

# Highlights of Sixty-four Years in Orthodontics

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In September 1906, it was my good fortune to be a member of a class in orthodontia at St. Louis University, taught by Dr. Edward H. Angle. He was a brilliant teacher but a harsh taskmaster as I soon found out. I had been in the class about two weeks when he inspected some of my technique work, threw it down on the desk, and said, "Strang, you are no good and never will be any good, get out of here". Mother Angle, as we all called her, attended all classes to be of service. She happened to hear this reprimand and noted that it had left me mighty dejected, to say the least. She came over, put her hand on my shoulder and whispered, "Don't mind what he said, just keep working". Fortunately I took her advice.

I had an excellent theoretical background due to the foresight of my father who was a dentist. In 1899, when I decided to also be a dentist, he said to me, "Son, I have always felt the need of a medical degree and, if you will do it, I will see you through both dental and medical courses". I took his advice.

At that time the University of Pennsylvania was offering a combined course in Dentistry and Medicine over a period of five years and I took it. For the first three years I attended lectures and clinics and took examinations in both departments. I did not get much sleep for need to study at night. At the end of the third year I obtained my D.D.S. degree and then it was clear sailing for two more years to obtain the M.D. degree and subsequently my licenses in both professions. I interned in the West Penn Hospital in Pittsburgh for one year and my objective was to specialize in oral surgery. On my return

home I obtained the appointment of Oral Surgeon on the staff of the Bridgeport Hospital, thereby inaugurating the Oral Surgery Department of that hospital in 1905. Because of that fact I have been retained on the oral surgical staff as an honorary member ever since, a tribute that I deeply appreciate.

I soon found out that if I wished to specialize in oral surgery, I would have to go to New York because Bridgeport was not a large enough city, at that date, to keep me busy and progressing. Furthermore, the anesthetics at that period were ether, chloroform and nitrous oxide without oxygen. All of these, of course, were administered through the nasal cavity and interfered with oral procedures. Cocaine was the local anesthetic.

I purposely had given as much anesthesia as possible while an intern at West Penn Hospital. The other interns were glad to have me do it because it was hazardous. I nearly lost one patient and that experience was keenly embedded in my mind. Again I sought my father's advice and he solved the critical situation by wonderful foresight. He said, "I believe there is a great future in orthodontia as a specialty but if you go into it you must take a course with the one man who qualifies as an intelligent practitioner and teacher in this specialty, Dr. Edward H. Angle". Again I took his advice and that is how I finally found just the specialty that completely satisfied me and always has. What a wonderful Dad!

Dr. Angle had an excellent faculty. Included on it were Professor Edmond Wuerpel who lectured on facial art and was a most spellbinding speaker; Dr. Frederick B. Noyes, who taught anatomy and histology and was one of

the best teachers that I had ever studied under, including both dentistry and medicine; and Dr. Martin Dewey, a rough individual who was clinical instructor. At the end of the course, written examinations were given in all subjects covered by the faculty. It was tough but most stimulating and profitable instruction.

The appliance taught to us in 1906 consisted of the heavy, plain archwire held in position by clamp bands on the first molar teeth. Nickel-silver bands with ligature spurs were formed for the teeth to be moved. Brass wire ligatures or dental floss ligatures were the activators for tooth movement. The dentures were enlarged in all dimensions by tipping the teeth to correct the malocclusion. Bands with labial and lingual spurs were then placed on teeth that had been rotated and retaining plates were made for each denture. The retention period was just as long as the patient would wear the plates. When they were discarded, various degrees of malocclusion recurred.

I feel certain that Dr. Angle attributed the failures to inability, in treatment, to move the roots of the malposed teeth as well as their crowns. The forces of occlusion did not stabilize tipped teeth. Hence the roots of the malposed teeth must be moved in treatment, as well as the crowns. This led him to the evolution of the pin and tube appliance, the first mechanism available for crown and root movement.

This was an extremely complicated device. The archwire consisted of three separate parts. The anterior segment was of arch form and included the incisor, canine and premolar areas of the denture. The ends of this segment were rectangular in form and fitted accurately in harmonious inserts in the ends of the molar segments of the appliance. The round .020 archwire

was primarily formed in passive adjustment to the six anterior teeth and then vertical springs were soldered to the archwire at locations to give passive adjustment into the tubes on the banded teeth. Believe me, that was a precise technique!

The two molar segments had threaded distal ends which carried nuts. They were placed in the molar buccal tubes with their anterior ends located just distally to the ends of the anterior segment. After the anterior segment was attached to the incisal and canine teeth and its distal ends were in alignment with the anterior ends of the molar segments, these molar segments were slipped forward onto the ends of the anterior section and the nuts tightened to activate tooth movement. At subsequent appointments the anterior segment was carefully reshaped to move the anterior teeth into alignment and expand the molar teeth. The premolars were moved by ligature attachment. Hence they did not have bodily movement; neither did the molars.

This pin and tube device was so complicated that it was soon discarded. It was replaced by a decidedly simpler and more efficient bodily tooth-moving appliance. This was termed the ribbon arch appliance. With this, Dr. Angle introduced the bracket attachment on the bands. This was a tremendous forward step in orthodontic mechanisms. The archwire associated with it was rectangular in outline form and accurately fitted the vertical slots in the brackets. The opening into this slot was at the occlusal edge of the bracket and the archwire was adjusted to the bracket with its greater width in the vertical plane. It was held in place by small lockpins.

With this appliance most of the teeth could be moved bodily in all dimensions of space and rotated. This

permitted a definite plan of treatment to be prepared in written form before treatment began, certainly a forward step in orthodontics. But it was not long before certain deficiencies were found in this beautiful mechanism. The premolar teeth could not be moved bodily, and mesial and distal tipping bends could not be incorporated in the archwire.

After years of experimental procedures, it still remained for Dr. Angle to perfect a mechanism that eliminated all previous deficiencies. With this, every tooth could be moved in all the required directions of space. To obtain this perfection he changed the form of the brackets on the bands by locating the slot in the center of the bracket and placing it in the horizontal plane instead of the vertical. The bands on which the brackets were soldered were so positioned on the teeth as to have the brackets at the center of their labial and buccal surfaces. The archwire was held in position by brass ligatures. The brackets were of such form that these wire ligatures could be stabilized by being caught over their projecting gingival and occlusal ends. As the slot in this bracket was of greater depth in the horizontal plane instead of the vertical, as in the ribbon archwire bracket, the archwire, which was still of rectangular outline, had to be harmoniously changed by placing the wider side in the horizontal plane instead of the vertical. This change of the wider plane of the archwire and corresponding modification of the slot in the bracket enabled the operator to include the premolar teeth in the appliance setup. The tube on the anchor molar was also changed to fit the rectangular archwire.

I had used the ribbon arch appliance long enough to have mastered its technique, and the use of lockpins instead of wire ligatures was certainly very much of an advantage, both for the

patient as well as the operator. Consequently, I did not immediately change to the edgewise appliance. Eventually, the fact that premolar and molar teeth must also be moved bodily, as well as the six anterior teeth, won me over. The fact that, in Class II, Division 1 cases, the maxillary buccal segments had to be moved distally primarily by distal tipping bends and then uprighted, which could not be done efficiently by the ribbon archwire, forced me to change to the edgewise mechanism and give up the precious lockpins. Fortunately the delicate stainless steel ligatures had replaced the brass wires and I was comforted. I soon found that the edgewise mechanism was exceedingly more efficient than the ribbon arch appliance and, in my mind, is still supreme today.

So much for this journey through appliance development. Note that Dr. Angle completely dominated this period of progress by his marvelous ability to increase the efficiency of treatment mechanisms. However, we must not lose sight of the fact that he was coincidentally deeply concerned with theoretical progress in our specialty. He wrote many papers published in dental magazines. His textbook *Treatment of Malocclusion of the Teeth* passed through seven editions. The first seven chapters of the last edition of this textbook deal entirely with theoretical subjects of intimate relationship to orthodontics. Certainly he deserves a great amount of credit for developing a sound foundation for our specialty which was essential to its establishment as a true science.

The tenacious stand against extraction of teeth in treatment that Dr. Angle exhibited and preached indicated that he firmly believed that there was no limit to growth activities in the maxillary and mandibular bones if properly stimulated by the functional

forces associated with normal occlusion. He believed that if normal occlusion was obtained by treatment and subsequently maintained long enough by retaining appliances, stabilizing bone growth would be acquired around the tooth roots.

Those of us who adhered to his teaching and never extracted teeth, but enlarged the dentures to accommodate all of the dental units, and maintained the results with retaining appliances were subjected to disappointment in case after case when retainers were removed. Molar, premolar and canine width was lost and rotated incisors reappeared. Why did this happen?

Primarily, we did not know that there was a time limit to the growth period of the maxillary and mandibular basal bones. Drs. Oppenheim, Hellman, Broadbent, Brodie and several other outstanding scientists told us that at a later period. It also took us a long time to realize and profit by the fact that a denture in malocclusion is a well-stabilized structure. The roots of the teeth are surrounded by bone and the crowns by muscular activity that is harmoniously balanced. If this were not so the teeth would be shifting around and be very unstable. Enlarging the dentures to make space for the full complement of dental units upsets this well-balanced, supporting and fixation force. Temporarily the retaining appliance overpowers it but does not destroy or alter it. Consequently, when the retainer is discontinued, this unchanged muscular unit moves the teeth into stabilized malocclusion again.

In the early days of specialization I had so few patients in Bridgeport that I was able to spend two days each week in the office of Dr. Frank Gough in Brooklyn. Dr. Gough was also a student of Dr. Angle's, a few years previous to my time, and I learned a great deal from this association. A little later I

opened a second office in Hartford and maintained this until my Bridgeport practice could fill full hours of time. I traveled to Hartford by train, two days each week. I remember one of the students with me at that time. We used to catch a five-thirty train back to Bridgeport. My office in Hartford was several blocks from the railroad station and sometimes it was run to the station or miss the train. I recall my student, with a breathless voice after reaching the station saying, "Dr. Strang, I came here to learn orthodontia and not to be a champion runner".

In the *Dental Cosmos* for July 1924, the writer presented a paper entitled "Pitfalls in Class I Cases of Malocclusion". To the best of his knowledge, this was the first paper to call attention to the fact that there were some cases of malocclusion in which the spaces for the permanent canine teeth were greatly reduced by an abnormal forward shifting of the premolar and molar teeth. Consequently, the treatment indicated to make space for the canines was the distal movement of these buccal teeth instead of the usual procedure of expanding the buccal segments. Some forward movement of the incisor teeth would also be indicated but not as much as the expansion treatment required.

Almost coincidentally with the publishing of this paper, an excellent contribution by Dr. George Grieve of Toronto, Canada appeared in print. In this article Dr. Grieve described the forward positioning of teeth in relation to the basal bones tabulating it as the "Forward Translation of Teeth". In the more exaggerated malocclusions of this type he advocated the extraction of four first premolars and the repositioning of the canines and incisor teeth utilizing the premolar spaces for this purpose.

Those of us who were still convinced that extraction was a violation of basic principles condemned Dr. Grieve for advocating this compromise. We continued in our effort to move buccal teeth distally and to expand the dental arches.

This brings historical events to the time that Dr. Charles H. Tweed of Tucson, Arizona enters the picture. He was one of the last students of Dr. Angle and followed his teaching faithfully for several years. Like the rest of us, he was not getting stability in his final results. He attributed it to denture expansion and began to extract first premolar teeth to avoid this procedure. I had heard of him because he was being severely criticized by many of his associates, particularly in the East. I noted that he was scheduled to be on the program of the next meeting of the Angle Society in Chicago. I planned to be there with the objective of lacing into him for violating Dr. Angle's sacred principle of nonextraction in treatment.

Previous to reading his paper, Dr. Tweed had placed on tables before and after models and photographs of one hundred consecutively-treated cases. In many of these he had extracted first premolar teeth. The results in all of these one hundred cases were magnificent and beyond criticism. I also met Dr. Tweed and noted that he was a most modest, unassuming and friendly chap.

Dr. Tweed read his well-written and illustrated paper, explained his objective of keeping the teeth overlying basal bone, which made it necessary to extract teeth in many cases, but did produce stable results. Then he sat down. There was no applause but the room filled with shouted demands for the floor. For at least an hour, Charlie got the worst word lashing that you

can possibly imagine and not one word of praise for the beautiful results of treatment. Here was a student of Dr. Angle's violating the most fixed and rigid rule in Dr. Angle's instruction—never extract teeth.

During all this vicious attack, my mind took a complete turnover. I could visualize nothing but that marvelous exhibit of treated cases. Not one individual in the room had complimented the essayist. They were all ripping him to pieces for extracting teeth. Finally, I obtained the floor and complimented and defended him to the best of my ability. When I sat down I took a tongue lashing that compared very favorably with the one Charlie had received. Subsequently, I took his course, practiced, taught and published his techniques in my textbook. Dr. Tweed's work was so outstanding as to elevate him, in my mind, to the position of the best clinical orthodontist in the present era.

I have emphasized the fact that Dr. Angle would never permit extraction of teeth in treatment procedures. He was also just as strongly opposed to any modification of the archwire from the horizontal plane, such as vertical spring loops. Dr. J. Lowe Young, one of Dr. Angle's earliest students, broke this rule by placing vertical spring loops in the archwire to open space for blocked out canine teeth. He would form the archwire with loops in the canine areas. Then, before placing the archwire on the teeth, he would open the loops for activity. Molar stop spurs were soldered on the archwire to rest against the buccal tubes so the loops would be contracted when the archwire was ligated to the teeth. These contracted loops would not only open the spaces for the canines but also would tip the crowns of the incisor teeth labially, an undesirable movement. Dr. Angle was very critical of this technical procedure

even though it did open the spaces for the canines, but the labial tipping of the incisor teeth was not a desirable, associated movement.

It occurred to me that, if such a loop could be placed in the archwire in a passive state and then activated after the archwire was ligated to the teeth, there would be root action, primarily, and stationary anchorage on the teeth on either side of the loop, thus producing space opening without tipping the crowns of the banded teeth. The use of traction spurs soldered on the archwire to act as anchorage for the ligatures that activated the vertical spring loops was suggested by Dr. Allan Brodie. I placed these on the gingival side of the archwire and close to the anterior end of the molar tubes. Ligatures attached to these spurs, carried to the first premolar brackets and tightened, activated the vertical spring loops and, by subsequent adjustments, gradually opened spaces for the blocked-out canines. If the incisors tended to move labially, Class II elastics could be added to the set-up. I used this appliance adjustment for a sufficient time to verify its efficiency.

I then decided to write a paper and present the use of the vertical spring loop auxiliary in the edgewise arch technique to open and close spaces in the dentures. I had a number of excellent slides for illustrations. I gave this paper at an Edward H. Angle Society meeting in Santa Barbara, California. Before the date of the meeting I sent a copy of the paper to one of the members who was on the program to discuss it. Dr. Angle had passed away about six months previous to this time.

Subsequently I learned that this discussor had shown the paper to Dr. Cecil Steiner who was then and still is one of my closest and precious friends.

He told Cecil that he was going to rip me to pieces for disloyalty to Dr. Angle and for promoting the use of such a modification of the edgewise archwire. Cecil's reply was "You had better modify your discussion because I am certain that Bob Strang does not promote any treatment procedure until he knows, by trial, that it is a good one".

The discussion that followed my presentation duplicated in detail the one previously described given to Dr. Tweed at Chicago, only I was the culprit. The scheduled discussor did not adhere to Cecil's suggestion but criticized me most emphatically, as did several other members of the society. The most virulent of my accusers of disloyalty to Dr. Angle was one of his last students. For fifteen minutes he had the floor and used that time to chastise me as a low-down traitor to Dr. Angle. When he got through the atmosphere was in tense silence and eyes were fixed on me. My primary reaction was to give him back as good as he had given me. Fortunately, for once in my life, I used my head. I got up and walked over to where this irate young man was seated and said, calling him by first name, "If I had been in such recent, student relationship with Dr. Angle as you have been and had listened to a member of Dr. Angle's society present a paper that advocated treatment procedures that were completely out of harmony with Dr. Angle's teaching, I would have called him all that you have called me today, only a little worse." I then shook his hand. The tension broke and I surely was relieved. We had a good many situations like that in those early days.

In the primary period of the Tweed treatment, in an effort to avoid extraction, space to provide room to move the incisor teeth lingually to overlie

basal bone was made by buccal expansion of the deciduous canine and molar teeth. This was not a stabilized procedure as the buccal muscles forced them back. Extraction of the first premolar teeth, when they erupted, was found necessary to stabilize the rotation of the incisor teeth and provide room for the erupting canines.

Dr. Harry Bull of Jersey City should be given credit for teaching and insisting that permanent stabilization of results in treatment depended upon all teeth being maintained or replaced on locations overlying basal bone. In other words, dentures should not be expanded in treatment.

As a result of frequent discussions with Dr. Bull, who was a student of mine, I began an analytic study of the problem of permanent stability of our cases without plate and appliance retention subsequent to active tooth movement. I believed that if our treatment procedures were correct, there should be no need of plate and appliance retention. Nature's retainers should take over after active appliances had performed their work. The appliance, reduced to passive adjustment and maintained on the teeth for a short period, should be all that was necessary to allow the natural tissue retaining structures to replace it. So I decided to give nonretention a test. I reasoned as follows:

Teeth in a malocclusion were well-stabilized, but how?

1. Their roots were surrounded by a bony structure, the alveolar process.
2. They were securely attached to this process by the periodontal membrane.
3. The crowns were stabilized by cuspal interrelationship.
4. The crowns were also maintained in a fixed arch form and held in proximal contact by muscular activity and balanced muscular forces.

The fact that these active, noncalcified muscular tissues could be stabilizing agents has been overlooked and underestimated far too long. That muscular habits produce malocclusion has been recognized for years. On the other hand, it has escaped our attention that balanced muscular forces within the oral cavity are not only dictators of crown positioning subsequent to tooth eruption, but also, thereafter, maintain intertooth relationship, either in normal or in maloccluding adjustment. Muscles are universally looked upon as movers of structures and not stabilizers. In the oral cavity and throughout the entire body they are both activators and stabilizers.

By teaching and with my textbook I have endeavored to repay the great indebtedness that I owe to many of my associates in our specialty. My first two students came from foreign lands and were referred to me by the S. S. White Dental Company. Dr. Cavalcanti from Brazil was the first. This was in 1929 and the edgewise arch mechanism had just been brought out by Dr. Angle. He spent several weeks with me being in the office during the daytime and for three hours every evening at my home, where I had fitted up a room for technical instruction. Several years later, at his request, I gave a course for ten students at Rio de Janeiro. I could not speak Spanish but fortunately one of the students in this class spoke excellent English and was my interpreter. Also my textbook had just been published in Portuguese and each student had a copy. It was a wonderful experience and when I left, every student, with wife and children, came to the airport to see me off. I'll admit there were tears in my eyes.

My second student was Dr. Kenneth Adamson from Melbourne, Australia. He also spent several weeks with me at the office and home for his instruction

period. On his return to Melbourne, he inaugurated the orthodontic course at the University of Melbourne. Subsequently, Ken and I maintained close friendship and in the summer of 1940, with my wife and two daughters, I visited him in Melbourne. War was declared while we were there and shortened our visit. Our ship came back with no lights at night. U. S. A. certainly looked good to us when we landed at Los Angeles. I am thrilled to add that Ken Adamson, three years ago, was Knighted by Queen Elizabeth, when she visited Australia.

The next neophyte was placed under my care for an orthodontic education by Dr. Glen Bowman of Pittsburgh. This was in 1930 and his name was Dr. Will M. Thompson. Bill has never obtained freedom from me as will be subsequently noted. I continued my teaching in Bridgeport for a short period having three classes of five members in each.

In 1936 I was scheduled to give a two weeks course on the edgewise appliance technique at the Columbia University Dental School. This was a graduate course for practicing orthodontists with twenty-five individuals enrolled. As I alone could not handle that number, I prevailed on Bill and Dr. Morse Newcomb of Cleveland, who had been a member of one of my classes in Bridgeport, to cooperate with me as clinical instructors. Bill and I gave ten of these annual courses at Columbia. Morse was with us for the first two and was then succeeded by Dr. Glen Whitson of Brooklyn.

In 1948 Bill and I transferred our course to the University of Toronto. It was zero weather while we were there. Our hotel was some distance from the college and walking back to it at ten-thirty at night, when we dismissed the class, was a snappy experience, to say

the least. We were scheduled for a second year at Toronto but were unable to do so because so many of their students, whose courses had been interrupted by military service, were being discharged and were reentering the Dental Department so that all facilities were crowded and there was no place to accommodate us.

It so happened that Dr. Edward Strayer, also a student of ours, and then head of the Orthodontic Department at Temple University, Philadelphia heard that we were available for a graduate course and reported this to Dr. Gerald Timmons, Dean of the Dental Department. Dr. Timmons called me and made a date for an interview. This was in the fall of 1949. My interview with Dr. Timmons was a very tense and thorough discussion, and lasted about three-quarters of an hour. Finally he said, "Strang, I don't give a damn about you but I have learned that you are getting students from all over U.S.A. and that's good for Temple and so I'll take you". Well, that hit me right on the chin and my reaction was, "I'll see that you change your mind and at least give me some credit for having a good course".

At the beginning of the session, I handed Dr. Timmons the schedule for the entire two weeks. It outlined definite technical procedures, hour by hour, on every day except Sunday. Lectures, quizzes and a final written examination were scheduled for evenings from seven-thirty to ten. The dean was present at every morning class for the first week. At the end of that week he came to me and expressed his approval in most complimentary words. My reaction was, "At least he knows we're here for business and respects us". For eleven years, Bill, Glenn and I gave our course at Temple and Dr. Timmons became a very close and precious friend. In 1965 Temple University honored



me with an Sc.D. degree and Bill Thompson joined me as co-author of the fourth and final edition of the *Text Book of Orthodontia*.

Of the two weeks' course that I gave at Oslo, Norway in 1961 I have a most treasured memory. Perhaps it is due to the fact that there were three feminine dentists in the class of ten members. The class was held in the dental department of the university where the facilities were perfect. Frankly, I felt more like a guest than a teacher, even though I worked the students at high speed from nine in the morning to ten in the evening. Saturdays and Sundays I was entertained in various homes. Christmas greetings still come to me from members of that class. Added to the pleasures of this trip was the fact that my daughter, Dr. Ruth and her friend, Mrs. Shields, joined me at the end of the course and we travelled through northern Europe for two weeks. During that trip I lectured to the orthodontic students at the University of Copenhagen.

My final activities in teaching orthodontics were at Boston University when Dr. Margolis was Professor in Orthodontics. I taught several classes of graduate students the edgewise arch technique. I hold a very fond remembrance of that association.

In 1949 I was temporarily side-tracked, as it were, from our specialty to pay an indebtedness of long standing to a local dentist, Dr. Alfred C. Fones, nationally known as the founder of the specialty of Dental Hygiene. In 1912 Dr. Fones had visited Dr. Smith in Philadelphia who was giving his patients prophylactic treatments every three months and had, thereby, reduced dental caries in these individuals to a remarkable degree.

At the time, Dr. Fones was a member of the Board of Education of

Bridgeport and had noted the high percentage of dental caries in the school children of the city. This was causing a great deal of absence from school and even retardation from advancement to higher grades. He believed that routine prophylactic treatment could overcome this dental problem to a high degree. He knew that the dentists of the city could not take time from practice to give these treatments but a corps of trained young women could do it.

He obtained permission and finances from his Board to train a group of twenty-five young women to give these so-called prophylactic treatments. For their training he outfitted his garage with portable dental chairs loaned by dental companies. For theoretical education, he organized a faculty that any dental school would be proud of; they gave their services free, because they had faith in this project.

Among the instructors were the Dean and Assistant Dean of the University of Pennsylvania, the Dean of Harvard, five professors from Yale, one professor from Columbia, and an outstanding dentist from New York. Dr. Fones needed someone to teach Anatomy and Physiology. I had been out of college but a few years, and my orthodontic practice was nothing to brag about, so I had the time and when he asked me to teach those subjects I jumped at the chance. I not only taught those subjects, but also attended every lecture that those outstanding members of the faculty gave. I know I learned more than the students did; it was a wonderful experience.

I never forgot how much I owed Dr. Fones for this association. I did not believe that I could ever repay him and I was never able to do that before he passed on. However, in 1949 I was asked to inaugurate and be the

Director of the Fones School of Dental Hygiene at the University of Bridgeport. Here, at last, was my opportunity to repay my indebtedness to Dr. Fones. I said that I would accept the challenge and, if successful, I would serve as Director for five years. I was fortunate in obtaining as Assistant Director, Miss Frances Ferri, a graduate of the Harvard School of Dental Hygiene. The Bridgeport dentists and others in the state were most cooperative in serving on the staff as lecturers and clinical instructors. Several dental hygienists were added to the faculty and about twenty-five students were in the first class. Each year the number of students increased, some coming from states far from Connecticut. The school gained excellent credit and enrollment increased every year. My term of service mounted to a period of twenty years. In 1966 the University of Bridgeport honored me by the presentation of a Doctor of Laws degree.

About thirty years ago I began a careful study of the before and after models of cases that were well-stabilized with excellent results several years after the retaining appliances had been discarded. The similarity of the outline form of the before and after dentures was striking and the width across the mandibular dentures at the canine and first molar areas was universally duplicated in the two sets of models. There was no doubt in my mind that balanced muscular force had dictated, produced and stabilized these arch forms, the one in malocclusion and the other in normal occlusion. The thought came to me that these mandibular canine and molar measurements on models of malocclusion could be taken as guides to produce stable results in treatment and thus eliminate retaining appliances. I believed they could, but I certainly needed clinical proof to substantiate that belief. From that time on my treat-

ment archwires conformed to these measurements on the malocclusion models. In extraction cases, when first premolars were removed and the canines moved distally, the width across the canines could be proportionally increased. No retention was used when the active appliances were removed. Muscular activity made the final adjustments. A few habit cases, such as tongue-thrusting during swallowing, required plates in the maxillary dentures to stabilize the incisors. The mandibular dentures, even in these cases, were well-balanced without retainers.

In *The Angle Orthodontist* for January, 1949 is an article entitled "The Fallacy of Denture Expansion as a Treatment Procedure". I read this paper at the Angle Society meeting at Santa Barbara, California on March 24, 1947. On the last two pages of this article the writer states his conclusions evolved from this analysis of completed cases, several years after retaining appliances were removed.

1. Every malocclusion represents a denture under the influence of and stabilized by balanced muscular forces.
2. These balanced muscular forces are inherent to the individual and cannot be changed by any known method of treatment.
3. These muscular forces are present in two forms—muscular tonus and muscular contractions.
4. Successful treatment, as illustrated by permanent stability, must aim to preserve this muscular balance rather than alter or upset it.
5. The key teeth in designating the tooth positioning that is harmonious with the muscular forces constantly in action upon the denture are the mandibular canine and first molar dental units.
6. Therefore, stabilized results can only be gained when the width of the

mandibular denture in the canine and molar areas is maintained inviolate.

7. The form of the maxillary denture and the positioning of the maxillary teeth are governed by the mandibular denture form and tooth positioning established by adhering to the dictates of muscular balance.

8. When it is impossible to rearrange the mandibular dental units in the desired alignment with the incisors re-established in locations overlying their basal supporting bone, without moving the canine teeth labially and the molar teeth buccally, extraction of dental units is definitely indicated.

9. If muscular balance is preserved in treatment, it should be possible to eliminate mechanical retention at the end of active treatment and have a result that would remain stable.

Having drawn these conclusions, the next logical step was to test them in clinical application. For three years (1946 to 1949) this was done. The archwire patterns were shaped to preserve the width across the mandibular canine and molar teeth that was present in the maloccluding denture. Only in extraction cases, wherein the canines were moved distally into the wider, premolar areas of the denture, were these canine key teeth moved slightly buccally. Also, in closed bite dentures, in which the canine crowns had been tipped lingually by the occluding maxillary canines, the mandibular canines were tipped labially to normal axial inclination coincidentally to opening the bite.

At the end of treatment the archwires and bands were removed and no retaining appliances were placed on these dentures. The patients were seen every six weeks with most gratifying results. In three cases it was necessary to place a bite plate in the maxillary denture to prohibit a return of too

great an overbite. None of the cases required any retention in the mandibular denture. Consequently, I believed that sufficient data had now been accumulated to verify the value of this offering and establish it as a basic principle for successful treatment.

There is no question in my mind that denture expansion as a treatment procedure in the correction of malocclusion should be discarded and every effort should be directed toward preserving the muscular balance that is the most important factor in establishing and maintaining tooth positioning. It is an inherent and unalterable balancing force in every individual that comes to the orthodontist for corrective procedures and cannot be ignored or modified. It is established early in life and apparently is just as inflexible as is the growth pattern of the basal bones.

Always remember that a case of malocclusion is a definitely stabilized unit. Therefore, in treatment, you must not disturb the action of the structures that produce this stabilization. Consequently:

1. Do not increase the width across the mandibular canine and molar teeth in treatment. If, however, you have extracted the mandibular first premolar teeth to provide space for overlapping and rotated incisors, the canines may be moved distally and buccally to harmonize with the amount of premolar area required for the correction of the incisor deformities.

2. Overcorrect rotated teeth as the periodontal membrane fibers must be reduced in tension.

3. Correct faulty axial positions.

4. Correct overbites.

If you follow these suggestions, no retaining appliances will be needed except in tongue-thrusting cases.

I cannot end this historical contribu-

ution without paying tribute and expressing deepest gratitude to the many, many friends that professional activities have blessed me with. It is understandable that in those early days, when there were comparatively few members in this developing specialty, our contacts in meetings were more intimate and friendships were closer. We all had treatment problems to solve and were hoping for constructive help. In turn, we tried to be of service to our fellow members. Those were the days of trial and error and error predominated. Slowly, but progressively, errors were eliminated, progress was made and today, orthodontics is a scientific specialty.

I have noted that a high percentage of recent graduates in dentistry are selecting orthodontics as their special field of practice. This is filling an essential need because the demand for this service is rapidly increasing. Owing

to the fact that the period of treatment must extend over the years of denture growth and development, the number of patients that an orthodontist can accept must be limited if he is to be able, at each appointment, to give the time-consuming appliance adjustments essential to continuous progress.

In closing, I take this opportunity to extend affectionate greetings to all my former students who endured those lengthy days and nights of instruction. I still recall what one of them said to me as his goodbye words, "Dr. Strang, I'll tell you what I'm going to do when I get home. I'm going out to my cabin in the woods with my old hound-dog and sit on the porch in my rocking chair with a cigar in my mouth. I'll rock and rock, pat the great big dog on the head and shout, "Dr. Strang, go to the big, bad place where all sinners go!"

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