

The Congenitally Absent Premolar Problem

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The congenital absence of one or more permanent teeth is the most common oral anomaly. Most frequently absent, exclusive of the third molars, are the second premolars especially in the mandibular arch. A solution to this problem, and one we have found practical, is space closure with appliance therapy similar to that used in cases where extractions are part of the treatment plan.

To determine the approximate incidence of missing premolars, full mouth radiographs of three hundred consecutive patients were examined. There were 124 males and 176 females in the group and the age range was seven to twenty-five years. None sought orthodontic treatment specifically for this condition and were usually unaware of it. Excluded from the series were mutilated cases and one case of partial anodontia.

Twenty persons, or 6.6 percent, had a total of 29 congenitally absent second premolars, predominantly in the mandible.

By contrast, only eight persons in this group of three hundred had a total of twelve congenitally absent maxillary lateral incisors. Since treatment was sought specifically for correction of this condition in most cases, we may presume that the percentage is even higher here than it is generally. This series indicates that second premolars are more frequently absent than lateral incisors, although the reverse is usually held to be true. Our findings are in substantial agreement with a recent survey of 3557 children, where 6.01 per cent had one or more teeth congenitally absent, with the mandibular

second premolar most frequently missing followed by the maxillary lateral and central incisors.

In cases where the second deciduous molar was still present, root resorption varied from complete to none at all. In the latter cases it may be questioned whether the teeth will be retained throughout life and therefore whether treatment is indicated.

Deciduous teeth without permanent successors in any part of the mouth are rarely if ever retained beyond early adult life. "The attachment apparatus of the roots of the deciduous teeth cannot accommodate the heavier stresses of an adult jaw; hence, in deciduous teeth without successors, resorption will occur due to stresses of occlusal trauma." This is particularly true in the case of the lower second deciduous molar where the large occlusal area and thin roots present an unfavorable proportion. Even were this tooth retained in an occasional case, its large mesio-distal width compared with the space normally occupied by the permanent premolar makes normal inclined plane relations impossible. Ankylosis, with an apparently "submerged" deciduous molar, is a frequent complication in these cases.

We are confronted then, with an edentulous space, or one that may soon become so in the posterior part of the mouth. The injury that may result to the occlusion and to the dental and periodontal tissues is well known and treatment becomes a necessity.

TREATMENT ALTERNATIVES

The two possible treatment plans are replacement with an artificial substitute and mechanical closure of the

space. In weighing the advantages and disadvantages of each, esthetics is fortunately not a consideration in this area as in the case of the absent maxillary lateral incisor.

The chief advantage of the "prosthetic" plan is its rapidity, in comparison with the time required for successful completion of the "orthodontic" plan. If the occlusion in other areas does not warrant treatment, it may be the plan of choice.

Retention of the deciduous molar and its replacement at the time of exfoliation is also the plan of choice in the less frequently seen malocclusions where interdental spacing is a prominent feature.

The disadvantages are:

1. A fixed bridge requires full or partial coverage of at least two abutment teeth with considerable removal of tooth structure. If little or no caries is present most patients and many dentists are reluctant to proceed.

2. It compels a young person to wear an artificial substitute for the life of his dentition. The free gingival margins in relation to teeth change throughout life, exposing the finishing lines of the castings, and the best made bridges wear or break. Such factors require remarking at intervals.

3. Crown and bridge prosthesis is an exacting phase of the general practice of dentistry. If it is decided to use a fixed bridge, Strang cautions that "the orthodontist is in a delicate ethical situation for very often he knows that the dental practitioner, who will be called upon to make the artificial substitution, is not a competent prosthetic worker, yet he can hardly tell the parents that this is the reason for eliminating the ideal method of treatment. Such a decision, however, must be reached if the facts warrant it."³

Space closure with appliances avoids these disadvantages. A better result is obtained if correction of the occlusion

warrants the extraction of an opposing premolar and the prospects of success are even greater if bilateral treatment is used.

A possible objection to space closure in the mandibular arch is the increase in anterior overbite where one greater than desirable already exists. This is felt to be due to mesial movement of molars, the same objection that is frequently voiced regarding premolar extraction therapy in general.⁴

This is perhaps based on the similarity of the temporomandibular joint to a simple hinge, where movement of an object toward the rotational axis (the equivalent of distal movement) results in an opening, and closing results from a forward (mesial) movement. Even if we assume such a mechanistic and oversimplified view of these structures, a few millimeters mesial movement, as in space closure, compared with the far greater distance between condyle and incisors will result in negligible overbite increase. Moreover, to consider only mesial and distal movements is to ignore the much greater roles of levelling various areas of the occlusion and of correcting axial inclinations, by means of which the overbite is corrected. Correct management of extraction cases in our experience results in a *decrease* in the original overbite.

Or the objection may be based on the observation that posterior extractions, performed for other than orthodontic purposes, frequently result in closure. This may be true in untreated cases where the teeth are permitted to drift and tilt. However, even here it has been pointed out by Bull⁵ that older patients who have lost all lower posteriors, as in the frequently seen "lower lingual bar case," do not always present a deep overbite.

We can only conclude from this that the anterior overbite is the product of many complex variables in the dentofacial skeleton and masticatory

musculature. With a full-banded technique and proper appliance manipulation it is possible to finish treatment with an almost "end to end" bite, so that if a slight relapse occurs in this area, as sometimes happens, the final overbite after retention will not be excessive. It is a hasty generalization to indict this method of treatment for overclosure.

An appliance capable of root movement is essential since proper vertical axial inclinations are an objective if space closure is to be maintained. If this is neglected, Strang states, "all of these teeth are eventually going to readjust themselves to the lines of the force in action upon them. *They are going to do this by crown movement and not by root shifting* In the premolar area the greatest relapse will be manifested by a recurrence of spacing in the extraction area."⁶ This precaution is doubly applicable in view of the difficulty of maintaining proper proximal contact in the lower second premolar area.

TREATMENT PLAN AND APPLIANCE THERAPY

An analysis of the malocclusion as a whole will dictate the strategy of movement. Of particular importance are upper to lower molar relations, crowding anterior to the space, and inclination of incisors relative to basal bone.

The premolar space may be closed by the mesial movement of molars, the distal movement of premolars and canines followed by the lingual movement of incisors, or combinations of both.

Bands are placed on the first molar, first premolar, and canine. Second molars are banded if the posterior segment is desired as anchorage. If incisors are in good alignment, are not procumbent, and mesial molar movement is the objective, incisors are banded immediately. The most distal band

carries an edgewise tube; other bands carry double width brackets. Siamese brackets are very efficient, but make arch manipulation slightly more difficult near the end of treatment.

Uniform tube and bracket height from cusp summits and incisal edges in the same arch is an accepted principle of edgewise technique. However, the lower first premolar bracket in most cases must be placed further gingivally than the other attachments in order to elevate this tooth. There are two reasons for this:

1. The distal marginal ridge of the premolar, due to its small lingual cusp, is low in comparison to the mesial marginal ridge of the molar.

2. The molar cusps usually show greater abrasion due to their longer period of use since eruption. Placing attachments at uniform heights will increase the discrepancy of marginal ridge heights resulting in an unsatisfactory proximal contact.

The summit of the buccal cusp of the first premolar is slightly reduced to harmonize with adjacent teeth. The above precaution will aid in attaining a better proximal contact in an area where it is frequently difficult to do so.

Successive round wire arches are placed for levelling, correcting rotations and principally for uprighting. A double round loop is incorporated in the center of the space (Fig. 1) making the action gentle in the first phases of treatment and effective over a longer period of time. The loop is activated slightly and adjustments are made at intervals of not less than four weeks.

A rectangular wire (.021 x .025) into which has been incorporated a Bull loop and tie back spur (Fig. 2) is placed next without activating the loop. Later the loop is opened one millimeter by tying back at intervals of not less than three weeks. More frequent activations result in loss of anchorage and unfavorable tissue reactions.⁷

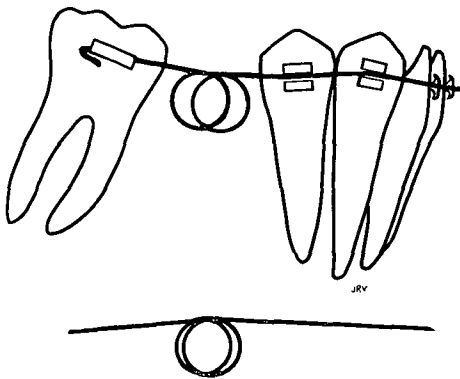


Fig. 1 Round wire arch with double loop (active) in the mouth. Below it, archwire in its passive form before insertion.

Intermaxillary elastics of the Class II or III type may be used either to aid desired movement in one segment or to prevent undesired movement in another.

When the crowns are in contact and x-rays reveal that the roots are not parallel, the molar may be given a tipback, and the premolar a tip-forward bend, while actively maintaining proximal contact.⁸

If the second molar has not been

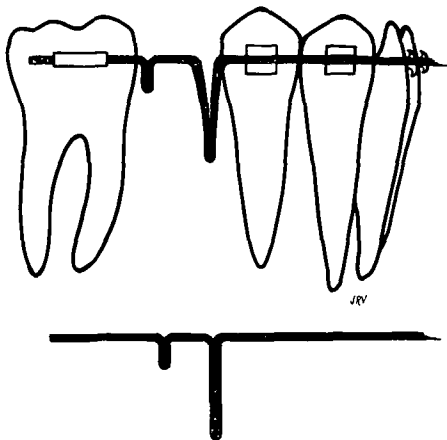


Fig. 2 Rectangular wire arch with Bull loop (active) and tie-back spur in the mouth. Below, its passive form.

banded it will usually be found mesially inclined. A slight mesial inclination is normal and may actually help maintain proximal contacts throughout the arch. If excessive, it may be corrected by banding and uprighting.

CASE REPORTS

Case 1. M. B., female, 11 years. Class II, Division 1 with moderate lower anterior crowding. Lower second premolars, right and left, were congenitally absent (Fig. 3). Brother was missing one premolar.

Lower deciduous molars and upper first premolars were extracted. Intermaxillary elastics, in addition to occipital anchorage in the upper arch, were used. Lower second premolar spaces were closed by a combination of mesial molar movement and distal premolar and canine movement. Treatment time: twenty-six months.

The lower right premolar shows distortion of its apex, and the lower left premolar, slight apical resorption (Fig. 3B).

Case 2. J. S., male, 13 years. Lower left second premolar and upper right second premolar were congenitally absent. Buds of upper left premolars were ectopic, and upper lateral incisors were undersized. The patient's father gave a history of partial anodontia.

The series of four x-rays (Fig. 4) taken over a period of three years shows the space closure and uprighting of adjacent teeth. The crowns have been moved together approximately 10 millimeters and the apices $1\frac{1}{2}$ millimeters.

No root resorption is evident. There is slight distortion of the premolar apex.

Case 3. B. G., female, 11 years. Class II, Division 1 bi-maxillary protrusion with moderate lower anterior crowding. Lower second premolars, right and left, were congenitally absent. (Fig. 5)

The ankylosed lower deciduous

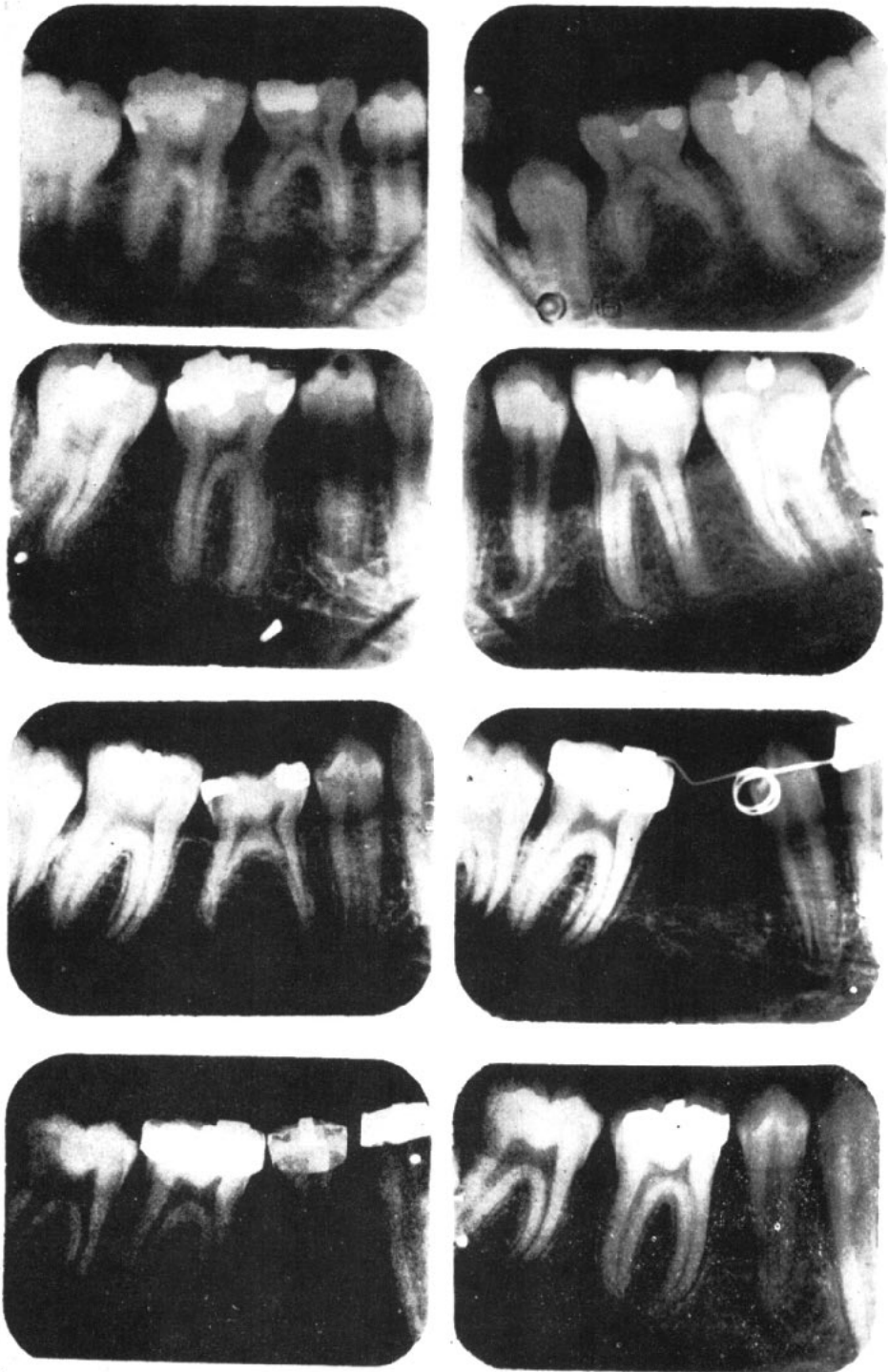


Fig. 3 Above, before treatment. Below, after treatment.

Fig. 4 Above left, pre-treatment. Above right and below left, progress x-rays. Below right, post-treatment.

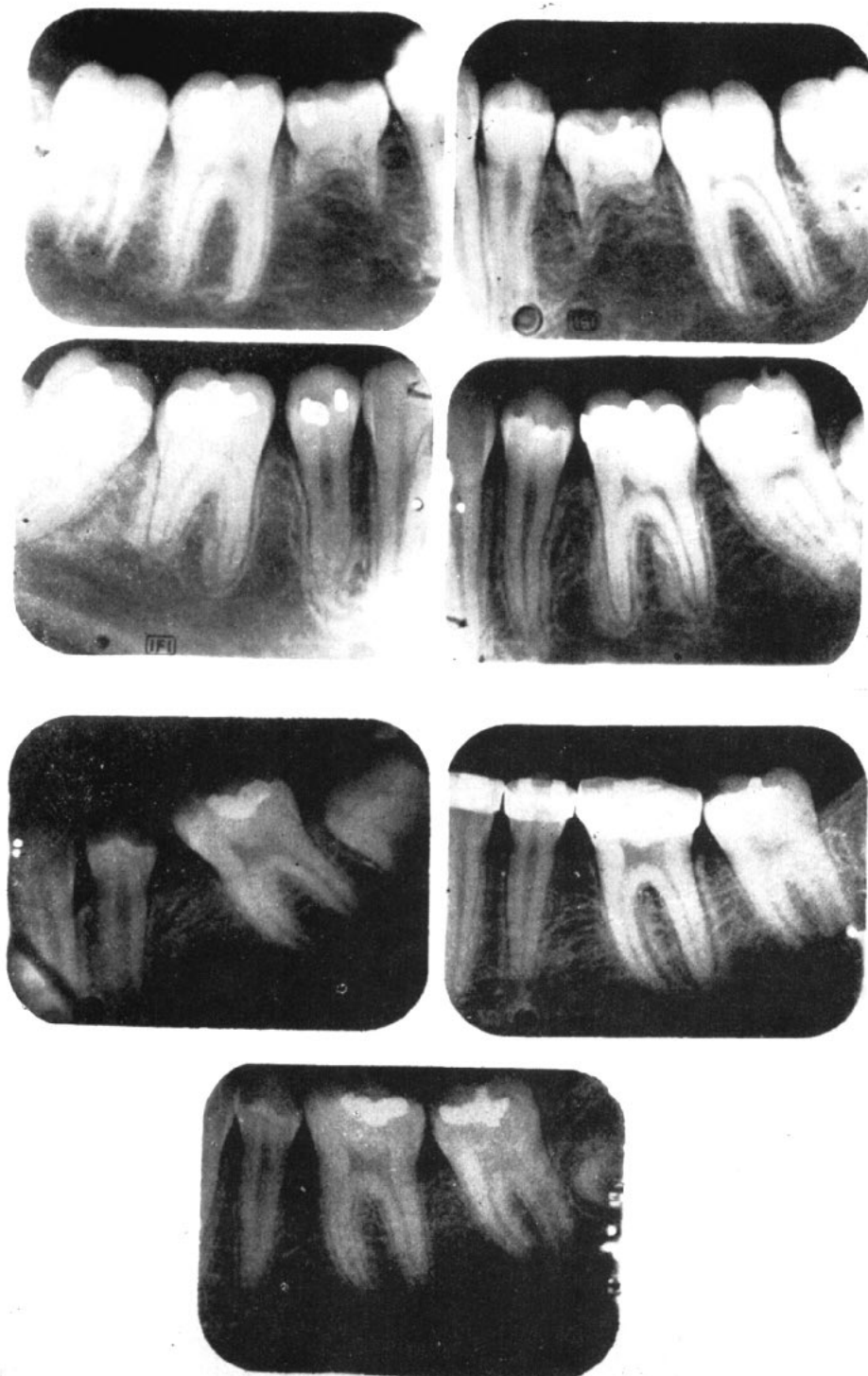


Fig. 5 Above, pre-treatment. Below, post treatment.

Fig. 6 Above left, pre-treatment. Above right, progress x-ray. Below, post-treatment.



Fig. 7 Left, pre-treatment. Right, post-treatment.
 Fig. 8 Above, before treatment. Below, after treatment.

molars and upper first premolars were extracted. Lower second premolar spaces were closed by movement of adjacent teeth in both directions. Treatment time: three years.

There is slight resorption of the distal root of the right first molar and moderate resorption of the apical third of the distal root of the left first molar. An upper premolar also showed re-

sorption of one third of the root. Contact between left molar and premolar is open.

Case 4. C. B., female, 9 years. Class I malocclusion, with slight crowding in anterior segments. Lower right second premolar was absent; the deciduous molar was extracted previously. (Fig. 6)

The upper right first premolar was

extracted. Although this unilateral treatment resulted in a slight shift of both maxillary and mandibular midlines to the right, it was felt that the malocclusion did not warrant extractions on the left side. Treatment time: seventeen months.

Final x-ray eight months after removal of appliances shows no root resorption. Occlusion, contacts, and inclinations are good. (Fig. 6)

Case 5. J. M., male, 11 years. Class II, Division 1. Lower left second premolar was absent (Fig. 7); mother and two brothers had congenitally absent teeth.

The deciduous molar was extracted, and intermaxillary elastics used in conjunction with the edgewise appliance. The space was closed approximately one third by distal movement of the canine and premolar, and two thirds by the mesial movement of the molars. Treatment time: twenty-four months.

There has been no root resorption. (Fig. 7). This case is an example of compromise treatment since there was no extraction in the maxilla.

Case 6. T. P., female, 14 years. Class II, Division 1. Lower second premolars, right and left, were congenitally absent. (Fig. 8)

Mechanotherapy as previously described was used. Treatment time: twenty months.

There is resorption of the apical thirds of both right molar roots and, to a lesser extent, of both premolar and left molar roots. (Fig. 8) The maxillary incisors showed severe resorption (more than one third) early in treatment, and the lower incisors, which were not banded for bodily movement, but were *tipped* upright by contact with the arch-wire showed moderate resorption. This patient showed a greater predisposition to resorption than any we have treated.

ROOT RESORPTION

It is felt by some that the extensive bodily movements as advocated here predispose to apical root resorption.

Hemley has stated that if teeth were moved by tipping, rather than bodily, there would be no such predisposition. "Accordingly, therapy on 195 consecutive cases was instituted, either with the attempt to avoid movement of apices horizontally through bone, or, in those cases in which it was felt that a horizontal movement was necessary, every effort was made to accomplish this movement as slowly as possible . . . Forty two (21.5%) of the 195 cases treated showed root resorption. . . . There are all told 172 teeth that showed root resorption, and the total number of teeth subjected to treatment was 4,959: that is, only 3.5% showed any evidence of resorption."⁹ Only 62 per cent of the 195 cases were carried to completion, and it is likely that the resorption percentage would be higher had all been completed. Neither were the number of teeth actually subjected to orthodontic forces recorded, nor were the ages of the subjects and the length of treatment compared in the two groups.

Of interest is a more recent statement of Hemley's in a discussion of the Tweed method: "If these abnormal axial inclinations are to be avoided, it would be necessary to move the teeth bodily through bone structure. The attempt to achieve this type of movement, for almost half a century, has been acknowledged to be a failure by Tweed and his followers . . . (and) it should be noted that body tooth movement has not been successfully demonstrated since the introduction of root moving devices in 1908."¹⁰

A *controlled* experiment, in which large numbers of teeth were subjected to both types of movement, would be of value. Until one is performed, this

type of movement cannot be condemned or abandoned.

Phillips, in a recent investigation which merits attention, attempted a correlation between the degree of resorption and the type of movement of the maxillary central incisors in sixty-nine cases completed with the edgewise appliance. "No correlation between the distance a tooth is moved during treatment could be shown with the amount of apical root resorption during treatment No significant difference could be drawn between the amount of apical root loss resulting from the three various types of movement (apical tipping, anterior or posterior apical displacement, lingual bodily movement.)"¹¹

Halderson et al. compared the tissue reactions of different appliances. "The extremes of force used in the *edgewise mechanism* make it imperative that sufficient time elapse between appointments to allow the periodontal membrane to recover from the insult and injury of the appliance. Histologic studies on human beings indicate that, for this appliance, as it is ordinarily used, three weeks is a minimum period between adjustments (Gottlieb). The edgewise mechanism operates, more than any other appliance, in the realm of controlled pathology. It would be of little practical clinical use if this were not true; yet this fact is often neglected. The clinician who adjusts the appliance with forces of such severity that he routinely prescribes aspirin after weekly appointments is not only endangering the tissues with which he works, but he is also failing to use an excellent mechanism to best advantage and is making a great deal of extra work for himself."¹²

Discussing the *twin wire appliance* in the same article, they state that "the greatest danger in this appliance lies in the distance through which the force

may be applied to a tooth. There is a temptation to keep the force, light though it be, active for too long a time and too great a distance. During animal experimentation it was found to be *easier to cause root resorption with this than any other appliance tested.* (italics ours). In spite of the light weight, the pressure may be far too continuous for safety."

This is in accord with the original investigations of Oppenheim¹³ who warned that physiologic orthodontic movement is not possible but, to decrease the amount of permanent injury the moving force should be light and intermittent, with frequent periods of rest.

If we accept these principles, it will be seen that a Bull loop incorporated into an edgewise arch is as "physiologic" as an appliance can be. The force resulting from the prescribed one millimeter opening expends itself in about two days, mostly in the region of the periodontal space which has been widened by the previous application of lighter arch wires. The vertical legs are then in contact with each other, affording a degree of stability or splinting to the recently traumatized dental and periodontal tissues, and allowing the reparative processes to take place in the three week or greater interval.

There are other theories to explain apical resorption during treatment, all of which undoubtedly hold true in certain cases.

Becks, in numerous reports on this subject, stresses the association between susceptibility to resorption and endocrine disorders (hypo-thyroidism, and less frequently, hyperpituitarism) and acute and chronic infectious diseases which disturb general mineral metabolism. "I am decidedly of the opinion that the root resorptions observed in orthodontic practice are produced not by mechanical force *alone*, but that

they are rather the result of an individual predisposition to increased resorptive activity."¹⁴ He found the percentage of cases of root resorption twice as high in patients with osteoporotic jaws as in those with normal structure.

Rudolph¹⁵ reports that the percentage of resorption progresses with each year of treatment and with increased age at onset of treatment. Fischer agrees that "the age of the patient and the length of orthodontic treatment bear a direct relationship to the incidence and extent of root resorption."¹⁶

As every orthodontist knows, root resorption in certain cases is inevitable and its effect on the health and longevity of the dentition merits our attention. With the termination of treatment the process ceases and teeth exhibiting apical resorption show no greater than average mobility.

Jacobson, in a paper entitled the "Clinical Significance of Root Resorption" solicited opinions on this subject; Dr. Samuel Charles Miller, a clinician (periodontist) of wide experience, states that root end resorption is of 'no great significance except in differential diagnosis'. . . . Dr. Allan Brodie pointed out, 'The importance of the process from a clinical standpoint has been greatly overestimated. The retention apparatus of the tooth is largely restricted to the coronal 2-3rds of the root - its apical 1/3 is relatively functionless in this regard. The loss of even a small degree of alveolar height (at the crest) is of greater significance'.¹⁷ Jacobson emphasizes that, among other factors, it is not the kind of appliance that has any connection with the character of resorption, but "what the appliance is made to do."

We are in agreement that skill, patience, and judgment in the use of the edgewise appliance, as advocated here for extensive space closure, will cause

no greater than the usual incidence of apical resorptions, found to occur in certain cases regardless of the type of movement or the type of appliance used.

SUMMARY AND CONCLUSIONS

1. Congenitally absent premolars are seen frequently in orthodontic practice.
2. Space closure avoids the disadvantages of prosthetic replacement.
3. An orthodontic approach to the problem is offered, explained and illustrated with case reports.
4. The problem is a complex one and, of necessity, the solution is also. It is presented as a worth-while service in many cases and not as a panacea.
5. The relation of this type of tooth movement to apical resorption is discussed; the latter need not be a deterrent to the method proposed.

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