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A magazine established by the co-workers of Edward H. Angle, in his memory. . . . . .

The Angle Concept of Class II, Division I Malocclusion

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This paper is not to be interpreted as a defense of Dr. Angle's concepts. The controversies that have raged over them, however, have shown very clearly that there is a general and wide-spread misunderstanding of what Dr. Angle believed and tried to teach. My only purpose in writing this article is to attempt to explain some of Dr. Angle's ideas and to point out the significance of certain of his contributions. In order to consider the Class II problem, it will be necessary to review such points of controversy as the 'Maxillary First Molar', 'The Classification' and the 'Line of Occlusion'. All of these subjects are links in the chain and we cannot understand one if we neglect the others.

It is easy to understand differences of opinion among men and easy to forgive them, but it is not easy to forgive disagreements that arise from misunderstandings that have their roots in ignorance. And this apparently is the condition that faces us with regard to many of Dr. Angle's ideas. There is general and wide-spread ignorance and misunderstanding as to what he believed and this is very hard to reconcile in a progressive profession. There seems to be only two possible causes for the conditions and after a little teaching experience one is no longer shocked at the discovery of them. One is the disinclination on the part of the average student to think for himself; and the second is his inability to visualize anything other than purely mechanical concepts. The vast majority of men who have been questioned on Dr. Angle's theories have never read Dr. Angle's own words

on these controversial points. They have been content to accept the conclusions of others as to what was intended and, if we are to judge from what has appeared in print, their guides and informers have not always been reliable.

For twenty-five years many of Dr. Angle's closest friends in orthodontia tried to induce him to write an explanation of these principles, for they realized that most of the opposition arose through misunderstanding. Writing, however, was by no means his favorite past-time, for he wrote laboriously. He had struggled, harder than anyone will ever realize, to put down in words the beautiful concept of the denture that was his and he dispaired of ever making it clearer. So his urgers were always put off.

I was one of those who more recently tried to get Dr. Angle to do this work, but without avail, and my only excuse for endeavoring to interpret his ideas for others is that my own interpretation of them was carefully checked, on all of the salient points, by Dr. Angle himself. This paper is an attempt to show, by quotations of his own words, the growth and development of Dr. Angle's ideas, and we cannot understand the Class 11 question without first grasping the facts that went before it.

The paper is necessarily long and for that reason it seems wise to start by enumerating the points I shall try to make, so that these may be borne in mind during the reading.

1. The Angle Classification is based upon the relation the lower jaw bears to cranial anatomy and this relation, at present, can be determined only through a study of tooth relations.

2. The maxillary first molar is the most dependable point from which to start such a determination, but the location of this tooth was not intended by Dr. Angle to be taken as correct wherever found.

3. The 'Line of Occlusion' is not 'the line of greatest occlusal contact' only; it is the ideal architectural plan of the entire denture.

4. The aim of Angle's Class II treatment is not the developing of the mandible by appliances but rather the placing of the teeth in such a position as to enlist *natural* forces for this development.

Until 1899, when the classification was published, orthodontists were concerned primarily with attaining the best interdigitation of cusps that was consistent with an esthetic aligning of the teeth. Dr. Angle was studying from a different point of view. He was asking why we have a definite number of teeth and why, in lower animals at least, this definite number is always arranged in a characteristic manner for each species. It was in this way that he discovered the significance of what we now call Normal Occlusion and from that day he taught occlusion as the foundation of orthodontia.

This was the beginning of the biologic concept and I shall attempt to show how this concept grew in Dr. Angle's mind from this simple beginning until it had its final development in an all-embracing biologic philosophy. 'The Line of Occlusion'.

To attempt to trace the exact steps by which Dr. Angle made his path from discovery to discovery would be impossible but it is possible to obtain hints from his own words which give some indication of the course he followed in his reasoning. That he received many valuable aids from the study of lower animals cannot be denied and it is quite probable that his investigations in this same field led him to reflect upon the relative significance and importance of different teeth in the denture.

Having demonstrated to his own satisfaction that there should be a definite orderliness in the arrangement of teeth and that only one plan of arrangement could possibly give the fullest efficiency to an organ, the primary function of which was and always had been the obtaining and preparing of food, he next thought upon the marked deformities found in Man. The broad foundation he had laid for himself enabled him to appreciate the significance of what he saw rather than merely to enumerate details and he realized that these deformities could be placed in groups which had specific and common characteristics.

The Classification of Malocclusion was given to the profession in 1899 and appeared in the March and April numbers of the Dental Cosmos for that year. As we read it, if we remember, some of the concepts of the day,—concepts that were held to be correct and were subscribed to by the entire profession, we can get some idea of the revolutionary character of this contribution. Teeth were considered to be the only significant factors and any arrangement which would accomplish an interdigitation of cusps and give the mouth a pleasing appearance of 'straight teeth' was the end sought, even if eight or nine dental units had to be sacrificed to this end. Some of this is hinted at in the opening paragraphs of the paper.

> "It would seem that the term malocclusion would be far more expressive; for in studying the subject we must not lose sight of the importance of the dental apparatus as a whole and the important relations not only of the two arches to each other, but of the individual teeth to one another. The shapes of the cusps, crowns, roots, and the very structure are all designed for the purpose of making occlusion the one grand object, in order that they may best serve the purpose for which they were designed,—namely, the cutting and grinding of the food. Examined carefully, it will be seen that there can be no 'irregularities' of the teeth if they are in perfect occlusion, but that all must be regular and even, each contributing to the support of the others, and all in perfect harmony. Not only this, but the jaws, the muscles of mastication, the lips, and even the facial lines, probably, will be in best harmony with the peculiar facial type of the individual."

In this one paragraph we have two ideas which were startling for that time. First, occlusion was pointed out as the great end of the denture. We have a denture for the purpose of preparing food and all other purposes it may have must be subservient to this. Any orthodontist of that day would have agreed with this, yet most orthodontists were devoting all their energies to improving esthetics at the expense of function. Dr. Angle did not ask them to forget esthetics but he did say that if function was thought of first they would properly come closer to true esthetics than was possible through mutilation. The second idea is that teeth are not the entire picture. We must think of jaws, masculature and facial lines.

> "From an extensive intercourse with dentists and students I am impressed with the belief that although diagnosis is the question of greatest importance, it is yet apparently the least intelligently studied and comprehended."
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> "In the beginning, I wish to thoroughly impress the necessity for complete separation of *diagnosis* from *treatment*. This statement seems necessary for the reason that I have so frequently noted a mental conflict in the endeavor to consider the two together in the first instance, the question of the treatment by appliances or by extraction apparently forcing itself into the first view before the facts upon which these should be based have had due consideration. As a matter of fact, if the diagnosis of any given case is first thoroughly mastered the line of treatment and the appliances necessary to bring about the various tooth-movements required are, in nearly every instance, clearly indicated, even to the devices necessary for retaining the teeth when correctly placed."

There is much in these lines that could be applied today. Although occlusion has been accepted as the end sought in orthodontic treatment, diagnosis continues to be 'the least intelligently studied and comprehended'. Too many men are trying to correct abnormalities without understanding even the nature of their problems. Too many are looking only at an alignment of teeth while they sacrifice teeth, time and the good name of the specialty. And today, as in 1899, the remedy for the condition is the same as that given in the next paragraph of Dr. Angle's paper.

> "In order to diagnose all cases of malocclusion correctly, it is necessary to be familiar with, first, the normal or ideal occlusion of the teeth; second, the normal facial lines. These must be so fixed in the mind as to form the basis from which to reason, and to intelligently note all deviations from the normal; and it must follow that without clear, fixed, and definite ideas of the normal, the limits or boundary lines of the abnormal must also be vague and indefinite, and the line of treatment the merest empiricism".
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> "A knowledge of the occlusion of the teeth being of the first importance, it should embrace a knowledge of not only the normal relations of the occlusal surfaces of both permanent and deciduous teeth, but of their entire forms and structures. The growth and normal development of the jaws and muscles, together with the development of the teeth and the normal periods for taking their positions

in the arches, should receive careful attention. Our perceptions of the subject would be broadened also by a comparative study of the occlusion of the teeth of the lower animals."

Here we have another intimation that there is a relation between the teeth and the surrounding parts. In this particular passage only the relation to 'normal facial lines' is mentioned but as we go farther we shall find this principle enlarged upon and reiterated all through Dr. Angle's writings. That this relation is not fixed and unchanging is hinted at when he urges the study of the growth of the jaws and muscles, the development of the teeth and their eruption and the study of comparative anatomy. Incidentally, this paragraph gives us an inkling of his own sources of information and speculation.

We have heard so much of the recent discovery of the part muscles play in malocclusion that the following paragraph from the same paper is quoted here. Dr. Angle wrote these lines in 1899.

"The harmonious relations of the occlusal planes and of the dental arches are further assisted by another force,—namely, muscular pressure, the tongue acting upon the inside and the lips and cheeks upon the outside of the arches. The latter serve to keep the arches from spreading, as do the hoops upon the staves of a cask; the former prevents too great encroachment upon the oral space. I am satisfied that this muscular pressure is a far more important factor in relation to the study and correction of malocclusion than is generally recognized. It not only contributes to maintaining the teeth in their normal positions and to harmony in the size of the normal arches, but it is equally powerful in maintaining inharmony in the sizes or relation of the arches and malocclusion of the teeth, when once established."

And then comes the introduction of the classification.

"As already stated, there can be but seven distinct positions which teeth in malocclusion can occupy. These, with their inclinations, form combinations practically limitless in variety, to the casual observer presenting differences so distinctive as to render each apparently wholly dissimiliar from all the others. Failure to grasp the underlying principles has given rise to the teaching that, as each case is so radically different from all others, it necessitates the invention and construction of an appliance to meet its special requirements."

"In reality all cases of malocclusion may be readily arranged in as well-defined classes as plants, animals, or the elements; and by thoroughly mastering the distinguishing characteristics of occlusion and of the facial lines peculiar to each class, the diagnosis of any given case is greatly simplified."

"At the same time, familiarity with the possibilities of tooth-movement and with the changes requisite to each distinct and separate class, to attain harmony in occlusion and in the facial lines, and a knowledge of the standard appliances designed for each special class as best suited to produce these changes, will reduce the difficulties of treatment to the minimum."

"In diagnosing cases of malocclusion we must consider first, the mesio-distal relations of the dental arches; second, the individual positions of the teeth. In what is said upon diagnosis and in the classification which follows, for convenience, two points have been selected from which to note variations from the normal in the arches. These points are indicated by dark lines in the engravings, which show the normal relations of the cuspids and mesio-buccal cusp of the upper first molars with the buccal groove of the lower first molar."

"Of course, in determining the mesio-distal variations *all* of the teeth are to be taken into consideration, but the points indicated have long been favorites with the author in beginning the diagnosis of cases, for the reason that the first molars and cuspids are far more reliable as points from which to judge, owing to the fact that they are found to occupy *normal* positions far more often than any of the other teeth, the molars being less restrained in taking their positions, while the cuspids, owing to their history and great size, force their way usually into relatively normal positions in their arches."

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"*Class 1.* Relative position of the dental arches, mesio-distally, normal, with first molars usually in normal occlusion, although one or more may be in *lingual* or *buccal* occlusion."

"*Class* 2. Relative mesio-distal relations of the dental arches abnormal; all the lower teeth occluding distal to normal, producing very marked inharmony in the incisive region and in the facial lines."

"*Class* 3. The relation of the jaws is abnormal, all the lower teeth occluding mesial to normal the width of one bicuspid, or even more in extreme cases."

"The loss of a tooth by extraction or otherwise is usually followed by such marked changes in the positions of the remaining teeth that both diagnosis and treatment are greatly complicated. Therefore great care and judgment should be exercised, making allowance for the tipping of teeth and other changes which have taken place as a result of extraction."

There are only a few points to be accentuated here but they are important because they have never been generally understood. First, it should be noted that the mesio-distal relation of the *dental arches* was the basis of the classification and not the relation of the molars or cuspids. These points were selected for convenience. In fact, this was still more markedly pointed out later when the words 'the jaws and dental arches' were substituted in the seventh edition of 'Malocclusion of the Teeth', 1907, where we read on page 35.

"Hence in diagnosing cases of malocclusion we must consider, first, the mesio-distal relations of the jaws and dental arches, as indicated by the relation of the lower first molars with the upper first molars—the key to occlusion; and second, the positions of the individual teeth, carefully noting their relation to the line of occlusion."

The other point to be especially noted is the last paragraph, when the changes following extraction or mutilation are spoken of and the need for making allowance for this is stressed.

The closing paragraphs of the paper once more bring out the point that there is a relation between the occlusion of the teeth and normal facial lines. There is talk of the 'outlines of the perfect face' and there seems to be no doubt that at this time Dr. Angle was thinking in terms of a single perfect face. (It remained for Professor Wuerpel, a teacher of Art, to correct this impression. The amusing story connected with this change of viewpoint relative to facial perfection, may be read in Professor Wuerpel's paper, 'My Friend, Edward Hartley Angle,' published in the September, 1931, issue of 'The Dental Cosmos'). These closing paragraphs follow.

> "One of the evil effects of malocclusion is the marring or distortion of the normal facial lines. It follows that, in the application of the principles of orthodontia, our effects should be so directed that the improvement of these lines of inharmony shall result in molding and modifying them to harmonize with the ideal lines of facial beauty so far as lies within the range of the possibilities of the art and of the type and temperament of the individual. Our opportunities for benefiting humanity are very great in this field, far exceeding those offered by any other branch of dental science; for patients with facial lines so distorted as sometimes to be a marked deformity of constant humiliation to themselves and their friends may be so treated as to bring about a complete transformation of the facial expression, even to the establishment of lines of beauty. But, lacking a proper appreciation of the true purpose of orthodontia, we may work in such utter ignorance of the requirements of facial art, as is often done, as to not only fail to improve the appearance, but even to produce results more unpleasing than the original condition."
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> "In order to work more intelligently it is important that we shall have first fixed in our minds the outlines of the perfect face, so that we may ever have an ideal which, like teeth in normal occlusion shall serve as a pattern from which to note deviations and to guide us in all our efforts toward the establishment of the normal."
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> "All who hope to attain real success in the correction of malocclusion should cultivate a love for art and the beautiful, and form the habit of observing and carefully studying the normal and abnormal lines of the human face, together with their relations to and dependence on the occlusion of the teeth. An appreciation and intelligent application of the principles of art must go hand in hand with the successful practice of orthodontia."

One can well imagine the furor that the classification aroused. It apparently shocked most of the profession into silence for a time until they realized its revolutionary character, but this was not for long. Strange to say, the storm did not break over the classification itself; this seems to have been accepted as a handy way to catalogue cases of malocclusion. The

real fight developed over a point that had not been emphasized in the contribution; namely, the molar relationship.

Naturally, an intelligent student when reading 'all of the lower teeth occluding distal to normal' would ask immediately, "What is being taken for normal?" Upon reading back, the only thing he could find would be the reference to cuspid relationship and the mesio-buccal cusp of the upper first molar with the buccal groove of the lower first molar. Few, apparently, read the qualifications that went with this assumption, and the rest jumped at the conclusion (which is still prevalent) that Dr. Angle considered the first molar a fixed point.

With this mistaken assumption before them, all sorts of arguments, mixed with sarcasm, were advanced to laugh down the idea that any tooth could be relied upon to that extent. Men who had never thought of anything deeper than teeth, now became very critical of them. Skulls of South Sea Islanders with an almost anthropoid prognathism were displayed alongside of white skulls to show how the first molar varied in relation to skull anatomy; mutilated cases, with this tooth forward to the extent of its own width on one side against a normal position on the opposite side and other anomalies were exhibited as proof of the fallacy of the doctrine.

Not until 1905, six years after the introduction of the classification, did Dr. Angle make any serious effort to answer his critics and, knowing the man, one can well imagine that during this time he went back over the ground again and tested every step anew. Then came his much discussed paper, 'The Upper First Molar as a Basis of Diagnosis in Orthodontia' which was subsequently printed in full in the June, 1906, issue of the Dental Items of Interest. Both the paper and the discussion which followed its reading hold a great many points of interest. Early in the introduction, Dr. Angle says:

> "Yet, I say, notwithstanding all this, we do have a simple principle to guide us to a correct, intelligent decision in diagnosis, which is also a sure clue to a correct line of treatment, even to retention. A principle, too, which eliminates 'guessing', is antipodal to both 'guessers' and 'guessing'. It is a principle, too, so simple that experts are not needed to understand and interpret it, but any sincere student, no matter how humble, with intelligence to master the English alphabet can understand this principle and apply it successfully in diagnosis, and this principle applies to every case of malocclusion in existence in a human denture today, or that ever did exist. Indeed, every case of malocclusion carries with it this principle which is a key to its own solution, its correct diagnosis, and that key is the key to occlusion—the first permanent molars, or more particularly as I shall show you later, *the upper first permanent molars*. I repeat that this key is not for the 'guesser' or the would-be improver of God's law, but for the student of occlusion—the interpreter of Nature's great law in the human denture."

"You know our friends of the old school loudly proclaim that the first molar is so variable in regard to location as to make it utterly unsuitable as a basis from which to reason; that it is located, as it were, by chance, having no connection with the facial requirement, and is a mere will o' the wisp which is in great danger of leading vast numbers of the younger members of the profession astray and to the committing of serious blunders with lasting results, as well as seriously handicapping the progress of orthodontia, etc., etc."

"Now, if the upper first permanent molar were variable and unreliable as to its correct location, they would indeed be right and we would be wrong, but I shall try to prove to you that instead of varying so greatly from its correct location, it is, on the contrary, *if intelligently comprehended,* found to be in reality one of the most stable and unvarying points from a typal standpoint of our whole anatomy, therefore wholly trustworthy as a basis for diagnosis."

The italics in the above paragraph appear in the paper and it should be apparent to the reader that the qualification, 'if intelligently comprehended' and 'from a typal stand-point' would be absolutely unnecessary if the location of this tooth were to be accepted as correct wherever it might be.

Dr. Angle then goes on to enumerate various points in the early history of the tooth before it comes into function. He is beginning to bring in his evidence, the basis upon which his deductions are founded. The nature of this evidence should be carefully noted.

"The first molars have the largest crowns, best defined cusps, largest roots and strongest attachments to the alveolar process of any of the permanent teeth, and owing to their great size and their position in the jaws they are chief in the function of mastication. As the first molars are planted in the alveolar process long years before the permanent teeth, anterior and posterior, shall take their places in the line of occlusion, they have become very firm of attachment; so by their size and strength they can and do act as dictators of these teeth, and indirectly of all the other permanent teeth, as they take their respective positions in the line of occlusion at their respective times. They also act as wise rulers, determining by their own length the length of bite, and in a way, in no small degree, decide the length of the face and the art relations, which, in importance, is best illustrated —and in a striking manner—by what the face misses in after years when the teeth are sacrificed, allowing the settling together of the jaws and the shortening of the face, with consequent inharmony of facial lines, always so noticeable, and their wise control of the normal mesio-distal relations of the jaws by the locking of their well-defined cusps is a factor in the plan of growth and development of the face and jaws of mighty importance."

"In building the human denture nature has worked toward a definite end, to produce the most efficient parts with the most efficient arrangement of these parts, that they may in function be most efficient. And this type has been Nature's pattern for the human denture as long as man has been man and had need of teeth."

Do we find here any talk about 'planes', 'perpendiculars', 'angles', 'measurements' or fixed points? Is there any effort to locate the molar mathematically? Is this the reasoning of an engineer? Decidedly not.

There is, on the contrary, much talk of the early history of the tooth, its primitiveness (hence stability), its size, its position at the center of the load; in short, its biological significance and the facts that palpably point to its importance. This is not the talk of the mechanic, looking for a magic formula. Rather, is it the biologist, endeavoring to interpret from what he can gather from all sources, the significance of his findings. He sees that the positioning of this tooth in the jaw is such that it has the best chance to assume its important role when it comes into function.

It is inconceivable to the writer that after the rest of the paper has been read, there could have remained any trace of the idea that Dr. Angle thought of this tooth as a fixed and unchanging point. Yet that his intention was and is, generally misunderstood is shown very clearly by orthodontic writings. Simon's effort to disprove what he considered to be Dr. Angle's views, shows very clearly this misconception. And strange to relate, Simon only succeeded in falling into the very error he thought Dr. Angle was guilty of. He offered the upper canine and its fixed relation with the orbit as a substitute for the molar. His is a mechanic's concept as against Angle's generalized biological principle.

> "That no two human dentures have ever been created that were exactly alike it is more than reasonable to suppose, since it has never yet been demonstrated that Nature ever duplicates her forms. No two trees of the same species have ever been alike; no two leaves on the same tree are ever just alike; no person's hand or foot, while of definite pattern, have ever been exactly like those of any other person, nor have any two teeth of different persons, even in the same family, ever been counterparts one of the other. In every denture that Nature has ever created each tooth has differed from every other tooth of the same kind, and every dental arch has differed in size and form in a corresponding manner, just in the same degree that every other fibre and feature of every individual has differed from those of every other individual, yet blending in the whole into the greatest harmony possible to the *type* peculiar to the individual."
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> "But these slight deviations from the general plan in individuals of species in trees, leaves, dentures, hands, feet, etc., are not abnormalities. They are nature and found in every department of nature, and the general form of the dental arches and the arrangement and placing of the different teeth with relation to each other in these arches—occlusion—is just as constant as the arrangement and placing of the five fingers on each hand and of the five toes on each foot."
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> "Naturally, then, for the very wisest of reasons we use the first molar as a basis for our diagnosis, for, as we have seen, it is Nature's very corner-stone in the building of the structure (the denture) and we have noted with what zealous care as to time and place Nature, the great architect of the type, placed that

corner-stone that the parts of the denture might be, when completed, not only in perfect harmony with the whole denture, but with the rest of the head and even the entire anatomy, just as she has been careful in the placing of other important parts of the head, as for example, the sphenoid bone, the eye, or the ear, that when all was completed they would be in harmony with the whole."

"That we find the upper molar to vary mesially or distally in its location with the rest of the skull in different races, tribes and individuals according to type is not surprising to men who have any knowledge of comparative anatomy."

Compare the above paragraph with Simon's statement on page 366 (Diagnosis of Dental Anomalies).

"I was able to determine, by gnathostatic methods, that in a large majority the orbital plane passes through the summit (or point) of the cusps of the maxillary canines. The relationship, moreover, is not dependent on the age of the individual and I call it the 'law of the canines'."

Dr. Angle's paper closes with the following paragraph.

"So far in what I have said relating to the first molar the upper and lower have been regarded as of equal importance, as they should be, for in function of mastication they are equal, as well as in influence upon the rest of the dental apparatus during its growth and development, and they should be of equal importance in diagnosis, *but only when they succeed in locking normally* in their mesio-distal relations. But owing to the fact that the lower molar is dependent upon the caprices of the migratory mandible, it is in consequence less reliable than its sturdy, though somewhat smaller, but far more steadfast antagonist. For this reason the upper first molar becomes the true basis of diagnosis."

The discussion which followed the reading of the paper was spirited. It was printed in full and the interested reader is referred to the files of the magazine for complete details. Many endorsed it, some probably without understanding it any better than those who condemned it, and the arguments raised to refute it were the same as those we hear today. One discusser, however, Dr. William J. Brady, whose remarks follow, showed very clearly that he grasped the biological significance of the contribution.

"First, there is no absolutely fixed point from which the development of the cranium can be gauged, either in the animal man or any other. The nearest to a fixed point is the anterior margin of the foramen magnum, the place used by zoologists generally as the starting point for all cranial measures and comparisons."

"Second, the next nearest fixed point is the placement of the principle grinding tooth of the superior maxillary. This is a premolar in some animals and a molar in others; it is the first molar in the case of man. Examination shows that the relation of this tooth to the rest of the cranium is very constant throughout all the animals of a certain species or type, the relation, of course, varying with each type, but remaining practically constant for all animals of a kind. This fact applies to man the same as the rest."

"If abnormality of location occurs—as it does at times—the reason therefore is usually so plain as to admit of exact calculation of the correct position of the tooth, and this point Dr. Angle especially emphasized, but it has been overlooked or misinterpreted in the discussion."

"It is on this very point that Dr. Angle has been subjected to the most criticism, all of which has come from a misunderstanding of his meaning, though I must say that it looks as though some of his critics have not tried very hard to understand him. He has never at any time taught that the first molars are invariably found in the proper place, but has maintained that Nature is very constant in correctly placing them, and that any malposition thereof can almost always be accounted for by some simple cause, and the correct position calculated, and this teaching is certainly correct."

"There should be no difference of opinion in this matter, or at least it should not take the form of criticism of the paper from a misunderstanding or misinterpretation of its statements. Such proceedings are unscientific, the thing we especially want to avoid. There should be no question between any of us at all over this, for I think we practically all believe the same thing, and we have lost sight of the main question, and are discussing mere differences of expression."

"The differences of opinion lead me to feel that we are not yet familiar enough with the development of the face, jaws, and teeth. We cannot fully understand the presence of the abnormal till we comprehend the origin of the normal. We cannot master such problems as this one till we have traced the development of every bone of the cranium from its beginning to its completion, when we can see what Nature intends to perform and can understand what really occurs when it fails to reach the intended end. We will be at sea on many thing till such study has been made."

In closing the discussion, Dr. Angle did not attempt to argue the point further. He asked that the audience think over the points that had been made and reflect on them. Then he closed with this paragraph:

"Those who listened carefully to my paper know that I intended to lay down no inflexible rule, but only one which is, I believe, the nearest to an inflexible rule that we have as a basis to reason from in diagnosis of cases of malocclusion."

There are several reasons for the general misunderstanding of Dr. Angle's contentions. In the first place, he had a very broad back-ground and great reasoning ability. He studied everything that came under his eye but was not content to merely assimilate facts. Facts interested him only insofar as he could discern their significance. His concepts were built up step by step and each step was checked by every device of an unusually alert and ingenious mind. The road he traveled in his reasoning had no short-cuts but it was traveled so unconsciously that he did not realize that other men had not been that way before. His failure to realize this accounts for his inability to make himself clearly understood.

A teacher is usually faced with two great obstacles and the way he goes about overcoming them will largely determine his success. He must realize

first, that the ability to reason correctly is the rarest quality of the human mind and second, that his student does not possess the same back-ground as himself. Study on the part of the student will correct the latter but the first is a more difficult problem. In order to make up for this deficiency, the teacher must be able to put himself in the place of the student and, using material from the *student's* own background, build up from simple beginnings, the thoughts he wishes to convey. Material from the teacher's background must be used very carefully for the student will be skeptical if he cannot check on it from his own experience. And when the principles taught are of an abstract nature, the problem is made still more difficult.

The eternal cry is, "Give us a rule or law that we can follow blindly and without thought!" And there is no such rule in orthodontia or, indeed, in any of the biological sciences. The persistent student comes to realize that there is a balance in all living things and that although size and proportion vary, the balance must be maintained. He also comes to realize that no teacher can transmit this view-point to others without study on their part. It was only in his later years that these facts smote Dr. Angle with all their force and it accounts for his disinclination to explain himself. But the attitude he maintained toward his own students, right to the end, was an inflexible demand that they be well-grounded in the necessary fundamentals. It was only then that he would instruct them in orthodontia.

But even more general than the misconception surrounding the "Maxillary First Molar' is that which is held regarding the 'Line of Occlusion'. Indeed, if this concept was understood there would be no misjudgment of any other of Dr. Angle's principles. Unfortunately there seems to be very few who comprehend what it means. When Dr. Martin Dewey, after quoting Dr. Angle's definition in his text, goes on to say that the " 'Line of Occlusion' can also be defined as the line of greatest occcusal contact", he betrays his ignorance of the true import of the 'Line'. Dr. Angle had used this definition quoted by Dewey, in the sixth edition of his book, but in the seventh edition we find the following discussion of the 'Line of Occlusion', on page 22.

> "Yet after a much greater consideration of the question he (Dr. Angle) believes that this definition, though more nearly expressing the true condition than the terms previously employed, is still inadequate and he would define it as being the line with which, in form and position according to type, the teeth must be in harmony if in normal occlusion."
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> "There can be then, but one line of occlusion, and it must be the same as the architectural line on which the dental apparatus was constructed. This ideal line was intended to govern not only the length, breadth, and peculiar curve of the

dental arches, but the size and pattern of each tooth, cusps, and inclined plane composing these arches. And more than this; that as the dental apparatus is only a part of the great structure—the human body—each part and organ of which was fashioned according to lines of design, it must have been intended that the line of occlusion should be in harmony in form and position with, and in proper relation to all other parts of the great human structure, according to the inherited type of the individual. Hence its majesty, and according to our conception of it must be our ability to comprehend not only the art requirement in each case we treat but as well must it govern our conception of the requirements of the position of the teeth in occlusion and in the various operations in treatment. The line of occlusion then, is more than the tangible or material. It must be regarded as the basic ideal of the dental apparatus, the comprehension and appreciation of which will grow in proportion as our knowledge of the science of occlusion unfolds."

To grasp the full meaning of this definition and the explanation thereof, it is necessary for the student to be well-grounded in all the sciences fundamental to orthodontia. The study of biology, anatomy, physiology, embryology, comparative anatomy, and histology are a *prerequisite* to the comprehension of the definition. Each of these contributes to our knowledge of the development of the denture and to its function after completion and unless the extent of these contributions is realized the nature of the problems involved cannot be understood. If these innumerable factors may be considered as forces, it can be said that some of them are responsible for formation, others for growth, others for development and still others for stabilization of the denture. They are not even or equal. Some are active only for a short period of time and the ratio in power between them is constantly shifting. The denture, or every individual tooth in it, might be likened to a ball supported in mid-air by jets of water playing upon it from all angles. Varying the intensity of different jets or groups of jets will be followed by changes in the position of the ball, until it comes to rest again in balance with a different group of forces.

The points around which the battle of the six year molar have been fought are these. First, it cannot be proved that the maxillary six year molar is constant wherever found and Angle admits it. Second, if it is capable of movement at all it is valueless as a starting point for a diagnosis. This is apparently a sound argument. Let us see if it is as sound as it appears to be.

It was Dr. Angle's opinion that a study of animal dentures, of embryology, physiology, anatomy and other contributing sciences, and of normal occlusion in the human being, could not fail to impress the thoughtful student with the importance of the 'chief grinding tooth' of the Maxilla. When there is a perfect denture, the positioning of this tooth in relation to

the base that is to support it, the muscles that are to activate it, the nature and arrangement of the bone that surrounds it, is immediately apparent even to the casual observer, and scientific investigators in other fields have freely admitted that this tooth shows a remarkable constancy.

But if we are forced to deal with the abnormal and if the tooth has moved out of its correct relation to the cranial anatomy, where can we look for a starting point? The answer is, back to our knowledge of the normal. Every untoward condition in the denture is followed by definite changes and these changes are so invariable that, knowing the normal, we can determine from the position of the tooth or teeth, the correct position of the molar.

To illustrate this let us assume that the deciduous cuspid has been lost prematurely. We have good evidence of the contributions that the so-called forces of occlusion make to the denture. We know that the proximal contact areas are the meeting points of many forces that are exerted on the teeth. The tongue on the inside acting as a cushion and the lips and cheeks on the outside acting as binders, meet in the contacts and if these contacts are broken the stronger force (labial and buccal musculature) is going to assume a dominating position and the arch will collapse to a point where a 'jam' is formed or the resistant forces balance the offenders. This is generally understood if we are to judge by methods of treatment in vogue where expansion is almost invariably deemed necessary in varying degrees.

But this bucco-lingual pressure is not the only force being balanced at the contacts. Indeed, if all other forces were to be removed we should probably find that these were not actually in a balance, the buccal and labial force would be stronger. There is another force, never spoken of and apparently seldom considered in diagnosis, which is the crux of the whole question. This has been variously spoken of as the 'great weight of occlusion', 'the forward drive through the contacts', 'the anterior component of force' or the 'physiological forward drift of the teeth'. This force acting in a straight line from the molar forward to the cuspid is antagonized by the backward pull of the lips and these two forces also meet and balance in the contact points. This force is contributed solely by the molars and is due to the fact that the occlusal plane of the upper and lower molars in occlusion is not at right angles to the long axes of both teeth. The crowns are mesial to the roots and the resultant force of the teeth striking together is in mesial direction. Hence, if a contact is broken from any cause, this force is unopposed and we not only have a collapse but also a mesial migration of the teeth posterior to the break.

There are certain landmarks and certain characteristic changes that follow this phenomenon which makes it comparatively simple to resolve the

case back to the original. Teeth do not tend to move bodily by themselves and we usually find a tipping of the teeth which should give us a hint at once. This is almost invariably true of the lower molars and *any* tipping of these teeth should be corrected in the mind's eye before we try to classify the case. In the upper jaw there is frequently a bodily movement of the molars, but rarely of the cuspids. Hence, if a cuspid crown is tipped to the mesial beyond normal, the assumption would be that the crowns of the teeth in contact with it to the distal are also in front of their normal position to the extent of this tipping and in order to classify the case we must visualize this cuspid crown back to normal relationship with its root apex, together with the teeth posterior to it, before we can decide what position the molar was intended to occupy. In those cases where the cuspid is entirely out of the arch and the bicuspid and lateral are too close together, unless the incisors are markedly displaced to the lingual, we can assume that the closing of the cuspid space has been accomplished by a mesial drift of the molars and bicuspids and probably some lingual collapse of the teeth posterior to the closed space.

To treat such a case without allowing for and correcting this mesial position of the buccal teeth, is to court failure. Yet it is done all too frequently. Expanding the arch in such a case and carrying the incisors forward until the canine space is formed will result in that common orthodontic monstrosity—'a toothy case'—because the arch has been built around a foundation which, to begin with, was forward of its normal relation with the head and physiognomy. The common lament after such a result has been attained, is "Why did I not extract the first or second bicuspids?" And this is sometimes resorted to but with indifferent results, for the molar, once in front of its normal position at the center of the load, is accelerated in its mesial tendency in much the same manner as a piece of wire is forced out of a dull pair of shears which fail to cut. The more the tooth tips, the faster it will travel.

These are some of the details Dr. Angle is referring to when he uses such phrases as 'if intelligently interpreted' and 'if the case has been mutilated.' The reader is urged to go carefully over the quotation again, or better still all of Dr. Angle's writings, with these details in mind.

When the seventh edition of 'Malocclusion of the Teeth' was translated into German, Dr. Josef Grünberg of Berlin, who did the work, asked Dr. Angle's permission to include some of this detail in explanation. We, accordingly, find in the chapter on Diagnosis, material that does not appear

in the American text. To the best of my knowledge none of this has ever been translated for publication. Dr. Angle introduces it as follows.

"As a rule it is not difficult to diagnose cases not complicated by mutilation. In order to make a correct diagnosis we must carefully take into consideration all the changes involved as a result of mutilation and until now we not only have lacked general experience in the migratory tendencies of the teeth but also a reliable method of their investigation. As a result of thorough investigation, Dr. Grunberg deserves the credit for having recognized and established a method for determining the migratory tendencies of teeth and thus having offered a solution to this important problem in diagnosis."

Dr. Grünberg then goes on to explain many of the points that have been taken up in the present paper which relate to the fact that Dr. Angle has been misunderstood in his position on the six year molar. He quotes many of the passages already referred to and these we shall not repeat here. Then he goes on to say:

"But how shall we be able to determine the relationship of the jaws as normal or abnormal? Certainly not merely through an examination of the facial contour. The diversity of human types, the variability in the development of the eminentia mentalis, the results of extraction, and other factors will make such a determination impossible."

"For the establishment of the relationship we do not possess any other anatomical landmark but the teeth. These will serve us as a safe guide provided we consider that each tooth bears a normal mesio-distal relation *to its respective jaw*. This will prove correct almost without exception in all cases where the presence of the teeth and their arrangement entitle us to conclude that no movement of a pathological nature of the buccal teeth has taken place in a mesio-distal."

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"As I have mentioned before, Dr. Angle has pointed out that in cases where movement of the teeth has taken place as a result of extraction, we must first determine the degree and direction of this movement. It is extremely important that we understand the changes following extraction, not only of the permanent but also of the deciduous teeth. The permanency of the position of the six year molar has caused confusion. This law is referred only to the normal that had not been marred by mutilation."

"It is evident that any other injury in the denture resulting from advanced caries or from badly contoured fillings must be followed by a migration of the teeth, although not to such pronounced degree. However, as can be easily proven, this point has not been given all the consideration it deserves. In the majority of cases the actual relations of the teeth were considered sufficient in order to establish a diagnosis. It is clear that the meaning of the author was not understood."

"During a course given in Vienna in 1908 I pointed out this fact and gave the name "reconstruction" to the minute examination of mutilated cases, and the determination of the correct mesio-distal positions of the teeth as related to the jaws and skull. In this reconstruction we must not bear in mind the case after the completion of treatment, but *we must determine in each separate jaw the original position of each tooth,* which has changed its position in the mesio-distal direction through a loss of a permanent or deciduous tooth."

There is much more along this same vein in the chapter and with it a definite method for determining the amount of 'drift' in any given case, but space will not permit of further quotation.

From all this evidence and a great deal more that is available in the literature, it should be apparent that Dr. Angle's contentions on the six year molar were not those which have been credited to him. Those who were his friends and followers throughout the growth of his ideas (and he only stopped growing at his death) know that he has been misunderstood and that a true understanding of his concepts can be gained only through a thorough knowledge of the fundamentals upon which those concepts were based. He would have liked nothing better than to have been able to teach that *any* point in the denture bore a definite relation to the cranium or the body and he believed that not only the molar but every other tooth had such a position in the normal. He knew, however, that these positions were the result of such innumerable forces and factors, none of which could be measured, that the problem defied mathematical computation. Instead, he insisted that we become adept at judging correct proportions by studying the significance of normal, and this explains his insistence on Art as a study fundamental to orthodontia. This was and continues to be the 'Angle Creed' and it cannot, by any stretch of the imagination, be called a mechanical concept. Quite to the contrary, it is idealistically biological in principle and no evidence thus far has been able to overthrow it.

Now what has all of this to do with the Class II, Division I question? Only this. If the foregoing is not grasped one cannot understand what the classification means. Obviously we must have a point from which to start and that point must be valid and dependable. We have sought to show Dr. Angle's reasons for considering the maxillary first molar as such, if its position is intelligently interpreted. If this is granted we can then base our diagnosis on tooth relationships for there is no dissension on the correct articulation of the teeth. Thus, the only qualification is that the molars must be visualized in their correct relations to their respective jaws, before the classification is attempted.

It should be noted that the classification depends on the position assumed by the lower jaw, never the upper. A Class II case is a distal position of the lower jaw; Class III, a mesial position of the lower jaw. Many have tried to claim that Class II could be any one of three things, namely, a distal position of the lower, a mesial position of the upper, or an equal and opposite displacement of both—in short, any position that would show a Class II molar relationship. This Dr. Angle emphatically denied and his position of 1899 has been strongly supported by scientific investigations.

In the November and December numbers of the Dental Cosmos for 1928 and in the June and July, 1930, numbers of the same magazine, there appeared reports by Dr. Albin Oppenheim of Vienna, on investigations of the above questions. Space will not permit a review of these articles but the type of material used and the conclusions reached are very interesting. His first observations were based on Eurasian skulls from the various European museums while those tabulated in 1930 were based on East Indian and Negro skulls. The study of the latter group was for the purpose of determining whether or not the conclusions reached as to the Caucasians would hold for other races. The conclusions of the first investigations are given thus:

"3. The fact that the true average of the porion-orbital-canine angle is of almost the same size in both normal and Class II cases, and the fact that the prosthion and sub-spinale in the overwhelming majority of Class II cases are situated even further back than in normal cases, precludes the assumption that the anomaly in Class II cases is located in the upper jaw."

"4. The anomaly consists (with few exceptions) in an under-development of the mandible (Sicher and Krasa)."

"5. The lagging behind of the prosthion line and of the subspinale line may indicate that in Class II cases we have also to deal with the slight underdevelopment of the upper jaw."

"6. The discovery brought out by these studies that the prosthion does not have a more anterior position (on the contrary its position is farther posterior) than in cases with normal occlusion, as well as the confirmation of the findings of Sicher and Krasa, afford us proof of the correctness of the demand constantly maintained by Angle that we direct our entire effort in the treatment of Class II cases to stimulating the development of the mandible. The numerous uncontested successes of Angle's followers are perhaps the best proof of the correctness of this doctrine. The extraction of teeth in the upper jaw, together with the forcing back of the anterior parts, on the assumption that the anomaly is located in the upper jaw, must be designated, on the basis of the evidence here assembled, as an error in practise."

The results of the further investigations of 1930 (Indians and Negroes) are just as interesting.

"On the whole we obtained the same results as in the first paper" . . . . .

. . . . . "in the overwhelming majority of the pathological cases we cannot assume any overdevelopment of the maxilla."

"These relations confirm the opinion that we have to locate the anomally in the mandible."

Hellman, in a similar series of investigations, arrived at the same conclusions.*

**The Face and Occlusion of the Teeth in Man*"—Int. Journal of Orth., November, 1907.
**The Face and Teeth of Man; a Study of Growth and Position,* Journal of Dental Research, April, 1929.

This, then, leads us to the answer of another question that is repeatedly asked: "If the maxillary molar is correct and if the lower arch is distal to normal, why does Angle advocate the setting back of the upper arch in treatment?" This question has been answered so often that there seems to be no excuse for its oversight. As early as 1906, during the discussion that followed the reading of the paper, 'The Upper First Molar as a Basis for Diagnosis in Orthodontia', Dr. Angle said:

> "Now why should we move the upper molars distally if they are in their normal positions in these cases? Simply to do the best we can to strike a balance between the normal in the upper and the abnormal in the lower. If it were practical to 'jump the bite' instead of the occlusion only, we would in every case of this kind that I have ever seen come the nearest to the ideal in establishing facial requirements, but we now know, at least some of us think we do, that what really does take place when we 'jump the bite' and maintain the normal locking of the cusps long enough for this occlusion to become permanent, is that in reality the mandible gradually slides back to its original or approximately original position and relation with the skull, the crowns of the upper teeth having been tipped more or less distally, while those of the lower jaw have been tipped mesially, so that in reality we have accomplished, after many months of difficult retention, merely the jumping of the occlusion, or what we now aim to accomplish and do accomplish easily in a few weeks by the Baker anchorage. Yet this is not the ideal but is the best we can probably do; hence the importance of jumping the occlusion as early as possible, hoping and believing that the normal relations of the teeth will stimulate and tend toward the normal growth of the mandible, and this principle and result will hold good quite as well in the third class as in the second."
>
> "Here is a statement which may surprise you. I have yet to see one of these cases where we did move the upper molars distally, together with the teeth anterior to them, that it did not show proportionately detrimentally in the contour of the upper lip, yet the compromise, as I have said, with the lower is the best we can ever do."

In the seventh edition of 'Malocclusion of the Teeth', 1907, on page 466 we read:

> "As we have seen elsewhere, Nature exercises the greatest care in correctly placing the upper molars mesio-distally; hence the question might here be appropriately asked, why, if this be true, is it necessary to move the molars distally in these cases, as follows in this plan of treatment. This is easy of explanation. The mandible being undersized through a perversion of forces, the movement of the teeth, if limited to the lower, would compel them to lean forward at too great an angle, while by dividing the movements between the teeth of the opposite arches this is prevented, and Nature, being assisted and stimulated through the correct distribution of force upon the teeth and normal functions of the muscles, is enabled to normally develop the mandible and all other tissues involved. Through the stimulus thus given it is quite probable that in time the teeth of the upper arch will regain their normal relations with the skull."

Both of the above were written concerning treatment with the 'E' arch and ligatures but when the Ribbon Arch was introduced, the success gained with the above procedure caused Dr. Angle to go one step further. There was still too much tipping of the mandibular teeth to satisfy him. Consequently, he established as his new aim in treatment, the maintaining of the lower teeth in an upright position and the tipping of the upper teeth backward the entire distance, to correct the cusp relationships. And this has been the Angle method of treatment for these cases for nearly twenty years. As late as 1928 and 1929 there have been complete explanations of this same matter in the literature* and the fact that this question is still being asked is a poor commentary on the powers of observation of the questioners.

To sum up, then, the points which must be considered when we endeavor to understand Dr. Angle's concept of Class II, Division I malocclusion, we have the following:

1. The Maxillary First Molar was never intended to be taken as a fixed and immovable point from which treatment could be started on the assumption that it was correct wherever found. It *was* considered to be the most stable point in the denture and a point which was intended to occupy a definite and physiological relation to cranial anatomy; but that it would move forward out of its correct position if the integrity of the arch was broken by extraction or any cause, was recognized.

2. Allowance should always be made for the drift of this tooth and a case should never be classified until the tooth and its main opponent are visualized in their correct relations to their respective jaws. Then, and only then, can a classification be based on cusp relationships but this is a perfectly safe procedure under these conditions.

3. The 'Line of Occlusion' is not the line of greatest occlusal contact only. It is not a 'tooth line' at all except as we think of the teeth as being placed and held in their normal position by the interplay of innumerable forces. It recognizes all of the known factors that play a part in the denture and the discovery of new forces will in no wise make it invalid.

4. Classification is based upon the relation of the lower jaw to cranial anatomy and this relation, at present, can only be determined through a

*Brodie, Allan G. *Rapid Treatment of Class II, Division I Cases with the New Angle Mechanism*—Dental Cosmos, August, 1929.
Idem. *The New Angle Mechanism*—Journal of the American Dental Association, November, 1929.

study of tooth relationships. A Class II case is one where the lower arch is distal to the upper to the extent of more than half a cusp. If there has been mutilation of the upper arch and the molar has drifed forward until its disto-buccal cusp engages the buccal groove of the lower first molar, we are not dealing with a Class II, but a Class I case.

5. Dr. Angle's Class II treatment calls for the setting back of the normally placed maxillary teeth to correct occlusal relations with the underdeveloped mandible so as to enlist normal functional forces in the development of this mandible and make possible a subsequent return of the entire denture to a correct position in relation to the rest of the anatomy.

The effort of this paper has been to show what Dr. Angle's concepts were and to do this, his own words have been used. If the reader feels that there has been too much interpretation or emphasis placed upon any part, or if he feels that an effort has been made to influence or prejudice him in any way, he is urged to go back to the original sources and *study,* not merely read them. There is much between the lines in all of them and the careful, dispassionate perusal of Dr. Angle's text will prove of great help to those who are earnestly and honestly interested in the progress of orthodontia.

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