional therapy of Rogers. This demand is not only justified on the ground of the presented findings but also as a result of the recent findings of Breitner-Tischler,[44] who have ascertained in histologic monkey material, the favorable influence upon the germs of the permanent teeth by the movement of the deciduous teeth.

Therewith the answer to the question as to the most favorable age for treatment is given. *Only* if the roots of the deciduous teeth are already so greatly resorbed that their quick loosening by the orthodontic procedure is to be feared, and a favorable influence on the germs of the permanent teeth hardly can be expected, should the treatment be postponed and performed on the permanent teeth. In this case, as already mentioned, the X-ray negatives must first of all be made, to see whether the formation of the root is completed, viz., no open foramen still exists. In contrast to this stands the demand of C. R. Backer[45] (p. 1096): "It is sound judgment to apply corrective treatment to teeth before their root development is completed."

The demand of supporters of the biological tendency, that the various treatment-periods are to be adapted to certain physiologic periods of development and growth, is contested justifiably by many authors "for one knows nothing definite about these periods"; also, "as there is no safe point of support with regard to the individual, active periods of jaw-development therefore, also, are no standard," (Aasgard,[46] Grude[40]); and "we cannot possibly foresee the time when a child is entering an accelerated growth period" (Eby,[49] p. 821).

Time of Retention

As already mentioned above, based on the healing processes of the

cementum resorptions, (p. 36, Vol. VI, No. 1), we cannot, from the histological specimens draw binding conclusions as to the time of healing because of the divergent findings. As discussed in extenso in the "Crisis of Orthodontia," the question of the *retention time* remains further an empiric question. It is impossible to fix a certain time of retention, even for cases of the same appearance, of the same age and sex, and the same diagnostic classification, (quite apart from constitutional moments) for the reason, first of all, that we can never know how great are the damages that we have caused and the reparative processes in the periodontium are dependent, with regard to extent and rapidity, solely on the degree of the reparative ability of the periodontium.

Prognosis

As we do not know anything about the amount required and the time necessary for the reparative processes, which are quite different in different individuals, *we can in no case of finished treatment say whether there will be a permanent success or whether a relapse is to be expected.* Just as we cannot prophesy at the beginning of a treatment whether it will be an easy or a difficult case, neither can we foretell whether, in certain cases, by establishing normal occlusion, a growth of bone will follow, thus making a success of our treatment. Consequently we can only agree with Ainsworth[47] who, from his great experience, made the following deduction: (p. 182) "that no conclusions are to be drawn from the cases shown unless it be the rather depressing one that among cases treated early, the successful ones are those where bone growth was destined to occur, and the unsuccessful ones where for some reason there is little or no bone growth." Hellman[48] arrived at similar conclusions after his extensive examinations on convincing diagrams by which he proved that orthodontic measures cannot in any way influence the natural growth and that "appliances may at times not only be of no help, but even be a definitive hindrance to natural processes of growth." "In nearly the same sense," says Eby,[49] an experienced practitioner (p. 821), "There are a great many cases which respond so beautifully to treatment that they seem to have the very will to meet every suggestion. There are other similar cases which may defy all efforts to the end of a modified result or failure. In both instances we may be dealing with conditions we think we are familiar with, and still either result may occur." A more hopeful point of view is expressed by Strang,[58] though also he points out (p. 314) "that we certainly cannot hope for 100 per cent successful results in many of our cases."

In contradiction to the statements of Hellman that the establishment of normal occlusion is by no means a guaranty for a full bone growth,

while on the other hand cases with quite defective occlusion may show normal growth, is the emphasis placed upon "physiologic retention" by Simon[59] (p. 277) which means the interdependence of bone form from the function, though he freely admits "the risk of a relapse" notwithstanding the "biologic mechanic therapy." The "permanency of the success" depends, according to this author, "upon whether we succeeded to establish normal anatomic-morphologic and normal physiologic functional conditions," (p. 276).

A similar contradiction of the statements of Hellman is the statement of McCoy[60] (p. 315) "that function and growth go hand in hand." A definite standpoint in regard to the possibility and frequency of relapses is not to be found from McCoy, for he only gives out of the most different points of view, instructions how to prevent a relapse (p. 314-320).

The uncertainty of the situation was splendidly characterized by a remark of Hawley's (Dental Cosmos 1919, p. 449): "Years ago one of my friends who had been struggling with the difficulties of retention . . . said to me 'If anyone would take my cases when they are finished, retain them and be responsible for them afterwards, I would gladly give him half the fee.' "

Nothing has changed as regarding this situation up to today—fifteen years later.

In contradiction to these statements is the constantly repeated and yet always unproved statement of the biologically orientated orthodontia as to the lack of need for any retention (Mershon) and the statement of Korkhaus[33] (p. 106) "that after such a procedure (the biologic procedure) a fear about a relapse *cannot* exist any more and that a longer retention is unnecessary." For this statement the proof has not been given up to the present day by anyone and this must first be given from a large amount of material. The few cases shown by Mershon[42] are not sufficient. After all, I do not presume, as already mentioned, to pass definitive judgment on the method used by Mershon, himself, as I was not able, even in performing these treatments, to imitate successfully his method of treatment. The cases that I examined were those where the lingual arch was used in Europe, and these had nothing to do with Mershonism. Korkhaus, though invited, did not give proofs for his statements. The same may be stated about Ketcham, to whom this invitation was given in 1929,[10] p. 652, and concerning which he surely has taken notice. (Proof for this lies in his remarks in Inter. Orthod. 1932, p. 447.)

Also Simon, to whom shortly after the appearance of the first edition of his book the invitation was issued to demonstrate at least some of the cases illustrated in his book several years after treatment, has not accepted

this invitation up to today. He has, therefore, not given the proof up to the present time as to whether he succeeded, at least in the majority of his cases, by following the methods of treatment that were strictly prescribed by the diagnosis made from his gnathostatic method, and that he could guarantee, by such a proceeding, "the establishment of normal anatomic-morphologic and normal physiologic-functional conditions, on which conditions depend the permanency of orthodontic results, (p. 276).

Also Salamon, who has written many hymns on the lingual arch, has not given any proof for the justification of his former enthusiasm.

From all the cases which are at my disposal, only three gross failures were shown, (Figs. 60, 75 and 122). In the beginning of the treatment no special difficulties could be expected or presumed; yet, in spite of this, it was not possible to carry out the plan of treatment prescribed by the diagnosis. As such a possibility cannot be precluded from any case, it would be interesting (as hitherto it has not been proved, too) to learn from good authorities conclusively, to what percentage they have succeeded in carrying out, actually, the strict scheme of treatment dictated (prescribed) by the gnathostatic or cephalometric diagnosis. Only by knowing this proportion and misproportion, respectively can it be decided and conclusively determined whether these methods, in the future, can claim only theoretical or also practical interest.

"Diagnosis and therapy are interlocking tooth-wheels of the same machinery. Diagnosis has only sense if it provided a helping therapy; therapy must be founded on diagnosis free from errors," (Salamon[67]).

Whether we treat according to biologic or unbiologic principles is not, above all, decisive for the achievement of permanent results. Only those unknown moments, pointed out by Hellman and Ainsworth, which cause, in certain cases, and do not cause, in other cases, a favorable growth of bone to take place, are of importance and, by no means, the above quoted moments pointed out by Simon,* the attainment of which is not in our power.

The attained successes are, therefore, not the result of our exclusive personal merit, as, for instance, the presumed correct analysis and treatment of the case. Hence, failures cannot be held as exclusively personal to the orthodontist. Relatively successful will be that orthodontist who was fortunate to have the opportunity of treating more of those cases which responded favorably to treatment; relatively poor in success will be anyone so unfortunate as to be confronted with opposite conditions in his cases.

Therefore, it may, on the whole, be useless to quarrel as to whether gentle, intermittent forces or, on the other hand, "biologic" continuous

*p. 169 of this article.

forces mean our safety. But my rejection of the manifold methods recommended finds justification in the negative or poor results found when making re-examinations which, oftentimes, were repeated for a long time. The humiliating poorness of results and the entire absence of reliable proofs for the correctness of the recommended methods, together with the many good permanent results which were obtained in the use of the expansion arch by myself, by many of my pupils and the followers of the Angle School in general, have brought me to the conclusion that the kind of procedure must be responsible in some way for the quality of the final product. It is not to be wondered that the ultimate result of our endeavors is attended with great uncertainty, if we but realize that our corrective measures, because of our very poor knowledge of the etiologic factors, are seldom of a casual but, in the majority of cases, only of a symptomatic nature.

That all our measures rest on uncertain fundament is further easily accounted for, if we keep in mind from how many different parts the tissues with which we are concerned descend embryologically. Consequently, all of these cannot be successfully influenced to the same degree by our corrective procedures which are very similar for all cases, differing only in some details. "The basis of the cranium and the bone-septum develop from the cartilaginous primordial-cranium; the upper jaw, vomer, front-bone, etc., develop as cover- or 'Beleg'-bone, viz., phylogenetically regarded, develop from skin-products; the lower jaw rises from the Meckel cartilage; the teeth are epithelially preformed; inherent in these embryologically different tissues must be an unequal energy of growth. Therefore, by the hypoplastic disposition of a single one of these or of all of these germ-tissues, the most different variations can be brought about," (Franke,[43] p. 171).

If I am opposed to and condemn different methods of treatment and, in spite of the reported general pessimism, still propose new methods, I do it because orthodontic treatment always will and must be performed and perchance I may help to augment the percentage of our permanent results by these new suggestions. Many of the things that I have showed have been tried for years and have been found to be correct (the nivellisation of the compensating curve; the headcap; the new form of the biting splint). Some of the suggestions, for the definitive judgment of which the time of observation is still too short, are very promising, (spontaneous rotation of the incisors after providing sufficient room; new kind of ligature). Certain damages are inevitable, but the reparative force of the human organism must be very powerful, so that even the demonstrated severe damages gradually experience recovery and probably these structures are restored to normal, for otherwise the rare reports of bad after-effects from orthodontic intervention could not be accounted for.

At any rate, we must always keep in mind that we work with living tissues and that each individual is a new problem wherein no prophecy for the whole line can exist.

Appendix

Elevation of Inclined or Impacted Third Molar Teeth

The elevation of impacted third molar teeth is about the only place where I find recommendable the continuous force of the spring, and where it has proved to be most excellent. In these cases all the skeptical objections uttered against it are not valid.

The ill-famed method, known as the "chiselling-out" of impacted third molar teeth, a terror for the dentist and a still greater one for the patient—that method with the lingering wound-and-after-treatment, accompanied by pain, lasting for weeks and often insupportable; frequently attended with trismus; that method for which still new modifications are recommended, should, at last, be condemned to disappear from the therapeutical lexicon of the dentist, in so far as we have not to deal with decayed and periodontically diseased teeth, which call for an immediate and oftentimes life-saving intervention.

One does not have to be an orthodontist, to say nothing of an experienced orthodontist, in order to apply successfully a method of treatment for these cases which takes less time and trouble than a difficult extraction and which precludes any danger or any unforeseen but always possible complication, and leads to a good result. Quite apart from these moments, the once lifted molar does not have to be extracted because, with the removal of the impaction, all trouble disappears and does not come again. In this way a sometimes valuable tooth is preserved for the patient. If, however, it seems best to extract the raised tooth, there are no special difficulties—no more than in the extraction of any other normally standing molar, it being easily accessible to the forceps or lever, and by the "orthodontic" movement loosened to a considerable degree. This loosening disappears completely some weeks after the discontinuation of the efficacy of the spring and the raised molar can be felt in the mouth as a normally standing third molar.

Should an occasionally made X-ray picture, possibly not taken at the time of an already beginning dentitio difficilis, reveal a strongly tilted or already wedged position of the third molar that would not indicate a normal development, the phrase, "prevention is better than cure," should be remembered, and the raising of the tooth should be performed before dangerous or disagreeable symptoms demand an immediate surgical intervention under unfavorable conditions. Yet in these cases a wide incision or the removal of

the mucous membrane suffices to eliminate the acute inflammation and the often already beginning trismus. The raising can be performed after the fading of the acute inflammation. The chiselling-out, performed under such unfavorable local conditions, quite apart from the after-pains, means great danger for the patient, because no surgeon can safely guarantee the impossibility of a sometimes lethally ending complication. (Osteomyelitis, mediastinitis, sinus-thrombosis.)

The making of the appliance is very simple. If the impacted tooth is not visible by a point, it can be uncovered by removing a small piece of the mucous membrane and, wherever accessible, a little wire is cemented into the crown. This wire has, at its upper end, a hook-shaped bend so that it can receive a spring (u, Fig. 123, I and II). Now a band is placed on the molar in front of the third molar tooth. If the inclination of the impacted tooth is not very pronounced, the resistance of a continuous tooth-row can be regarded as sufficient for its raising, but it is advantageous, in order to spare this anchor-tooth, to connect it with the molar of the other side by a lingually running wire, lying in contact with the front teeth (f, Fig. 123, III). By this means, the anterior teeth are added to the resistance and above all, rotation of the anchor-tooth is prevented. This rotation, however, can with certainty be avoided without this connection if a little detail, when making the appliance and described below, is taken into consideration.

If there are spaces between the teeth, they must be filled up for the purpose of gaining sufficient resistance, which is managed by a cemented band with a soldered-on supply tooth. If the adjoining tooth to the tooth which bears the appliance is missing (f.i. $\overrightarrow{6|}6$) this $\overrightarrow{6|}6$ is substituted by a connecting part, soldered on the band of the $\overrightarrow{7|}7$ and thus the necessary contact with $\overrightarrow{5|}5$ is established.

On the buccal side of the band which bears the appliance, some lock is soldered, (S. Fig. 123, I and II) from which a wire runs horizontally to the distal, (fi, Fig. 123, I and II). This wire is bent, at its distal end, rectangularly downwards. At the lower end of the bent part, which, corresponding to the local conditions, need not be longer than 2 to 3 mm., a 0.50 mm. diameter highly elastic spring-wire is soldered and coiled up in few windings, near the point of soldering into a short spiral spring still having a straight, projecting end which is directed toward the hook previously placed in the tooth and lies, in a passive state, distal to the hook. The direction of the coiling must be similar to that seen from the occlusal view in Fig. 123, II, so that the still passive spring-wire will be coiled up a little more when made active by being caught under the little hook "u." When this is done, the spring

maintains its spring-force until the hook, "u," (and with it the tooth), has been pushed so far distally that its new location corresponds to the original passive position of the spring. In order to be coiled up in the right way and

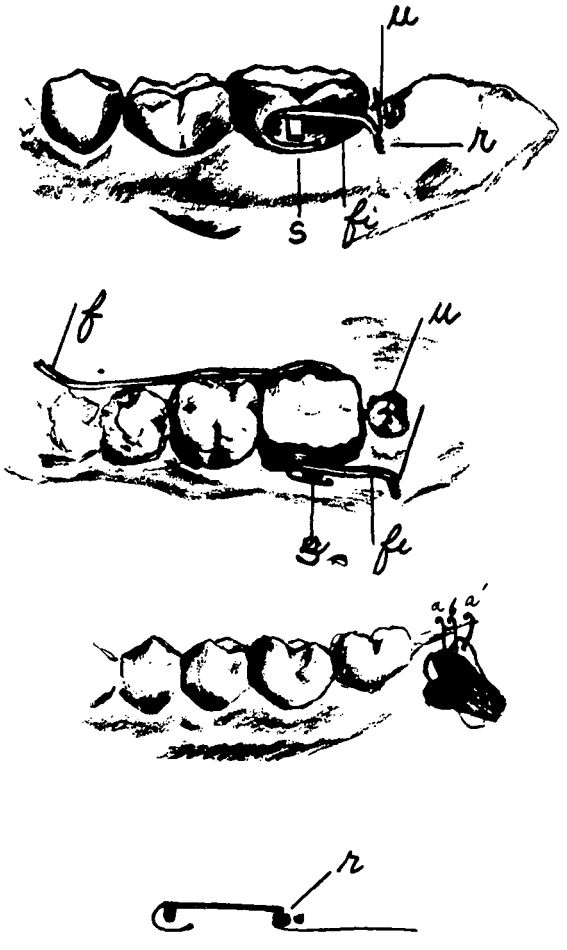

Fig. 123
Spring for the elevation of impacted third molar teeth. (For details see text.)

to become active, the spring wire in our case can, therefore, only be soldered in such a way that its free end lies distal to the soldering-point, (Fig. 123, IV). The coiling can now be effected only in the direction of the arrow. If the coiling takes place in a reversed manner, the passive spring, (in the

same position as in Fig. 123, II) must be coiled backwards to be caught under the little hook "u." The spring then has no or only a little tension, which is soon exhausted. To obtain absolute distal effect, the rectangularly bent part of the wire, (r, Fig. 123, I and II) must lie in the same frontal plane as the cemented little hook "u." If that is not the case, if, for instance, the knee of the wire is lying mesial from the cemented hook, the third molar will be shifted more buccally by the force of the spring and the anchor-tooth tilted lingually, if it is not prevented from doing so by the lingual arch. In paying attention to this detail of equal frontal-position of both the cemented hook and the rectangular bend of the wire, the lingual tilting of the anchor-tooth is certainly avoided.

In addition to giving the spring-wire the distal effect it should also be given a slight elongating efficacy, which can be attained by bending up the spring, before it is put into the little hook, to a level with the occlusal surface of the anchor-tooth. An unlocking of the spring from the hook can be avoided by its shape. By the "elongating" component of the spring sometimes a shortening (depression) of the anchor teeth can be observed.

In no case was a renewal of the spring or an increasing of its force necessary. One only examines the case every four or six weeks with an instrument, exerting a mesial-movement on the spring-end, to ascertain if the spring has still tension.

If, because of a greatly tilted position of the third molar, the little hook changes from position a, Fig. 123, III, to position a^1, which shows that the spring, at this time, has approached too much toward its original passive position and consequently no longer has sufficient effect, (quite apart from the created buccal component) the wire, (fi, Fig. 123, I and II) must either be lengthened to the distal or, if that is not possible on account of the local conditions, (as in case, Fig. 126) a second, third or fourth little hook must be cemented mesial to the first hook, (b, Fig. 123, III). This must be done, first, to again make active the spring and, second, to restore the condition which will produce an exact movement to the distal, i.e., to have the hook and the bent-down wire-end again lying in the same frontal-plane. When cementing new hooks no changes whatever are necessary on the appliance or on the spring.

In no case so far treated has there ever happened breakage of the spring if coiled up in this way and no renewal of the spring because of loss of elasticity was ever necessary.

When the wedging of the tooth has been removed, the spring is made inactive by coiling it up a little more and it is left for some weeks as a retainer in situ. If one decides upon extraction, the moment of releasing

from the impaction is most favorable on account of the existing loosening of the tooth.

The third molar shown in Fig. 124 was raised up in four months. The regular frontal-position of the cemented little hook and spring-fulcrum was renewed at intervals of four weeks. As the case was one of a bleeder, no extraction was made. On the right, in Fig. 124, we see the condition about one year after the elevation.

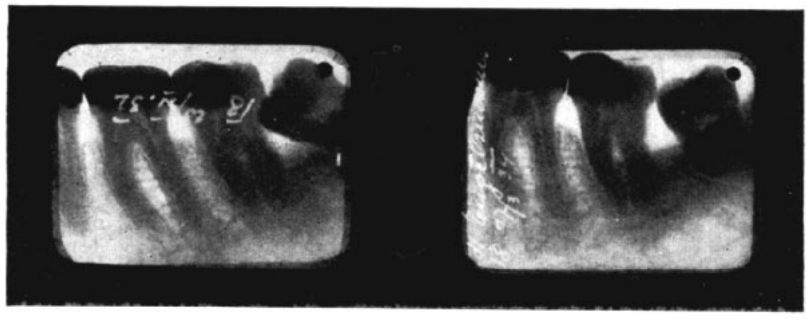

Fig. 124
Third molar tooth delivered from impaction.

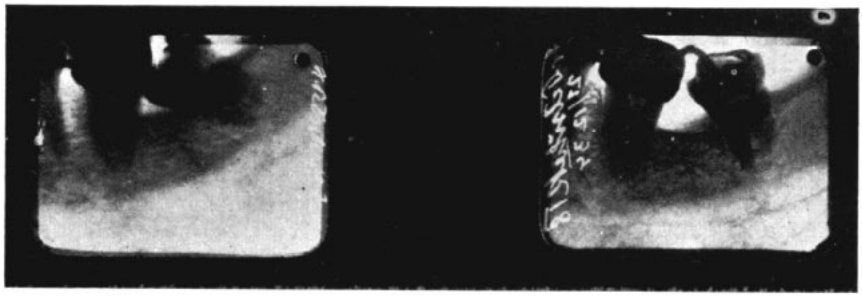

Fig. 125
Third molar tooth elevated. On the right, condition just before the extraction.

Fig. 125 shows another case after the adjusting of the appliance and on the right, Fig. 125, after the elevation. This case also required four months of treatment, during which time the spring was only twice made active. After the removal of the appliance the tooth was extracted by a short lever movement.

Fig. 126, left, shows a completely horizontal-lying third molar tooth after the adjustment of the appliance and the cementing of the first hook.

Local conditions did not allow a distal lengthening of the bucally lying spring-support. Therefore, at each appointment, at intervals of six to eight weeks, a new little hook, lying more mesially, was cemented. On the whole four hooks were cemented before the tooth had gained a favorable position for an easy extraction.

The described process does by no means represent an orthodontic intervention, sensu strictiori. Consequently, continuous working forces are admissible.

This simple manner of releasing impacted third molar teeth precludes all introductory mentioned troubles or moments of danger for the patient. The extraction of the released tooth, as to difficulties and healing, is the same as that of an incisor.

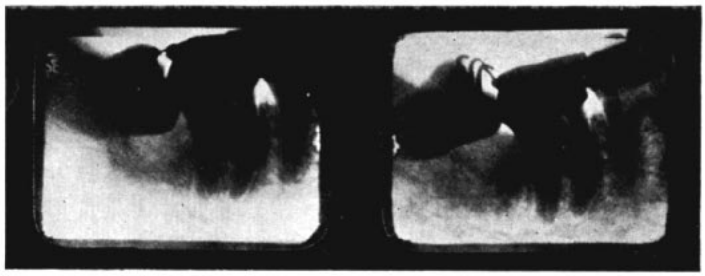

Fig. 126
A quite horizontally lying third molar tooth. On the right, after cementing the third hook.

Conclusions

1. The findings in human material do not permit unrestricted confrontation with animal material. Conclusions drawn relative to the happenings in man by deductions from those in animals are not forthwith admissible.

2. The fundamental condition for every biologic movement, whereby bone-resorption keeps pace with the tooth-movement, as is the case in natural growth and development, cannot be fulfilled by any orthodontic appliance.

3. Certain damages in the bone, cementum, periodontium and pulp are unavoidable, and one must always reckon with them.

4. These damages are incomparably greater in the use of continuous force than in the use of gentle intermittent force.

5. To reduce these damages to a minimum, only the most gentle, elastic, intermittent and always perfectly directed forces, with insertion of frequent rest intervals of longer duration, are to be considered for practice.

6. The smallest excess beyond the physiological pressure-conditions in the periodontal space is bound to result, as a consequence, in the appearance of cementum resorptions.

7. The cementum in man is an extremely vulnerable tissue, which does not need, in order to be resorbed, the resistance of osteoid, offering, pretendedly, more resistance to resorption.

8. As a result of the changes in the periodontium through the increased pressure, osteoclasts and cementoclasts develop. The resistance of the common bone suffices to bring about cementum resorptions. The quality of the bone (either calcified or uncalcified) has nothing to do with the question as to the formation or non-formation of cementum resorptions.

9. Exact conclusions as to the direction of movement can be drawn from the position of the cementum resorptions.

10. The extent and depth of the resorptions depend on the kind of force, on its intensity and the duration of its action. Each cementum resorption can endanger the tooth.

11. By the influence of continuous forces, the depth of the resorption can amount to such a degree as to produce perforation into the pulp.

12. The cementum resorptions are almost always filled up by secondary cementum. Whether this secondary cementum has full value of function is still a point of dispute.

13. The secure position of the ligature for a long time and the avoidance of change of direction of force at its renewal, guarantee, (in consideration of point 5), the least possible pathological changes in all respective tissues of the paradontium.

14. The disappearance of the alveolar crest is nearly always to be ascertained in our procedures. In the use of the expansion arch and ligature, if its breakage is avoided, it occurs only on the side of pressure. In the use of the lingual arch and fingersprings we find it, on account of the continual jiggling movements on the side of pressure and traction. For the same reason we find, in the first case, in single rooted teeth, two, in the latter, four resorptions in the cementum, corresponding to the places of increased pressure.

15. The disappearance of the alveolar crest is not uniformly circular but intact alveolar crest alternates with deep substance losses.

16. It is not known whether there takes place a restitution of the once disappeared alveolar crest.

17. The almost always ascertained formation of periostal bone apposition (osteophyt) in animals, to compensate for the thinning of the alveolar wall brought about by the resorption from the periodontal side, is

existant in man in only small degrees—often not at all. If it is there, it amounts only to a fraction of the periodontal resorption. An actual attenuation of the alveolar wall takes place.

18. The absence of bundle bone on the traction side is proof enough for the unbiology of our procedure.

19. With the application of gentle intermittent forces no deviation of the apex in the opposite direction to the crown-movement is to be ascertained by microscope in the first eight weeks. The fulcrum lies at the apex and the movement is accomplished according to the law of the one-armed lever. If the duration of movement, which under no circumstances can correspond to the conditions according to point 2, exceeds eight weeks, the deviation of the apex is microscopically ascertainable. The movement is accomplished according to the law of a second armed lever.

20. From application of continuous force a strong deviation of the apex follows immediately, which must always be regarded as an absolute pathological appearance.

21. A microscopical noticeable difference of width of the periodontal space at the pressure and traction side, already noticeable without measuring, is a sign of unbiologic tooth movement.

22. The formation of the angioma-like tissue in the periodontal space on the pressure side is to be understood as a pressure-diminishing auxiliary measure of nature, which only develops from the application of gentle intermittent forces, and this occurs only so far as the maintained vitality of the cells makes this means of defense still possible.

23. The over-shooting of the mark of the once initiated resorption is also to be regarded as a pressure-diminishing subsidiary of nature.

24. Jiggling movements of the tooth are, contrary to the hitherto general conception, not to be considered any more as an etiological factor of genuine root-resorption, and just as little as the action of strongest intermittent forces.

25. The relatively rare finding of a genuine root-resorption in the use of the lingual arch is not a proof for its biological action; the unavoidable jiggling prevents the formation of root resorptions.

26. In order to obtain a "biologic reaction" there does not exist a general admissible routine for all cases either as to the amount of force, or as to the extent of movement in certain periods of time. Each treatment is an individual problem.

27. The only criterion at our disposal, in order to avoid too severe pathological changes, lies in the continuous firmness and insensibility of the moved teeth.

28. Biological orthodontic movement does not exist.

29. Cemented biting caps (splints) or similar working appliances, as well as the use of chewing forces in general, to force the treatment of any malposition are absolutely inadmissible, and are to be cancelled from our orthodontic methods.

30. The supposition is that the ascertained co-movements of single teeth and tooth-groups effected by the application of the headcap, develop on these teeth results which approach more closely biological conditions.

31. The headcap represents, for the distal movement of the upper buccal teeth, the appliance of choice. As a result of the space gained thereby in the anterior segment of the denture, a spontaneous rotation of the incisors usually follows. From rotations attained in such a manner, as in all spontaneous self-movements, no relapse is to be feared.

32. The numerous disadvantages attributed to the Angle expansion arch are not justified. It possesses all possibilities to overcome any occurring tasks.

33. The decision of the question, expansion arch, or lingual arch, depends primarily upon their respective efficiency, and, to a lesser degree, upon the damages to the tissues. In contradiction to the attitude of present-day "biological" orientated orthodontia, the cosmetic must be given the last place.

34. Prophylactic orthodontic treatment on the deciduous denture and Roger's therapy are to be ranked first in our measures.

35. An X-ray status before the start of treatment is an obligatory demand, not only on account of the question of root-resorption, but also that we may ascertain how far the root formation has been accomplished. A negative ascertainment demands postponement of treatment.

36. Owing to the divergent findings in the healing processes it is not possible to state for all cases valid numbers of definite time for the retention. For this, as well as for the active treatment, only individual moments can be taken into consideration.

37. Such an individual consideration is indispensable simply for the reason that the rapidity and the extent of the reparative processes depend upon the degree of the preserved vitality of the periodontium, as well as upon the amount of the damages that have been produced. But we know of no means of ascertaining the progress of these reparative processes.

38. With the elimination of force the reparative processes start at once.

39. The reconstruction method demonstrates, in prominent clearness and comprehensiveness, the complicated processes, for it mediates a substantial idea.

40. There is no sure prediction as to permanency or failure of the

obtained success in movements of teeth brought about by orthodontic intervention.

41. In the prevailing majority of our cases our permanent successes are successes at random, for we do not treat casually but symptomatically and we never can foresee whether the structural changes and growth of the bone, indispensable for a permanent result, will really follow or not as a result of the influence of normal occlusion and the therewith attained normal function, as established by our procedures.

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