An Analysis Of Second Premolar Extraction Procedures

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The last fifteen to twenty years we have witnessed a most vigorous and intensive practice of extraction techniques for the correction of malocclusion. After analyzing some of these results there are many who are beginning to recognize that excessive lingual movement of anterior teeth, or the denture as a whole, is to be deplored as much, or more, than excessive labial movement. The reasons for such concern are the very same as those we fear from expanding and advancing of teeth within the dental arches, namely unstability and production of undesirable facial changes. A denture that has been retracted excessively may exhibit relapse tendencies particularly in the form of spacing and excessive overbite. An alteration of the facial profile can result in a change which may increase as the case matures. Some changes in the facial profile are desirable and are created intentionally. Others are undesirable and are the result of incorrect analysis or mechanical treatment.

The orthodontist is confronted many times with cases of malocclusion that seem hopeless to solve without removing dental units. In the same case he may recognize that if he does extract four first premolars he may later meet with certain objectionable features. This type of case whose treatment is not immediately obvious is sometimes called a borderline case. In such instances it has often been said that one wished he could extract a half of a tooth on either side. This, of course, is impossible, but by carefully changing anchorage values it may be possible to accomplish the same result as one might if he were able to extract the half of a tooth. It has also been suggested that the changing of anchorage values may be accomplished by the removal of four second premolars instead of the commonly accepted removal of the four firsts.

It has been difficult for the advocates of second premolar extraction to convince me regarding the relative merits of this procedure over those of first premolar extraction. I could agree that incorrect diagnosis of extraction versus nonextraction could determine success or failure of a case, but have never felt that the extraction of one premolar over another could significantly affect an orthodontic result. This procedure diametrically opposes one of the most fundamental and challenging principles in the treatment of malocclusion, the conservation of anchorage. These convictions and doubts prompted this investigation.

There is nothing new or revolutionary about second premolar extractions. In 1923 Nance had his first experience with such a condition and in an article[1] discusses this procedure in the treatment of a case that exhibited congenitally missing second premolars. All of us have dealt with the loss of these teeth when they have been congenitally missing, when they have had large restorations or were badly broken down through dental decay. These however, should not be the only considerations in selection of these teeth for extraction

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when planning for orthodontic management. In 1949 Nance[1] wrote "Regretably, in my opinion, it has been generally thought that extraction means, as a matter of course, the removal of the four first premolars. The very real advantages which may be had from the extraction of second premolars instead in certain malocclusions seem to have been overlooked." Today I am sure that many recognize that the conventional means of four first premolar extraction is not the only extraction plan to correct malocclusion and to reduce denture imbalance. However, such a plan is still not routine practice in many orthodontic offices.

The lack of interest in second premolar extraction procedures may be reflected in the fact that since the writings of Nance one searches, almost in vain, in an effort to find information dealing specifically with the loss of these teeth. Apparently one of the few significant contributions on the subject was made in 1955 by Dewel[2] in which he outlines the principles and procedures involved in second premolar extractions by discussing the diagnosis and treatment of a single borderline case.

Dewel's comments include the following statements: "In borderline cases the choice of teeth to be extracted is determined by the degree of discrepancy between teeth and bone and by the amount of space to be closed following extraction. Removing teeth in borderline cases creates more space than is necessary. Proper correction requires that, after the anterior teeth have been placed in their normal positions over basal bone, all remaining spaces be closed entirely by mesial movement of the posterior teeth. To do this, a delicate balance must be established between anterior anchorage and posterior resistance. Extraction of second premolars decreases by two teeth the resistance that the buccal segments present when the spaces are being closed."

Previously, in summarizing the indications for second premolar extractions Nance[3] states, "In treatment, after one removes first premolars, the six anterior teeth are pitted against the second premolars and molars, accordingly, the removal of the first premolars is a good practice when mesial movement of buccal teeth is to be minimized; on the other hand, when the second premolars are removed, mesial movement of molars is pitted against the first premolars plus the six anterior teeth and thus mesial movement of the molars is facilitated. It is upon this basis that one should decide whether to remove first premolars or second premolars."

Perhaps there would not be many of us who would dispute the accuracy and logic of the comments in the preceding two paragraphs, but many of us, in the past, simply have not recognized indications for mesial movement of molars in orthodontic treatment and have looked upon ourselves as lacking in technical skill if such movement occurred. As a result second premolar extraction has not been a popular plan of treatment with many orthodontists.

It is my belief, and I know it is shared by others, that there are many malocclusions that are existing in a state of good physiological muscle balance, which means there generally is an equilibrium of the muscular forces that act on the denture. A proportionate harmonious facial contour may be present. It is possible and perhaps even probable that in such a case the lower incisor teeth may be very well-related to the mandible and the mandible well-related to other skeletal parts. This malocclusion may be further characterized by moderate arch crowding and indifferent mesiodistal occlusion. The objective that I would outline for such a case would be to correct the existing malocclusion leaving lower incisor teeth in essen-

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tially the same relationships as they were before treatment. I believe there are many cases that fall into this category and, in my opinion, this type of case can be considered the chief indication for second bicuspid removal.

In similar cases there may be indications for lingual movement of incisors one to two millimeters, but denture retraction beyond this may be undesirable. Extraction of second premolars may be considered rather than first. Another indication for second premolar removal may be a mild Class II case with fair muscle balance where the arch crowding is not excessive. This may permit the correction of the malocclusion utilizing intraoral anchorage. Acceptable facial improvement may be brought about without the dangers of excessive denture retraction. Upper second premolars are extracted in such a case so that upper incisor retraction is not complete when all upper space is closed, thereby creating the necessity for increased use of Class II elastics to insure mesial movement of the lower molars. A mild case of bimaxillary protrusion may also be considered for second premolar removal.

A description of these cases perhaps places them in the borderline category. In instances where there is some indecision about extraction probably most of the accepted objectives of orthodontic treatment will be met if second premolars are extracted instead of first.

Second premolar extraction procedures denote a degree of conservatism, not in the preservation of teeth for it involves an equal sacrifice with first premolar removal, but in the amount of tooth movement in closing spaces left at extraction sites.

It will be the specific purpose of this paper to deal only with four second premolar extraction problems; however, it should be mentioned that there are combinations of first and second premolar extractions used in treatment planning. An understanding of principles involved in the removal of four second premolars provides a basis that will permit one to modify treatment to include second premolar removal in one arch or the other as may be indicated. Probably the most common extraction plan utilizing second premolars is that of removal of upper first and lower seconds. It is not uncommon to find malocclusions that present rather good lower arches where crowding may be minimum. In the same case there may be a protrusion of the maxillary incisors or upper cuspids that are partially blocked out labially. Maximum retraction of the denture may not be indicated. In such instances it is usually advisable to remove upper first rather than second premolars. This immediately provides space near the area where the discrepancy exists and does not necessitate moving the first premolars distally to provide spaces for the cuspids. First premolar removal facilitates the lingual movement of the anterior segment in protrusion cases. The extraction of lower second premolars in such cases provides space to adjust the minor arch-length discrepancy and permits the use of the lower arch for anchorage when Class II elastics are to be used. Minimum denture retraction may be accomplished also.

The opposite extraction program, upper second and lower first premolars, may be indicated in Class III cases where maximum retraction of the lower anterior segment is required.

Purpose

The purpose of this paper is to analyze results of cases treated by the removal of four second premolar teeth to:

1. Determine whether anchorage values are changed significantly from those of first premolar extraction.
2. Outline, review, and confirm indications and objectives of such

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removal and determine if they can be met.

Method and Material

The material consisted of twelve consecutively treated cases involving the removal of four second premolars. There were six girls and six boys in the sample. The age range of the boys was 9 years, 5 months to 13 years, 2 months, the mean age was 11 years, 8 months. The age range of the girls was 10 years, 10 months to 12 years, 8 months with the mean being 11 years, 7 months. All were Class I malocclusions.

Complete records before and after treatment were made including tracings of the lateral head x-rays. The mandibles were superimposed along the mandibular plane with the point of registration being pogonion. The line of the occlusal plane from the tip of the lower incisor to the occlusal surface of the left first molar was drawn on the first tracing. The distal contact of the left first molar and the tip of the lower incisor were marked and projected at right angles to the line of the occlusal plane. The apex of the distal root of the same molar and the apex of the lower incisor were also projected in the same manner. Readings in millimeters were made along the line of the occlusal plane to determine the extent of movement of the crowns and roots of these teeth. This method was an attempt to measure only movement in the horizontal plane and eliminate any error that might be introduced as a result of vertical adjustment of teeth. Lines connecting the apices of the distal roots and the distal contacts of the crowns of the molars, and also the long axes of incisors were drawn to determine the extent of tipping or change in inclination of the molars and incisors (Fig. 1). A Nance analysis to determine the degree of arch length discrepancy was made on the original plaster casts of each

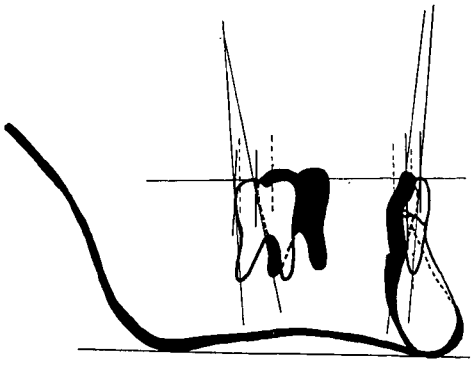

Fig. 1

case to determine if some generalizations could be made regarding arch length discrepancy and the indications for second premolar extractions.

For comparative purposes in determining the amount of mesial movement of molars and lingual movement of incisors, an equal number of first premolar extraction cases where no attempt had been made to conserve anchorage was analyzed in the same manner. In this group there were five boys and seven girls. The age range of the boys was 9 years, 10 months to 14 years 4 months ,with the mean age being 11 years, 9 months. The girls ranged from 9 years, 5 months to 15 years with the mean age 11 years, 3 months.

Before analyzing the results of tooth movement a brief description of the appliance used in the treatment of cases in the second premolar group should be mentioned.

Following the removal of the teeth a short period of approximately two months may be allowed before beginning appliance treatment. During this interval slight spaces may open mesial to the first bicuspid and cuspid and also some mesial movement or tipping of the first molar usually occurs. The appliance used is a full upper and lower edgewise appliance with rectangular molar tubes .022 x .028 and .010 wide

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posterior brackets with .022 x .028 slot on all other teeth. Cases are usually started by the placement of bands on the first molars, first premolars and cuspids. A light round archwire is placed and retraction of cuspids and first premolars started. The initial lower wire, as well as subsequent archwires, has extreme uprighting bends for the first molar. If less mesial movement of the lower molar is desirable at the start of treatment, the first premolars may be retracted separately, followed later by the cuspids.

After a one or two mm retraction of the cuspid and premolar, the anterior teeth are banded and carry the same type brackets as previously described. A series of active archwire changes follows to close spaces, level arches and perfect rotations. It is very difficult to control the inclination and rotation of the lower first molar and usually at some point, when most or all of the space has been closed, lower second molars are banded and carry rectangular tubes .022 x .028. If mesial movement of the first molar has taken place too rapidly, second molars can be banded earlier to add anchorage, but generally first molar movement in the mesial direction is desirable and therefore second molar banding is deferred as long as possible, and is principally for the purpose of controlling the first molar. There can be many modifications of the appliance and the technique to add or subtract anchorage units as the progress of the case may dictate. Class II elastics may be employed at any stage in the treatment to encourage mesial movement of molars if desirable. An edgewise arch should be placed prior to the use of elastics. Usual detailed arch adjustments, elastics, and tying of rotations with edgewise arches continue to take place until completion of the case.

Cases are generally retained by removing all bands except cuspids and the molars with buccal tubes, and a lower cuspid to cuspid retainer made. The archwires are readapted and tied back. The case may continue on elastics. The following appointment the remaining appliance is usually removed and a Hawley retainer placed. The lower cuspid to cuspid retainer is left cemented in place.

It should be remembered that there was variability in the appliances used to treat the cases in our sample. The variability was chiefly timing of band placement, use of elastics and retracting devices.

Findings

The findings are given in Tables 1, 2 and 3. Tables 1 and 2 show the individual cases and Table 3 gives the means and ranges for each sample.

Discussion

In the second bicuspid group, Table 1, the minimum amount of mesial movement of the first molar in Cases 10 and 11 can be explained on the basis that the crowding was in the form of blocked-out or impacted second premolars. These cases had the greatest arch length discrepancies. When a blocked out or impacted second premolar is removed, the space between the first premolar and molar either does not exist or is very small; therefore, there is not as much opportunity for mesial movement of the molar. The remainder of the cases exhibited crowding principally in the anterior segment. If these two cases were excluded from the sample, the means would be changed significantly. A specific attempt was made in Case 11 to advance lower incisor teeth. Case 12 shows a 0.5 mm of distal movement of the crown of the molar; this is principally due to a 6° distal crown tip. Second molars were banded nine months before completion of treatment and elastics were used only a very short period. These factors plus

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TABLE 1
SECOND BICUSPID GROUP

Case	Age	Mesial Mov. $\overline{6}$ Crown mm	Mesial Mov. $\overline{6}$ Root mm	Mesial Mov. $\overline{6}$ Change In Axial Inclination	Lingual Mov. $\overline{1}$ Crown mm	Lingual Mov. $\overline{1}$ Root mm	Lingual Mov. $\overline{1}$ Change In Axial Inclination	Nance Analysis
1	12 Yrs. 11 Mo.	6.0	8.7	— 8 °	1.2	0.7	— 1.9°	— 6.2 mm
2	9 Yrs. 5 Mo.	4.0	4.0	0 °	1.8	2.6	+ 1.8°	—10.1 mm
3	10 Yrs. 10 Mo.	5.0	8.6	—13 °	2.3	2.2	— 0.5°	— 6.2 mm
4	11 Yrs. 1 Mo.	5.0	4.5	0 °	1.1	0.8	— 1.8°	— 5.4 mm
5	11 Yrs. 6 Mo.	3.2	5.3	— 5.5°	3.2	1.1	— 6.5°	— 3.9 mm
6	12 Yrs. 6 Mo.	4.5	5.0	— 1.5°	1.5	1.2	— 0.8°	— 5.5 mm
7	11 Yrs. 11 Mo.	2.9	1.7	+ 4.5°	0.3	1.0	— 2.3°	— 6.6 mm
8	11 Yrs. 7 Mo.	3.3	1.7	+ 5.0°	4.2	1.1	— 7.9°	— 5.9 mm
9	11 Yrs. 4 Mo.	3.9	4.3	— 2.5°	3.0	1.5	— 3.3°	— 7.3 mm
10	13 Yrs. 2 Mo.	2.2	4.0	— 5.5°	0.8	2.2	+ 7.9°	—11.9 mm
11	12 Yrs. 4 Mo.	2.0	2.9	— 3.0°	1.2*	1.7	+ 9.0°	—11.4 mm
12	12 Yrs. 8 Mo.	0.5**	1.5	— 6.5°	3.0	1.5	— 3.9°	— 7.2 mm
Mean	11 Yrs. 7.5 Mo.	3.45	4.4		1.85	1.47		— 7.3 mm

* Indicates labial movement instead of lingual

** Indicates distal movement instead of mesial

TABLE 2
FIRST BICUSPID GROUP

Case	Age	Mesial Mov. $\overline{6}$ Crown mm	Mesial Mov. $\overline{6}$ Root mm	Mesial Mov. $\overline{6}$ Change In Axial Inclination	Lingual Mov. $\overline{1}$ Crown mm	Lingual Mov. $\overline{1}$ Root mm	Lingual Mov. $\overline{1}$ Change In Axial Inclination	Nance Analysis
13	13 Yrs. 2 Mo.	3.4	2.1	+ 3.5°	1.6	0.3	— 3.5°	—11.1 mm
14	9 Yrs. 10 Mo.	2.0	5.8	—12.4°	3.0	3.1	+ 1.9°	— 8.1 mm
15	10 Yrs. 7 Mo.	2.7	2.7	0	1.3	2.2	+ 3.8°	—17.7 mm
16	14 Yrs. 2 Mo.	3.0	4.0	— 3.2°	3.0	1.8	— 2.5°	— 7.3 mm
17	10 Yrs. 2 Mo.	5.5	7.6	— 6.1°	0.5*	0	+ 1 °	— 3.8 mm
18	15 Yrs.	2.0	1.0	+ 3.3°	0.9	1.1*	— 4.5°	— 8.8 mm
19	11 Yrs. 3 Mo.	1.7	7.2	—18.5°	5.3	3.4	— 4.4°	— 1.6 mm
20	10 Yrs. 10 Mo.	2.9	4.5	— 4.5°	5.0	4.8	— 0 °	0 mm
21	9 Yrs. 5 Mo.	2.6	1.7	+ 2.8°	1.2	1.9	+ 2.1°	— 6.0 mm
22	9 Yrs. 6 Mo.	3.7	5.0	— 4.9°	2.1	2.1	— 0.5°	— 2.1 mm
23	10 Yrs. 11 Mo.	4.4	8.0	—11.0°	6.3	4.3	— 5.0°	— 0.8 mm
24	14 Yrs. 4 Mo.	3.2	6.6	— 8.3°	3.8	3.0	— 3.5°	— 8.8 mm
Mean	11 Yrs. 6 Mo.	3.1	4.7		2.8	2.3		— 6 34 mm

* Labial movement instead of lingual

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TABLE 3

SECOND BICUSPID GROUP

	Mesial Mov. /6			Lingual Mov. /1			
	Crown	Root	Change In Axial Inclination	Crown	Root	Change in Axial Inclination	Nance Analysis
Range	0.5 D	1.5	—13 ° to + 5.0°	1.2 M	0.7	— 7.9° to + 9.0°	— 3.9 mm
	6.0	8.7		4.2	2.6		—11.9 mm
Mean	3.45	4.34	— 2.2°	1.85	1.47	— 0.9°	— 7.3 mm
			FIRST BICUSPID GROUP				
Range	1.7	1.0	—18.5° to + 3.5°	0.5 L	1.1 L	— 5.0 °to + 3.8°	0 mm
	5.5	8.0		6.3	4.8		17.7 mm
Mean	3.1	4.7	5.0°	2.8	2.24	— 1.2°	6.34 mm

variable response to tooth movement in individuals may help to explain the lack of mesial movement of molars in this case. Cases 11 and 12 were the only two cases where it was felt that no lingual movement of incisors could be permitted. A retraction of 3 millimeters in the lower incisor segment of Case 12 indicates that the original objectives have not been met and the denture has been retracted excessively.

All cases in the second premolar group, except the one where a specific attempt to advance lower incisors was made, show lingual movement of the lower incisor segment. The greatest amount of incisor crown movement was 4.2 millimeters which normally would be more than expected when planning second premolar extraction. I do not believe it possible to adjust teeth and consistently leave lower incisors in exactly their original positions or retract them to exactly a predetermined amount; it may be reasonable to expect in most cases that if the lower teeth were adjusted to within one millimeter of their predetermined position this would be satisfactory. I would not suggest that this one millimeter be labial movement unless the case specifically called for this type of movement such as the one presented here.

The degree of tipping of molars, both mesial and distal, in the second premolar group was not considered excessive with the exception of Case 4. All cases except two exhibited a distal tip rather than mesial tip. A change in inclination or angular change of 3.5 degrees amounts to approximately one millimeter linear change. Molars that were inclined distally after treatment show less mesial movement of the crown than if they had been kept upright.

The comparison group of first premolar extraction cases (Table 2) where no attempt was made to conserve anchorage showed only slightly less mesial

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movement of molars, the mean figure being 3.1 as compared with 3.45 in the second premolar extraction group. It has been stated earlier that the mean of 3.45 would rise significantly if the two Cases, 10 and 11, had been eliminated. Lingual movement of the incisor segment in the first premolar cases showed a mean figure of 2.8 mm as compared with 1.85 in the second premolar cases. It must be remembered that in the first premolar group, although no attempt was made to conserve anchorage, the objective as far as incisal retraction was concerned was slightly different than that of the second premolar group. The figures of the Nance analysis would indicate this to be true. A correlation between incisal movement is not reasonable. The greatest amount of mesial movement of molars of any one individual occurred in the second premolar group (6.0). The greatest amount of lingual movement of incisors occurred in the first premolar group (6.3). Again on the basis of the objectives this would be expected. It is interesting to note that the three cases in the first premolar group that showed the least amount of mesial movement of molars were serial extraction cases where spaces were opened in the dental arches early and kept open through subsequent extractions.

A frequent objection that I have heard expressed regarding second premolar extraction is that the contact relationship between first molar and first premolar is undesirable from the standpoint of future health of supporting tissues in that area. The difference in anatomy of the premolars dictates that the contact of first molar and first premolar be more of a point contact and that the contact is lower than that with the second premolar. It is my opinion that if the contact of the first premolar with the molar is closed tightly there is no reason to be concerned with that relationship. When the extraction site is closed to a considerable degree by mesial movement of molars, it is very possible that spacing at the extraction site will not tend to open if correct inclinations of teeth have been maintained. It may be possible to also theorize that eruption of third molars may be facilitated in a case where considerable mesial movement of molars has taken place. Because of the unpredictability of third molars it is not suggested that rescuing third molars be considered as an indication for second premolar removal. Most cases in this study have not been released from retention, therefore, postretention changes presently cannot be evaluated.

According to Black's average tooth measurements there is slightly more tooth size discrepancy introduced in second premolar extraction than first. The attainment of satisfactory occlusal relationships does not seem to be a problem in spite of the small discrepancy in tooth size. The clinical significance of our work is to be aware of the possibilities of movement of anterior and posterior segments in second premolar extractions and then relate these movements to diagnosis, a part of which should include anticipated changes in soft tissue contour. In recent years considerable attention has been directed to the profile of the human face, particularly the soft tissue profile. Although some controversy still exists, there is mounting evidence to indicate a close relationship between soft tissue and underlying skeletal and dental structures. As the hard structures are modified, there is a corresponding modification of the soft structure in those areas. Subtelny[4] in a longitudinal study of soft tissue and underlying skeletal structures found that the anteroposterior posture of the lips was closely related to the teeth and alveolar process. Bloom[5] showed a very high correlation between

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tooth movement and changes in the lips and concluded that it was possible to predict the perioral soft-tissue changes in relation to the expected amount of anterior tooth movement. Stoner and associates,[6] when analyzing a large group of treated cases, recognized that recontouring of the lips came about principally as a result of movement of incisor teeth.

If the above evidence is accurate, it then becomes the task of the orthodontist to predict how much tooth movement is necessary to produce the facial change he is seeking while accomplishing other objectives of treatment, and then to produce quite precisely that amount of anterior tooth movement. Since there is such variation in the type and severity of orthodontic cases, there also must be a variety of treatment plans and appliance techniques. One approach to extraction problems and one for nonextraction problems is not adequate to meet the needs of all cases. The routine use of second bicuspid extraction procedures may help to control excessive movement of anterior teeth when it is not desirable.

Summary and Conclusions

An attempt has been made to analyze tooth movements occurring in cases treated by the removal of four second and four first premolars. Also, to outline primarily the indications for the use of second premolar extractions. The sample was small and a great number of variables and extraneous factors existed in the study making it difficult to draw any correlation between various tooth movements. There does not appear to be any dominating evidence from which conclusions can be drawn; however, a few generalizations may be permitted.

1. There seems to be an indication for mesial movement of molar teeth in certain extraction cases if commonly accepted objectives are to be met consistently.
2. More mesial movement of molars (maintaining good inclinations) may be accomplished through second bicuspid extraction than first bicuspid extraction when that is the objective and the appliance is designed accordingly.
3. When arch length discrepancy is 7.5 millimeters or less and there is no indication for incisor retraction, it may be advisable to consider second rather than first premolars if extractions are to be performed.
4. There apparently is variability that exists in mesial movement and mesial drift of molars in different individuals. Some factors involved may be:
   a. Stage of dental development.
   b. Number of unerupted molars.
   c. Occlusion.
   d. Degree of arch crowding.
   e. Muscle balance.

There are many who have reported with pride, and justly so, the great distances that incisor teeth can be moved lingually. Diagnoses and treatment procedures to retain lower incisor teeth in precisely their original positions and inclinations or to move them predetermined amounts seem to provide an equal challenge.

The question of whether to extract or not to extract in the treatment of malocclusion is still perplexing to most of us. This paper in no way attempts to debate the question of extraction versus nonextraction. It does suggest, however, that once extraction has been decided upon a further analysis as to which teeth to remove should be considered, instead of accepting what some may still believe to be the only choice, namely, four first premolars.

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DISCUSSION

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Dr. Schoppe has presented the subject of extraction of second premolars very clearly. His points of emphasis are that extraction of second premolars in preference to first premolars in selected patients:

1) permits more rapid mesial movement of molars,
2) permits less lingual movement of incisors,
3) is probably the best means of gaining space when a minimum of space is necessary,
4) tends to alter the profile less, and
5) tends to hasten closure of the extraction space.

He has touched on the necessity for extraction of second premolars in certain segments and of first premolars in other segments of the same patient under special circumstances.

With all of this I agree implicitly.

There is one phase — that of facial profile — which should be commented upon more fully. With a full complement of teeth in contact with each other the dentition and lips "grow" forward not quite so fast as do the tip of the nose and the soft tissue chin point in the normal growing individual. This is due to two things:

1. The decreasing rate of growth of the tongue with age which permits the forward migration of the dentition to become slower.
2. The diminishing strength of the anterior component of force which pushes the dentition forward against the restraining influence of the lips and cheeks.

The amount of force exerted by the anterior component of force is extremely variable among different individuals, as Dr. Schoppe has already mentioned, and also varies from one time to another in the same individual. Where there is no anterior component of force some or all of the teeth may be spaced. It can act upon the incisors only when *all* the teeth of a buccal segment are in contact. Extraction of any tooth in the buccal segment immediately stops the forward push of the anterior component of force upon those teeth mesial to the site of extraction. As long as there is any spacing between contact points in a buccal segment, the anterior teeth stop moving forward in relation to the orbital plane while the nose and soft tissue chinpoint continue to grow forward as if no tooth had been extracted. Of course, the result is that the incisors and the lips become less and less prominent while the nose and soft chin point become more and more prominent the longer any space remains between contact points in a buccal segment.

As Dr. Schoppe has mentioned, ex-

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traction of second premolars permits rapid space or contact closure; this produces a minimum of profile change. The use of any external force such as extraoral anchorage on the molars tends to prolong the time of space closure. This stops forward movement of the dentition for a longer time and makes the dentition and lips even less prominent. In a dental protrusive case this may be desirable; in a dental nonprotrusive case this can be most undesirable because the nose and soft tissue chinpoint continue to grow forward and may result in a severely concave dental profile. Consequently, both the time required for space closure and the patient's age must be considered for a true evaluation of profile esthetics when extraction of first or second premolars is contemplated.

It has been reported recently on the basis of a statistical study* of twenty children that the body of the mandible of children who had serial extractions did not grow as much as those who had no extractions. However, in children with anodontia the body of the mandible seems to grow very much as if all the teeth were present; consequently, the chinpoint can be expected to continue its established pattern of downward and forward growth regardless of premolar extractions.

In conclusion: for certain patients the second premolar surely can be the tooth of preference for extraction.

*** Jacobs, Joseph, Master's Thesis, St. Louis University, Cephalometrics and Clinical Evaluation of Class I Discrepancy Cases Treated by Serial Extraction Procedures, 1959.**

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