The Missing Mandibular Second Premolar, A Problem in Orthodontic Treatment

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THE SCARCITY of articles on the treatment of cases with missing mandibular second premolars, and the general nature of the material presented, makes it seem logical for a study of the problem to be made and the results interpreted on the basis of recent research and trends in clinical treatment.

In reviewing the literature one gets the impression that great care has been taken to preserve and to recreate the complete pattern of the dental arch, lest balance be lost in the denture and its relation to basal bone and facial musculature. A critical study of completed cases frequently reveals relationships, which although described as being satisfactory, are most familiar to those who have created similar conditions and have found them to be unstable. Heroic efforts to obtain harmony and balance have resulted not infrequently in obvious lack of balance.

Much has been said about the necessity of retaining all the tooth units and their equivalent space when missing. Not to do so would result in lack of proper occlusal and proximal forces as a source of stimulation to basal bone. It has been my observation that much of the discourse regarding loss of balance about the face, and lack of stimulation for the proper growth of basal bone structure has been conjecture. The advent of the cephalometric X-ray has made it possible to study growth changes both in the untreated as well as the treated patient. Its use has resulted in more comprehensive diagnosis, and has made possible accurate study of tooth movement and accompanying bone change.[1]

Concerning the missing mandibular second premolar, Anderson says, "In treating such a case an efficient result, from the standpoint of serviceable occlusion, can be obtained by moving the mandibular molars forward the width of the premolar. Mesial occlusion of the mandibular molars with the maxillary molars is truly established. This plan of treatment produces normal occlusion of the teeth from the first premolar forward, but the mandibular molar is still one cusp mesial. The masticating efficiency in these cases, however, is far better than if an artificial tooth had been supplied; also the possibility of trouble from attachments made to vital teeth is eliminated."[2]

Strang has stated, "the treatment of these cases revolves around two plans: (1) The restoration of the space that should normally be occupied by the missing tooth, followed by the substitution of an artificial dental unit, and (2) the closure of the space by the movement of the juxtaposed teeth, with the production of as serviceable an occlusion as is possible and the elimination of artificial substitution. By following the first plan, the operator will be able to produce the best possible results in the restoration of

functional efficiency to the organ of mastication, because he will be placing in balance and harmony the tooth surfaces that were designed to approximate and occlude with one another in the grand plan of occlusion, he will also effect a more complete growth in the bony framework of the organ and more perfect functional balance in its musculature, and finally, he will make a more effective restoration of beauty of facial lines as the soft tissues mold themselves over the completely restored and fully grown basal structures. This, then, may be said to be the more ideal method of solving the problem. The disadvantages of closing the space, are the destruction of normal inclined plane relationship; the incomplete bony growth, the unbalancing of muscular forces by the necessarily abnormal occlusal surface contact, the blemish produced in the facial lines and the unpleasing appearance that results from the presence of a tooth in a location where its size and form do not blend with those of the teeth of proximal contact and do not balance with the general lines of harmony found in this section of the head anatomy.

"Regarding the mandibular second premolar teeth, the factor of greatest influence is the extent of the overbite. When the examination shows an abnormal degree of overlapping of the incisor teeth with the occlusal edges of the mandibular incisors striking the gingival tissues just lingually to the maxillary incisors, it would be a serious mistake to attempt to move the lower molars mesially and close the spaces where the second premolar teeth should normally be found because, in doing this type of tooth movement the tendency would be to increase the extent of the overbite. Certainly such a tooth shifting would not be of aid in overcoming the defect. On the other hand, the carrying of the molar distally and the first premolar and canine mesially, combined with the depression and the labial movement of the incisors, would tend to correct the abnormal tooth overlapping in the anterior section of the mouth."[3]

Recently Brodie[4] has demonstrated in his cephalometric study of patients from 3 months to 8 years of age, that those relationships, proportions, and angles formed by the bone structures of the head and face which exist at birth, continue the same through the developmental years. It has been shown that in orthodontic treatment the teeth may be moved in relation to basal bone, but the basal structure, itself, remains unchanged. If this is true, one could conclude that to a large degree nature dictates the size and proportion so far as structure is concerned. Our efforts will accomplish but little in attempting to increase the volume of basal bone structure.

All too frequently, results which on the surface may be interpreted as being an improvement in facial lines, as enhancing harmony and balance, are in reality not so. If in developing a denture the teeth are placed too far anteriorly in relation to structure, the lips will also be held too far forward in what is not a position of harmony and balance, but an unnatural, strained position. More growth in the entire face may be most desirable, but where it is lacking, movement of teeth alone is not sufficient and will only result in prolonged mechanical retention and final collapse in the anterior part of at least the mandibular dental arch.

Tweed[5] and Nance[6] stress the importance of maintaining teeth in proper relationship to basal bone as a requirement of harmony, balance,

and permanence in treated cases. To accomplish this they have not only utilized extensive anchorage preparation, but have also resorted to extraction of teeth in a surprisingly large percentage of cases. Interpreting their treatment with the best knowledge of growth and development obtainable to date, I am inclined to think that in many respects it is sound. If this is true, mandibular second premolars will be missing in a large percentage of cases where the conditions are such that a shortening of the dental arch length would not be a detriment, and frequently would even be desirable.

There may be an occasional case where it would seem desirable to leave the deciduous second molar in place, permitting it to act as a permanent tooth unit. In such a case it would be necessary to reduce its mesio-distal diameter by cutting away its proximal surfaces. This is something I am not in favor of, and have never done. The tooth may also be retained, maintaining its full size, but either leaving the six year molars in slight malocclusion, or slight overlapping of the lateral incisor canine contact, or in some instances in spite of one's best efforts, both may exist. Retaining the deciduous teeth, I believe, is for the most part unnecessary, and unsatisfactory. Where the second pre-molar is missing on one side only there may be more justification for maintaining the deciduous tooth, however, even in these cases I prefer to close the space.

When both lower second premolars are missing, if it is at all possible, that is, if the structures of the face will seem to accommodate such movement without becoming too flat, it is my choice of procedure to remove the mandibular second deciduous molars, also the maxillary second premolars, and close all four spaces so that the six year molars will occlude with their proper antagonists.

The following case records and discussion represent a clinical and cephalometric study of cases with missing mandibular second premolars.

The first case is that of a girl, age eleven years two months. The six year molars were in an end to end cuspal relationship. Both dental arches were narrow, and mandibular incisors were crowded with the lateral incisors in linguo-version. The anterior teeth of both arches were inclined labially. The mandibular second premolars were missing on both sides. There were no third molars present in the mandible. The maxillary third molars were formed in their crypts. The face showed a corresponding lack of balance in structure and musculature.

In studying the problem of treatment, I was anxious to leave the mandibular second deciduous molars in place in one case so that it would be possible to make a comparison with cases in which they were removed and the space closed. Since the deciduous molars were in good relationship to the rest of the mandibular teeth, and the mandibular third molars were not present, I decided to leave the deciduous molars in place. However, it is rather obvious from the labial inclination and crowding of the incisors, and the lack of basal bone structure that this case would have responded favorably to eliminating the second premolars of both arches.

The edgewise arch mechanism was used to create the tooth movements. Inter-maxillary elastics were used toward the end of treatment to correct arch relationship. No extra-oral anchorage was utilized. Treatment extended

Fig. 1, A.—Photograph of Case I before treatment.
Fig. 1, C.—Photographs of Case I after completion of active treatment.

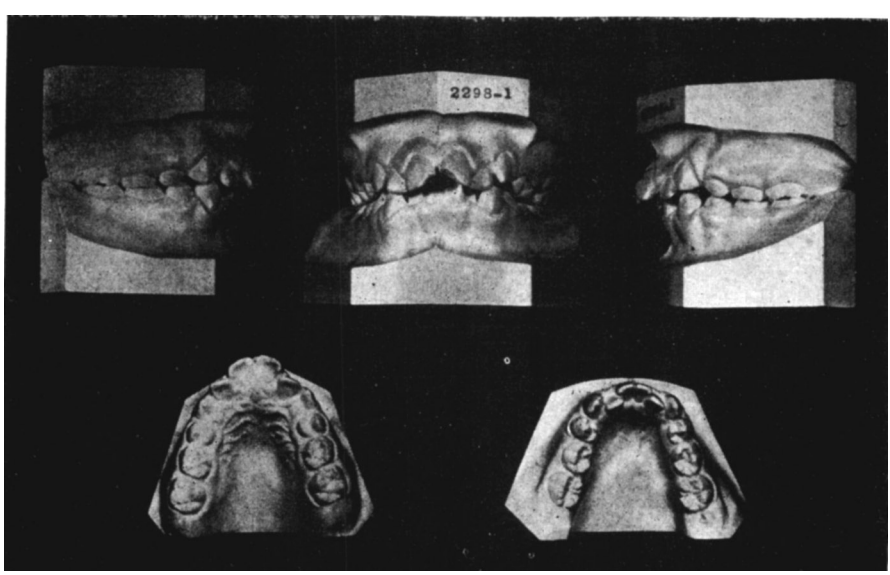

Fig. 1, B.—Models of Case I before treatment.

over a period of approximately two years and four months. The case is being retained by removable retainers which are worn at night only.

As would be expected, with the deciduous molars left in place, the mesio-buccal cusp of the maxillary first permanent molars do not occlude exactly in the buccal groove of the corresponding mandibular molar teeth.

Fig. 1, D.—Models of Case I after completion of active treatment.

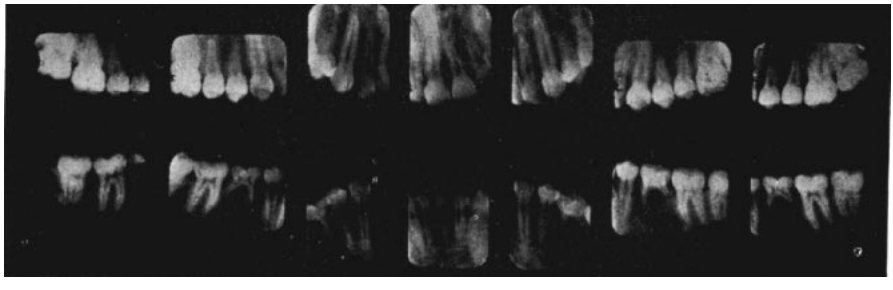

Fig. 1, E.—Radiographs of Case I after completion of active treatment.

There is a very slight break in the contact between each mandibular lateral incisor and canine tooth. Both maxillary and mandibular incisor teeth are sufficiently forward in relation to basal bone structure as to make retention questionable. The face, although much improved over the original, still presents a strained appearance of the musculature about the mouth. The intra-oral radiographs (Fig. 1, E) show healthy structures at the end of treatment.

A study of the composite tracing (Fig. 1, F) shows a tendency in tooth movement which is, for the most part, typical. However, there has been a shifting of the occlusal plane, tipping up in the posterior part, and lowering in the anterior. This is unfavorable, although it will probably shift back again during the post treatment period. The fullness under the lower lip after treatment, in contrast to the curved area originally, indicates an incorrect function of the mentalis muscle, and a danger signal. The function

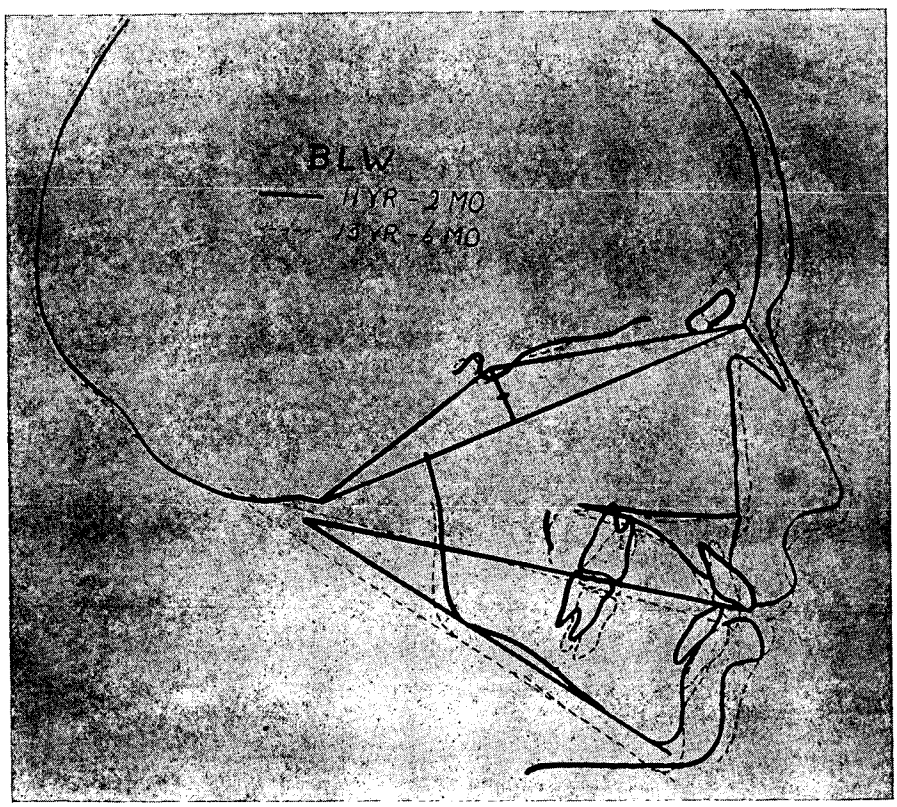

Fig. 1, F.—A composite tracing from cephalometric X-ray tracings of Case I before and after treatment.

of the lips before treatment was unsatisfactory. This contraction of the mentalis may be due in part to the patient's effort to keep the lips closed, with insufficient development of the upper lip to make the act comfortable. The position of the denture, I am sure, is also complicating lip function. It will also be noted that although this patient was treated in a favorable period, between eleven and thirteen years of age, the amount of growth is quite small. This is, no doubt, quite responsible for some of the signs of failure.

As indicated in the opening paragraphs, the tendency in the past has been to keep the space of missing second premolars, thinking that by so doing it would produce the normal stimulation to bone growth and would

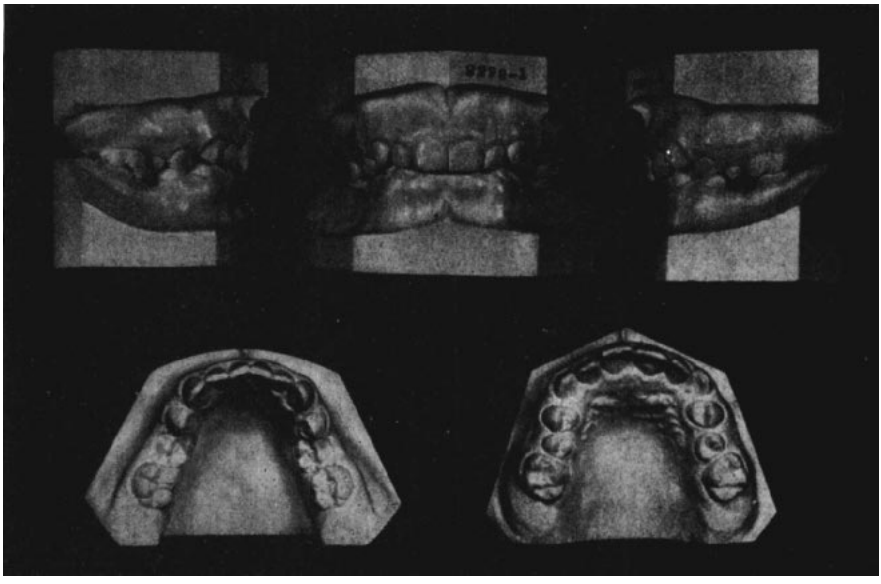

Fig. 2, A.—Models of Case II before treatment.

result in better harmony and balance. From the study of this case, I would be inclined to reverse the statement and say, "if it is possible to ascertain from the study of a case prior to treatment that nature is definitely lacking in growth and will not be able to accommodate the movements necessary to put every tooth unit into the line of occlusion, it would be better to com-

Fig. 2, B.—Models of Case II after completion of active treatment.

promise and remove some of the tooth material." It has been my conclusion that this case falls into such a classification. Instead of removing the mandibular premolars I have retained them and by so doing have courted failure.

The second case is that of a boy, age fifteen years and two months. He had some disturbance with feeding in infancy and has been slow in tooth

Fig. 2, C.—Photograph of Case II after completion of active treatment.

eruption. He was a healthy appearing boy of average height and weight. The case history gave no further information of particular interest.

He had a Class II malocclusion with the maxillary incisors inclined but slightly to the labial. The maxillary second premolars were small. The mandibular incisors and canines had a lingual inclination. The mandibular first premolars were inclined distally and the six year molars mesially, with

Fig. 2, D.—Radiographs of Case II after completion of active treatment.

the second deciduous molars submerged between them. The mandibular second premolars were missing. None of the twelve year molars had erupted yet at fifteen years, although they were fully formed and about to erupt. All four third molars were present, but tardy in their formation.

Noyes[7] has described such submerged deciduous molars as being ankylosed teeth, in which there is an arrest in growth. It has been his opinion that the only way to favorably influence this condition is to extract the deciduous teeth and also remove some of the adjacent bone tissue. When the premolar is present such a procedure would no doubt be necessary to assist its eruption. In the absence of the premolar, such a submerged tooth is of no value and its removal is certainly indicated.

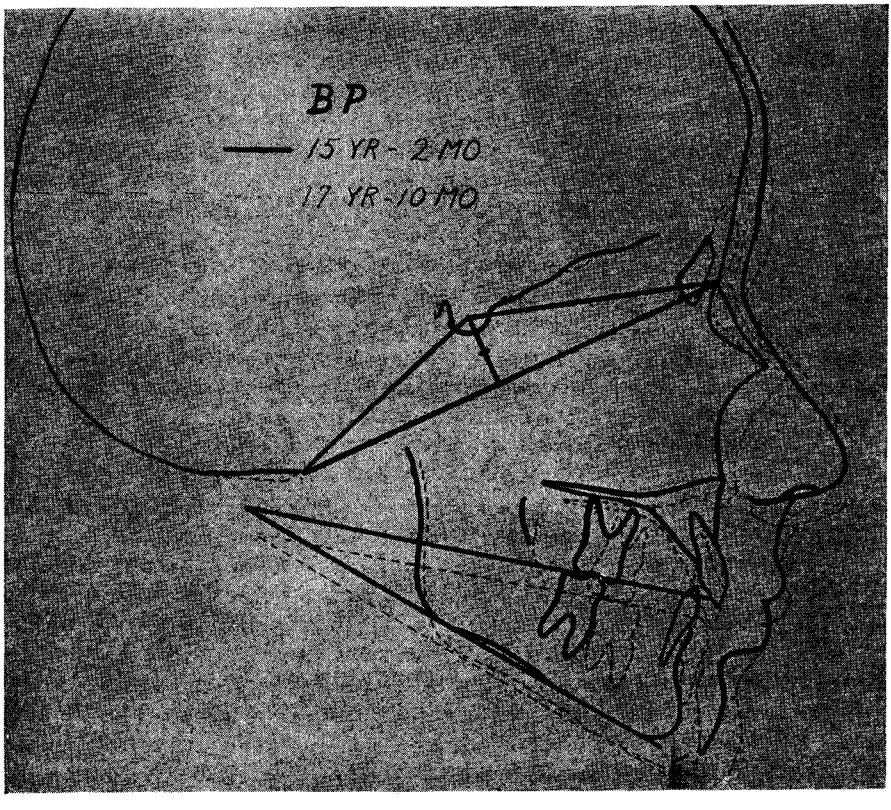

Fig. 2, E.—A composite tracing from cephalometric X-ray tracings of Case II before and after treatment.

The original profile photograph has been misplaced, however, the profile may be studied from the composite tracing (Fig. 2, E). The face seemed to be quite well developed, except for the depression between the lower lip and gnathion.

As I interpret this case, it is the type which Strang has described in which he said, "to move the mandibular molars mesially and close the space would be a serious mistake, because in doing this type of tooth movement the tendency would be to increase the extent of the overbite." This case

gave me some warning in the delayed schedule of tooth eruption. I agree that the deep overbite would seem to favor keeping the second premolar space open. However, the fact that the second deciduous molars were submerged, and had to be extracted; the presence of all four third molars; and my dislike for having bridge work placed at the conclusion of orthodontic treatment, made me decide to close the space for all four second premolars.

The edgewise arch mechanism was used to create tooth movements. The occlusal plane, arch form, and tooth inclination, were corrected in both arches. The spaces were closed in the mandibular arch by the use of loops in front of the molars augmented with intermaxillary force. When the molar relationship was correct, the maxillary molars were allowed to move forward with the mandibular ones, and were assisted in this movement by ligating over the distal of the buccal tube to a spur some distance in front of the tube. The active treatment of this case extended over a period of two years and eight months. It was dismissed at the end of treatment with no retention. I have observed the case just recently, seven months after appliances were removed, and the relationship remains unchanged except that the overbite has increased about a half millimeter in the incisor area, and the mandibular incisors are slightly more vertical in position. No incisor rotations have occurred.

The patient had a satisfactory facial outline at the conclusion of treatment. I am not pleased about the lingual inclination of the mandibular incisors. This was one of the first cases I ever treated with the edgewise mechanism, and in my ignorance, no labial crown torque was used on these teeth to increase their anchorage for creating molar movement. Their inclination has improved some, and my guess is that it will continue to do so. The occlusion in the posterior part of the mouth is satisfactory.

A study of the composite tracings (Fig. 2, E) shows a desirable change in profile outline. The deep groove below the lower lip has become a very satisfactory contour. In contrast to case I, this patient has had a rather large amount of facial growth even though treated at an older age, and supposedly almost undesirable period of growth. There has been quite an increase in the size of the mandible, and a corresponding growth of the maxilla. It will be observed in relation to cranium that the six year molars have moved bodily forward. The mandibular molars have moved forward the full width of the teeth, and are more distally inclined. The occlusal plane has remained unchanged.

Much more effort was required to obtain this patient's result than would have been necessary if the spaces had been kept open, nevertheless, I think it has been most justifiable. As the radiographs record, this boy happens to be one of those rare individuals who has never had a cavity. Should he be as fortunate in the future, he will, no doubt, have a satisfactory functioning denture with a minimum of dental attention.

Although when starting this case I was not certain that the plan for treating was the best for the patient, after appraising the finished case I am convinced that the result is more satisfactory than would have been obtained by keeping the space for the second premolars open. The success is due in no small degree to the favorable growth response of the patient during this

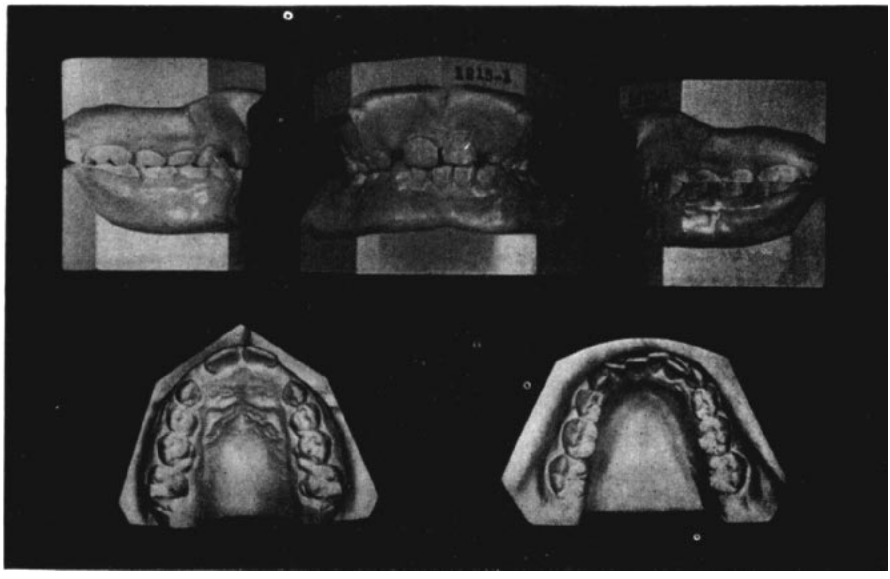

Fig. 3, A.—Models of Case III before treatment.

Fig. 3, B.—Photograph of Case III before treatment.

period. This response, of course, would have made the prognosis of any form of treatment more favorable. To those who have held to the theory that maintaining the integrity of the dental arches would stimulate bone growth and result in better harmony and balance, I want to point out that in these first two cases, the combination of treatment and growth pictures just happened to be such that teeth were removed from the patient with greater growth of structures. I fail to see any correlation between arch integrity and growth response in these two cases.

Fig. 3, C.—Models of Case III after completion of active treatment.

The third case included in this discussion is that of a boy age nine years and eight months. Between six and eight years of age he had chicken pox, measles, and scarlet fever. The rest of the case history revealed nothing unfavorable.

The teeth were in Class I malocclusion. The mandibular arch was crowded in the incisor area with the incisors irregular and in rotated positions. The maxillary arch was narrow, with the buccal teeth of the left side biting in lingual relationship to the mandibular teeth. There was insufficient space for the maxillary incisors. A small space existed between the maxillary central incisors. The median line of the maxillary arch was to the right side of that of the mandibular arch. The denture gave one the impression of being in quite satisfactory relation to basal bone structure.

The intra-oral X-rays showed the congenital absence of the mandibular second premolars. All four third molars were present.

The profile photograph showed the face to have quite a pleasing balance. I think the lower lip was slightly prominent.

In trying to determine a plan for treatment my dislike for prosthetic appliances at the conclusion of the case was a strong influence. A study of

the face, combined with the fact that more space was needed to accommodate all the teeth, made me favor closing the second premolar space. The presence of all four third molars further substantiated such a procedure. To make this plan seem more logical, the mother had a severe class I malocclusion in which there was insufficient tissue to accommodate the denture. She informed me that her teeth had been regulated a few years previously with obvious failure. A repetition of the same for the boy would most certainly not be appreciated.

Fig. 3, D.—Photograph of Case III after completion of active treatment.
Fig. 3, E.—Photograph of Case III six months after treatment.

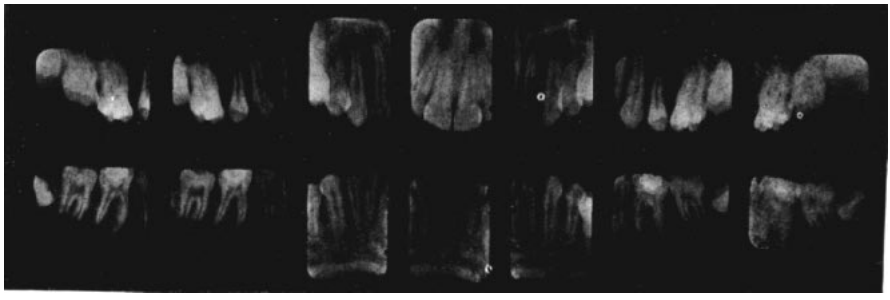

Fig. 3, F.—Radiographs of Case III after completion of active treatment.

Treatment was started at the age of nine years and eight months. The cross-bite was corrected along with lateral expansion of the maxillary arch. The mandibular second deciduous molars were removed and the six year molars permitted to move part of the way forward along with the correction of tooth alignment in the incisor area. The forward movement of the molars

was stopped when the distal portion of the occlusal surface was in contact with the mesial portion of the maxillary six year molars. The case was then placed on retention until the canines and premolars erupted. The maxillary second premolars were then extracted and the maxillary six year molars were moved forward to correct occlusion with the mandibular six year molars. The rest of the premolar space was then closed by moving all four six year molars at once. Tooth movements were created by the use of round labial arches and McCoy tube attachments. Although two years of active treatment were required, another two years of retention and observation were necessary before the case was completed. The patient was dismissed at the conclusion of treatment with no retainers. I have checked the case recently, ten months after the appliances were removed, and there has been no collapse in either arch, nor any tendency for mandibular incisors to rotate. I recommend that when closing second premolar spaces, if at all possible, treatment be delayed until the canines and premolars erupt. It will shorten the duration of active treatment.

A satisfactory functioning occlusion has been established. The face was a little flat at the conclusion of treatment, however, the photograph taken six months later shows the face in fine balance, and even a marked improvement over the original taken at the beginning of treatment. The radiographs at the conclusion of treatment show healthy structures throughout. In spite of the elimination of tooth material there is not any too much space available for the developing third molars. No cephalometric X-rays were made for this case, nevertheless, the rest of the records make a worthwhile contribution to this study.

Conclusions

1. A careful study should be made of each case of missing mandibular second premolars, and where at all possible, the spaces closed. It is also preferable in most instances to remove the maxillary second premolars and close the spaces so that the six year molars are left in correct relationship with their antagonists.

2. Diagnosis should be influenced by the amount of growth present at the beginning of treatment as an indication of the availability of tissue to accommodate tooth movements.

3. The cephalometric X-ray is invaluable as a diagnostic aid and as a means of studying changes accompanying treatment.

4. The extent to which basal bone structure develops seems to have no relationship to the enlargement of the dental arches.

5. If other factors about the denture will permit, treatment of cases with missing mandibular second premolars should be delayed until the eruption of the canines and remaining premolar teeth.

6. In the cases studied, the occlusion was more satisfactory, and required no retention where the spaces were closed, in contrast to prolonged retention where the space was kept open.

7. Appraisal of results should not be made at the time of completion of treatment. A successful case will continue to be so following the removal of all mechanical support.

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