

## Orthodontic History and What It Teaches

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It is a healthy thing for any profession or any specialty to occasionally pause and analyze the path it is following. An exceptional opportunity to do just this was offered by the Dental Congress held in Chicago this past summer. Selected essayists were requested to write articles on the progress of orthodontia in all of its various phases during the past one hundred years. Without exception these papers were the result of a great deal of labor on the part of their authors and the history of orthodontia was spread before the eyes of the audience in a comprehensive form. Some of the pages were bright, notably those dealing with mechanical advances, while others were dark enough to cause the thoughtful to pause. Three of the essayists, independently of each other, made the statement that orthodontia was not progressing, it was retrogressing. When statements of this sort are made by reputed authorities it is wise for men in any field to pause and examine the grounds upon which such assertions are based.

The present day specialist in orthodontia feels that he is the culmination of the gradual upward evolution that has taken place in this field. This is not the case. He is the product of strictly modern conditions and interpretations, and in many cases he has little or no connection with the past except some word of mouth instruction. Orthodontia today is at its lowest ebb. It is held so cheaply by the dental profession and the laity that the commercial laboratory is considered fully competent to treat malocclusion. The explanation is not difficult to state.

Orthodontia has gone the way of everything else these past twenty years. Its earliest disciples were thinkers—they were forced to use their minds and ingenuity to overcome the many obstacles that confronted them. Their chief fault was that they prospered too well and their prosperity has been the downfall of orthodontia. They failed to take note of tendencies that developed and to use their influence in guarding orthodontia from malicious trends.

Their success created a demand for orthodontic training—the shorter the better—and in response to that demand courses were offered by individuals seeking to gain affluence and authority. These courses, almost without exception, have been devoted to giving the student facility in the hand-

ling of appliances to the exclusion of anything fundamental. The men who took such courses, in most cases, were honestly of the opinion that they were being as well prepared as any who had gone before and are in no wise to be held accountable for the damage that has been done.

Certain of our dental schools have likewise contributed to the evil. Devoting but a few hours to orthodontics they have, at the same time, preached the doctrine that the general practitioner had every right to include orthodontia in his practise and thus we find, notably in the middle west, over eighty per cent of general practitioners including orthodontia in their services because their schools have stamped such practices as quite within their province.

All of these things have led to a condition where *average* orthodontic results are no better, if as good, as they were twenty-five years ago. The commercial laboratory is doing a land office business in constructing appliances and treating cases 'by correspondence' and they are getting away with it because their results are not much worse than those obtained by many men who restrict their attention to this field.

The well educated or well grounded man, thanks to his broad foundation, dares to think simply. On the other hand, the superficial or untrained seeks to hide his shortcomings behind glib words, fine-spun theories and the embracing of hypotheses that neither he nor anyone else understands. We see this in orthodontia as in other fields. Neglecting to learn things that are under his nose, and that in most cases would solve his problems, he blames his failures on factors that lie in fields about which only a few general principles are known.

The ignorance of too many orthodontists on subjects bearing directly upon this field is appalling. Such things as the anatomy, physiology and histology of the parts with which they deal are considered as merely cultural frills, not necessities of this work. Mechanics are their sole concern, much as they may prate about biological reactions in public. Concepts of the denture have become mechanistic to such an extent that extraction is being resorted to more and more as an easy way out of difficulties. Is it any wonder that men in a position to judge, see trouble ahead for orthodontia?

There is no more illuminating or humbling experience for a conscientious orthodontist than that of carefully reviewing the history of his specialty. Only after he has done this will he realize how far the science has strayed from its path of progress. I say 'strayed' because that exactly describes what has happened. Our early precepts have not been disproved in spite of much talk and throwing of dust. Some early beliefs have been

modified, it is true, but the principles have remained unshaken. The present day literature bears abundant witness to the fact that these principles are not understood by many of the writers, not to mention those who read them, and as a result there is a lack of definition of issues that is severely detrimental to further progress. The author is fully aware that the last word has not been said on orthodontia but he is just as firmly convinced that future gains cannot be made by men who have no starting place, no foundation from which to reason.

With the idea that it might be helpful to some and interesting to all, a brief resume of outstanding contributions to orthodontia in the past has been arranged. It is not intended that this should be accepted as a substitute for the reading of such works as Weinberger's splendid history or of the original sources. We have been concerned only with that side of the science that deals with biological concepts and with etiology. It is in these fields that the science is lagging and where it shows the need for clear thinking.

Dentistry and orthodontia began to emerge from pure empiricism with Fauchard around 1728 but then, even more than now, it took many years before the teachings of such men showed any effect in raising the level of the profession. While Fauchard is best known for the 'bandeau', forerunner of the expansion arch, his works are replete with sage observations and sound advice. Among other things, he comments upon the importance of the deciduous teeth and warns about the dangers incident to their extraction, both from the standpoint of their effect upon occlusion and the risk of injuring the underlying tooth germ.

With John Hunter's 'Natural History of the Human Teeth', 1771, we have the first clear statement of orthopedic principles. Hunter was the first to describe the growth of the jaws, not as an hypothesis, but based on sound, scientific investigation. His findings have never been successfully challenged. He was the first to describe normal occlusion of the teeth and he denounced extraction in strong terms.

In 1810, Fuller attributed the projection of the mandible to a habit which caused it to remain this way permanently.

Charles Bew, 1819, wrote on occlusion thus: "By the arrangement here offered it will be seen that nature, as if to guard her work from injury by close contact, had so planned the situation of the teeth, that no single tooth should in fact press solely upon the other, but in the powerful triangular ratio of one to two, and even in this the power seems to be admirably settled for the general economy by being confined to the sides."

In the same year we have the following from the pen of Delabarre, "He that is nothing more than a mechanic ought not to be admitted into the sanctuary of Esculapius, his duty here should be confined to those machines with which alone he has the right to interfere."

"The management of the second dentition is a stumbling block to dentists of moderate ability; they have for this a certain routine, which, I say it with regret, is sustained by writings of authorities with those, who find in these books of ready made opinions, food for their minds and foundation for their practise without giving themselves the trouble to inquire into their value."

"These principles may be applied to the treatment of second dentition; it is much easier to extract teeth than to determine if it is absolutely necessary. The extraction of a tooth requires nothing more, on the part of the practitioner than a certain degree of facility in the use of instruments usually employed in this operation; while the knowledge necessary to appreciate the consequences can only be acquired by time and study."

From 1830 to 1836 we find supernumerary teeth, thumb sucking and tongue positions advanced as prolific causes of malocclusion. In the last of these years, Blandin discusses the effect of the denture on the expression of the face from the developmental standpoint and points out the changes in the face between the new born, the infant, the adult and the aged. He talks about the changes in the facial angle under the influence of the teeth and draws attention to the fact that since the constantly elongating superior dental arch is backed up by the pterygoid process it follows that the face will be projected forward by growth.

In 1839, B. A. Rodrigues wrote that irregularities of teeth were due more to deformities of habit than to natural causes. He insisted that muscles, through long incorrect use, would change the form of bones.

Desirabode in his "Complete Elements of the Science and Arts of the Dentist," 1843, had this to say, "It is necessary to have the most accurate knowledge of the anatomy of the mouth particularly that of the teeth and to unite general notions of anatomy, physiology, medicine, hygiene, mechanics and still more, the skill of the goldsmith." ". . . after the organ itself, are the laws of its development, the functions which belong to it, and the conditions upon which the integrity and entire accomplishment of these rest."

It was shortly after this that Sir John Tomes published his "Dental Physiology and Surgery" from which the following is taken.

"When we see how much can be done by orthopedic surgery in restoring crooked and deformed limbs to their natural form, whether the patient be

middle aged or young, we should at once conclude, even without the aid of experience, that much might be done to remedy irregularity in the arrangement of the teeth, and we should become more certain of our point when we observe that if the molar teeth from age or accident be lost, the under incisors, closing against the posterior inclined plane of the upper incisors, slowly but surely force the latter outward."

"It can scarcely happen that we have irregularity in the teeth of one jaw without a corresponding irregularity in the teeth of the other jaw; the one following as a consequence of the other."

Joseph Engel, in 1849, called attention to the fact that the position of the teeth shifted and, were any of them missing, those adjoining generally moved forward, not backward, due to constant chewing and usage. James Robinson, ten years later, advanced the development of the third molars as a cause of crumpling of the anterior segment of the arch.

It should not be supposed that all writers of this period were sages, for such is not the case. We find references that cause us to smile then as now but we cannot but be impressed by the powers of accurate observation possessed by many of these authors and the clear reasoning that followed them.

In 1858, Bridgman gives us this. "In a perfect 'bite' we have everywhere a series of inclined planes."

Heredity had its followers but then, as now, they were short on evidence and rather uncertain of themselves. Some of their views follow.

J. Foster Flagg, 1859, stated that the causes of irregularity were hereditary and mechanical, "The hereditary generally affecting the incisors while the mechanical causes influence the bicuspid, the cuspidati being about equally affected by both."

E. Sylvester Ware, 1863: "Now it often occurs that the children of these parents will seem to have the right side of the mouth<sup>1</sup> resembling the one parent and the left resembling the other."

Samuel Cartwright, 1857: "The shape of the jaws and the arrangement of the dentures of the parents, are strongly suggested in the line of practise likely proper to be adopted with regard to the children; and generally speaking, if permitted to proceed unchecked in them, the same forms of irregularity will be developed. Many hereditary mal-arrangements of the teeth may be traced to a non-expansion of the maxillary arches, and to a consequently undue state of pressure and crowding of certain of the replacing teeth within the jaws . . . ."

"When one parent is underhung, in the true sense of the word, one or

more of the children are found often to take after that parent in malformation of the jaws."

Ballard, discussing Cartwright's paper, said he thought many of the author's 'hereditary and congenital' cases would have fitted into the mechanical explanation better. He had never seen a baby born with deformed jaws but had seen plenty of them develop from mechanical causes such as sucking, etc. He cited a case of a child who had a protrusion of the lower jaw. He asked the nurse to check on its habits and found that it pulled on the mandible with the fingers in the mouth when going to sleep. The nurse laughed at his viewpoint and said that the grandfather of the child, a nobleman, had a similar deformity and that it was a family feature. However, the habit was broken and the jaw became normal, the 'family trait' being completely lost.

Ballard closes with, "I thought that was a good illustration of the fallacy of the doctrine of hereditary deformity."

In 1860, Emerson Colon Angel first emphasized the significance of the six year molars. He drew attention to their eruption and to the necessity of retaining them and all other permanent teeth in order to establish "correct occlusion of the teeth." It was he who first called these molars the "keystones of the arch." He called attention to the spacing of teeth following extraction and advised maintaining spaces instead of allowing or expecting them to close.

George Murray Humphrey, in 1864, published the results of his investigations on the growth of the jaws. He had been aware of Hunter's work and apparently set himself the task of checking this writer's findings. Using an entirely new and very ingenious method he verified Hunter's contentions on the backward growth of the jaws. His conclusions on the manner in which jaw changes come about are almost identical with those of Brash only a few years ago.

A paper that would do credit to any modern orthodontic journal was published in 1886 by Cornelius Ackerson Marvin. It was entitled, "Irregular Teeth." He starts thus:

"In regulating teeth, several objects are to be attained and they are always to be kept in mind throughout the continuance of the operation. They are:

1. The preservation of the correct facial expression.
2. The restoration of such expression (if, through irregularity it has been lost).
3. The proper articulation of the teeth for better mastication.

4. Their orderly arrangement, with a view of prevention of decay. He condemns extraction in regulating and then proceeds thus. "Nature makes all parts to correspond, and when she supplies a certain number of teeth in the mouth, it is fair to infer that the presence of all those teeth is necessary to regularity and perfection."

Marvin's distinctive contribution lay in his insistence on the maintenance of facial lines and he strongly advises his listeners to study the details of physiognomy so that they may add to and not detract from the natural beauty of the human countenance.

He is far in advance of his time when he writes "As to the age when Art should be called in to aid Nature, opinions vary—I say to aid Nature, by which I mean that this should be done at some stage of the period of growth."

With James Edmund Garretson's "Oral Surgery" we find the orthopedic viewpoint again being stressed.

"If for one moment, we refer to certain physiological relations existing between the first and second dentures, we may find that it is within our power to prevent the many ills that follow so frequently in this train, and simply by doing little, or more commonly nothing. The deciduous arch, as we are all aware, is filled completely by its ten teeth. The second or permanent set is to comprise in number sixteen and each certainly quite as large again as its predecessor. This increase in number and size of the teeth, it is evident, must be provided for in an enlargement of the alveolar arch. This provision is always attempted by Nature in the process described by the physiologist as the elongatory. I will illustrate this process of maxillary enlargement by considering the ten teeth as so many wedges placed in a *springy* arch. This arch is designed to lengthen by additions to either end. If now these wedges should be removed before others were ready to take their place, it is evident that the elongation being made at the ends, would, to a greater or less extent, be counterbalanced by a springing together of the parts of the removed wedges." . . . "In proportion to the number of the deciduous teeth removed prematurely will be the curtailment in size of that arch, at least of its alveolar face."

In 1873, L. Fleschmall, talking on "Irregularity of Teething, Diagnostic of Rhachitis" wrote:

"The teeth come first in the order of the bones affected, and the disturbances, therefore, in the ossification of the teeth can serve as a valuable sign of a very important disease." He goes on to trace very accurately, the time of the development of the teeth and shows how they come under the influence of the disease.

In this same year, Tomes gives the first detailed picture of musculature in its relation to the denture and since our ideas have changed very little on this subject it is interesting to note what he says.

“Along the outsides of the dental arch the muscular structures of the lips and cheeks are perpetually exercising pressure perfectly symmetrically, and on the inside the tongue is with equal persistency doing the same thing. Now if we imagine a plastic material placed between the tongue and the lips, it cannot fail to be molded into the form of a regular dental arch and this is precisely what happens with the mobile, freshly erupted teeth; and should it chance that an individual tooth becomes affected by some obstruction, so that it stands outside or inside its neighbors, it will obviously come in for more than its due share of pressure so that as soon as the obstruction is removed, it will be pushed into place. And as the muscular action of the tongue is more powerful than that of the lips, a tooth which stands inside the arch is reduced to its proper positions more quickly than one which lies outside. There is, I believe, no such thing as a natural tendency towards the assumption of a regular form in a dental arch, the physical forces at work, namely, the lips and tongue are amply sufficient to account for all of the phenomena observed; and explanations based upon such a tendency fall, like references to ‘vital force’ as an explanation of physiological phenomena, into the category of mere forms of words calculated to cloak our real ignorance.”

“Certain cases known as V-shaped contracted jaws likewise illustrate the power of the pressure of the lips and cheek to modify the position of the teeth, for it will generally be found that this malformation is associated with greatly enlarged tonsils, which necessitates breathing being carried on with the mouth open. Now, as everyone can easily verify upon himself, the effect of the mouth being held open, is to increase the tension of the soft parts about its angles, and the result of the increased pressure is to bring about a bending inwards at the corresponding point, i.e. the bicuspid region. At the same time, the median portion of the arch escapes the controlling pressure which would have been exercised by closed lips, and the effect of this is traceable in the excessive prominence of the median pair of incisors, and also in their oblique position which makes them correspond with the form assumed by the inner surfaces of the lips when the mouth is open.”

During all of the time represented by the foregoing writers there appeared many statements to the effect that man's civilized existence was the factor behind irregularity. In 1874, Simeon H. Guilford again gave voice to these sentiments as follows:

“Were there sufficient proportion of lime salts in the alveolus and teeth substance, placed there in the economy of nature by the eating of proper food, this same food giving health and tonicity to the blood, strength to the nervous system and tonicity to the blood and soft tissues, and did we at the same time give our teeth enough hard work to do, it is safe to say that in the second succeeding generation irregularity would be unknown and decay almost so.”

Alton Howard Thompson, a keen student of comparative anatomy wrote many papers on this subject in relation to the human denture. Following are some selected quotations from his paper “Dynamics of Dental Occlusion and the Structural Expenditure of their Maintenance.”

“The force with which the lower mandible is occluded against the superior maxillaries is, in the average mammiferous animal, probably without parallel in any department of animal mechanics . . . . The limited amount of tissue of which the apparatus is constructed does not appear capable of the intense manifestations of force demonstrated.”

“Another indication of the force is the development of the bones and muscles that support the teeth. The growth of the maxillaries exhibits dependence on the occlusion of the teeth for perfect and symmetrical production. Being at birth mere shells containing the active, laboring, tooth-forming pulps and growing crowns, as the teeth erupt and mastication comes upon them the bone solidifies and braces up the forming and formed roots to support the force. When the second denture comes into place the arch enlarges posteriorly, strengthens its substance, develops static force, and its arches and pillars of resistance but become more firm and dense with use. \*\*\*\*\* This force exercises a potent and wonderful influence in the acceleration of the growth of the bones and muscles, and the symmetrical moulding of the face in normal development.”

“With the presence of teeth and their active use, the integrity of the of the jaws and muscles may be said to be maintained. \*\*\*\*\*Asymmetry is frequently observable in persons who acquire the habit of asymmetrical mastication when the teeth are yet present, owing to diseases of the latter or some other lesion upon one side.”

The literature shows unmistakably that the ‘underhung’ jaw has been a problem from the earliest beginnings of orthodontia. This startling deformity, which we now call Class III or mesio-occlusion is commented upon by many of the early writers. Curiously enough, only a few of them refer to it as hereditary. A few mention imitation, others attribute it to breathing difficulties and still others to finger habits. One of the first to note

the action of muscles in its creation was Thomas Brian Gunning, who in 1881 wrote as follows:

"Cases of projection of the lower jaw, *caused by muscular action drawing the condyles toward the eminencia articularis*" \*\*\* may be treated so-and-so.

"A projecting jaw, which is well seated in the glenoid cavities, cannot be pressed back by any apparatus in the mouth, nor by any outside around the head and jaw, whether as pictured in the books or otherwise. If the condyles were pressed back from their natural position, the ear would be closed."

Toward the close of the nineteenth century and during the early part of the twentieth, Eugene S. Talbot exercised a wide influence on dentistry and orthodontia. He was the foremost exponent of hereditary factors in etiology and his writings were interesting and prolific. He was trained in medicine and much of his reasoning on congenital and acquired deformities show the result of this training. He was one of the first if not the first to advance the endocrine glands, especially the pituitary, as a possible cause of jaw deformities. Space will not permit a review of his work but the interested reader is directed to his text, "The Irregularities of the Teeth" which went through six editions.

No review of orthodontic history would be complete without reference to Norman W. Kingsley and his work. Kingsley was a deep and broad student, an outstanding craftsman and a writer of no mean ability. His writings cover the entire field and he is known as well by these as by his many ingenious devices.

Kingsley was very careful about what he had to say relative to heredity except in the matter of individual teeth as regards their form, color or suppresion. He was a strong believer in type however.

"Symmetry and harmony do not imply uniformity, and the dental arch may be developed up to the highest type of perfection, and yet there exist as great a variety of form as there would be in the faces of the aggregate beauties of the world."

"Races, nations and families are thus represented without deformity."

Kingsley went quite deeply into the matter of race inter-mixture and while he did not agree with Cartwright's 'high and selective breeding,' he did feel that mixtures of pure but different types might well lead to deformity. His most pronounced views however, were on the balance, or lack of balance between the development of the nervous system and that of the physical. I quote:

"A perfect dental development is the result of well-balanced physical and nervous systems, without hereditary taint."

“Abnormalities of development having their origin in the same individual are due to a disturbance of the trigeminal nerve during the period in which the crowns of permanent teeth are forming and arranging themselves in the jaw prior to eruption; or when arising from causes antedating the life of the individual are traceable to an inherited tendency, which tendency had its origin in a like disturbance in one of the progenitors, and was subsequently transmitted; or are the result of mixing different and distinctly marked types of jaws and teeth by the progenitors.”

“There can be no question that the Creator intended that there should be perfect harmony in the development of physical and nervous systems and that where such harmony exists we come nearest to the standard of a perfect organization. This harmony of organization or true balance of the two systems demands that in the earlier years of life the brain and nervous system be held in abeyance to the physical.

“The healthier mental organization is of slower growth. If therefore, we find that a certain mode of life destroys this harmony, breaks up this balance, there will follow necessarily deterioration and destruction of the race; and this is based on well recognized physiological law; if the brain and the nervous system are in an undue state of nervous activity, the drain upon the sources of nutrition will be at the expense of the physical system.”

“I do not hesitate to place it upon record that the next generation will see more of abnormality in dental development, and an increase of nervous and cerebral diseases, and that the two are correlated and spring from the same source.”

Isaac B. Davenport ushered in the era which showed the greatest progress in orthodontia. He started with a description of the anatomic features of the individual teeth, their relations to one another and the manner in which the occlusion of the upper and lower teeth best served the purposes of speech and mastication.

“Nature has furnished man with two dental arches, so formed and so placed in relation to each other as to be best supported at every point, while permitting all the movements necessary for the perfect comminution of his food.”

He then proceeds to show how every change of form in any of the teeth, or the loss of one or more teeth, so disturbs the normal relationship as to greatly lessen their efficiency.

“While analogy teaches that Nature’s form and arrangement of the dental organs are those best fitted to preserve them, evolved as these organs were under the general law of adaptation according to the need, it is true

that diseases have appeared which oftentimes have overcome Nature's provisions; but as we have only just begun to learn the causes of diseases, we can hardly jump to the conclusion that man has so changed all of his conditions that Nature is disposing of his dental organs, nor can we suppose that he would be better adapted to his present conditions by extraction of teeth."

"Nature never loses sight of perfection. Deformities and useless variations are eternally destined to die out sooner or later, and the fittest survive. The standard of perfection of an organ can never be lowered or diminished so long as its functional need exists."

This brief resume will serve to show that by the latter part of the nineteenth century practically all of the etiological factors, recognized today, had been advanced. It should be pointed out however, that it was largely made up of unrelated items and that there had been little or no effort made to coordinate these into a logical whole. This task remained for Edward H. Angle.

This man made his great contribution by gathering together all that had gone before and correlating it into a well ordered science. He started from a study of the significance of the normal and his interpretations of what constituted the normal were based on principles gathered over a wide field. It would be impossible to review his teachings in this brief space although by no means a futile task, for there are few indeed today who understand his principles.

Dr. Angle dominated the specialty of orthodontia for twenty or twenty-five years and during that time continued to expand his conception of its problems and contribute to their solution. Starting his educational work in various universities and finding it unsatisfactory he founded a private school where he at first conducted courses of a few weeks' duration.

With the beginning of his educational work he began to realize that the teaching of the dental college was not an adequate enough foundation for the study of orthodontia and that the vast majority of men had derived little or no benefit from their work in the fundamental sciences. Having derived great help himself from the application of these principles he sought to impart it to his students. In order to do this he gradually extended his course more and more until his last classes called for a year's full-time resident work following a year of preparation and review.

The author was fortunate enough to be a member of his last class and watched Dr. Angle's educational ideas in practise. It was a revelation in the art of teaching and an entirely new experience for the student. Having

been required to present himself equipped with the factual knowledge of anatomy, histology, embryology, etc. he was taught how to use his facts in the solution of orthodontic problems. Starting with a complete analytical study of the normal, he was led gradually into the abnormal. There was no demand made that he memorize etiological factors, physiological reactions etc.; he was made to reason from cause to effect on the basis of his factual knowledge.

The writer has been requested to write a series of articles on fundamental subjects, following Dr. Angle's methods of application. The question has been asked repeatedly where such material could be obtained in this form and the answer has been that there was no such source. Nor will this series be such a source. Those interested will have to refer to standard texts for their factual material and the effort will be merely one of indicating how such facts may be used to greatest advantage. There is no claim made for originality and the sole excuse for this effort lies in the desire to help those who are trying to help themselves.

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