

The effect of mandibular first premolar extraction on third molar space

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It is not uncommon to find impacted mandibular third molars in orthodontic patients treated by extraction of first premolars. However, the incidence of mandibular third molar impaction appears to be lower among such patients than in the population in general.

Faubion¹ compared a group of 20 patients treated by extraction of four first premolars with another group of 20 without extractions and found that almost four times as many third molars were retained in good positions in the extraction group.

Richardson² examined the incidence of mandibular third molar impaction in a group of 160 subjects followed longitudinally and found impaction in 28 percent of the cases where first premolars were extracted, and in 34 percent of the non-extraction cases.

Graber and Kaineg,³ on the other hand, reported on a longitudinal study of 45 premolar extraction and 47 non-extraction cases and concluded that removal of first premolars probably

does not enhance normal eruption of third molars.

The following investigation was undertaken to examine changes in molar space following first premolar extraction and factors which may influence such changes.

Material and method

A group of 48 subjects who had one or both mandibular first premolars extracted for orthodontic reasons was selected from the records of a longitudinal study of third molar development.⁴ They were compared with 46 subjects from the same study who had no mandibular arch extractions.

The extraction group included one case with unilateral aplasia of the mandibular third molar and 20 cases where the mandibular first premolar was extracted on one side only leaving 40 left and 35 right mandibular arch quadrants available for examination. Twenty-nine of the subjects in this group had no mandibular arch mechanics, the remainder were treated with

Abstract

Change in molar space is compared in 48 mandibular first premolar extraction cases and 46 non-extraction cases over a five year period. Significantly greater increase in molar space is found in extraction cases. It is, to some extent, related to the initial degree of crowding.

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Key Words

Premolar extraction • Molar space • Crowding

Figure 1

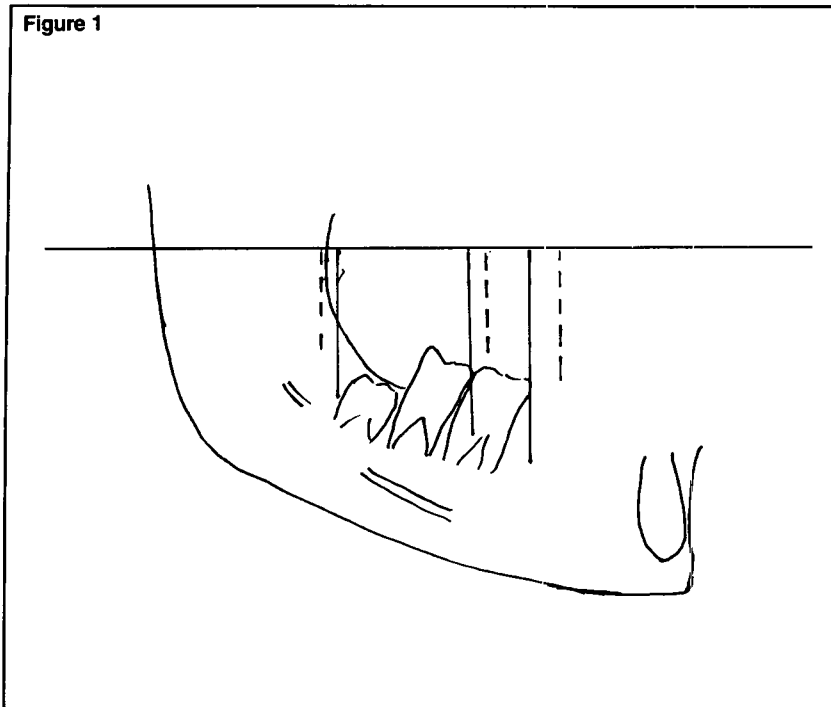


Table 1

Variable	Side	Extraction 1		Non-extraction 2		Difference 1 - 2 Mean MM
		Mean MM	S.D. MM	Mean MM	S.D. MM	
Original space condition	L	-2.45 ± 1.87		0.00 ± 1.03		-2.45***
	R	-2.35 ± 2.35		-0.13 ± 1.31		-2.12***
Original molar space	L	12.13 ± 2.75		15.11 ± 2.53		-2.98***
	R	11.98 ± 2.81		15.33 ± 2.36		-3.35***
Change molar space	L	7.59 ± 2.14		4.02 ± 1.76		3.57***
	R	7.52 ± 1.84		4.01 ± 1.80		3.51***
Change 6 position	L	3.74 ± 2.01		2.28 ± 1.56		1.46***
	R	3.59 ± 2.20		1.96 ± 1.33		1.63***

*P<0.05, **P<0.01, ***P<0.001, obtained by "t"-tests and Mann-Whitney "U" tests.

Figure 1
Method of measurement of original molar space, change in molar space and change in position of the lower first molar on a tracing of a 60° rotated cephalometric radiograph.
Solid line — first film
Broken line — second film

Table 1
Means and differences: between extraction (n = 40 left, 35 right) and non-extraction (n = 46 left, 42 right) groups.

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Table 2
Means and differences between extraction, second premolar erupted (n = 14 left, 12 right) and non-extraction (n = 46 left, 42 right) groups.

single arch, round wire fixed appliances.

In the non-extraction group there were four cases of unilateral aplasia of the mandibular third molar, leaving only 46 left and 42 right lower quadrants suitable for study.

Initially, records were taken as close as possible to establishment of the permanent dentition anterior to the first molar. A second set of records was gathered five years later and the following measurements made.

Casts

Original space condition: The arch length and total tooth size were measured on the first set of models with a Vernier microscope. The difference gave a measure of original space condition. Negative values indicated crowding. In some of the extraction cases the first premolar was removed before eruption of the second premolar. In these cases the second premolar was measured on a subsequent set of models.

Sixty-degree cephalometric radiographs

Original molar space: On a tracing of the first film the distance between projections of the distal contact point of the mandibular first molar and the junction of the ramus with the body of the mandible onto a horizontal through the maxillary plane gave a measurement of the original molar space (Figure 1).

Change in molar space was calculated after superimposing the tracing of the first film on the second, registering on mandibular structures, measuring the difference between the same two projected points and subtracting the original molar space from this measurement (Figure 1). Positive values indicated an increase in molar space.

Change in position of the mandibular first molar was measured as the distance between projections of the mesial contact point of the first molar onto the maxillary horizontal when a tracing of the first film was superimposed on the second registering on mandibular structures (Figure 1). Positive values indicated forward movement of the first molar.

All measurements on casts and radiographs were made twice by one observer with an accuracy of 0.5 millimeters.

Mean values for each variable were calculated for both groups, for left and right sides separately, and compared using "t"-tests. Mann-Whitney U-tests, which do not require the variables to be normally distributed, were also performed (Table 1).

A sub-group of 21 subjects (14 left and 12 right quadrants) was selected from the extraction group including only those whose second

premolars had erupted before first premolars were extracted; their means were compared with the non-extraction group by the same tests (Table 2).

Correlation analyses of all the variables for both main groups were made using Pearson correlation coefficients (Tables 3 and 4). The five percent level of significance was used.

Results

Mean differences for all the variables between the extraction and non-extraction groups were significant (Table 1). The extraction, erupted second premolar sub-group also differed significantly from the non-extraction group in all the variables except the original molar space on the left side (Table 2) which was smaller in the extraction sub-group, but was not statistically significant. Mann-Whitney U-tests confirmed the results of the "t"-tests.

In the main extraction group significant negative correlations were found between original space condition and original molar space on the right side (-0.40) and between original molar space and change in molar space on both sides (L -0.50, R -0.58). Significant positive correlations were found between original space condition and change in first molar position on the left side (0.31), between original space condition and change in molar space (0.61) on the right side, and between change in molar space and change in first molar position on both sides (L 0.49, R 0.46).

In the non-extraction group significant negative correlations were found between original molar space and change in molar space on both sides (L -0.62, R -0.37) and between original molar space and change in first molar position on the right (-0.38). Significant positive correlations were found between change in molar space and change in first molar position on both sides (L 0.46, R 0.43).

Discussion

The extraction group as a whole and the extraction, second premolar erupted sub-group showed slightly over two millimeters more original crowding on each side than the non-extraction group. This was to be expected since relief of crowding was the reason for extracting first premolars.

There was less original molar space in the extraction groups than in the non-extraction group although in the extraction second premolar erupted sub-group on the left side this difference was not significant. This may be partly due to the fact that the dental age of the extraction group as a whole was somewhat lower than the non-extraction group and some of the

Table 2

Variable	Side	Extraction 1		Non-extraction 2		Difference 1 - 2 Mean MM
		Mean MM	S.D. MM	Mean MM	S.D. MM	
Original space conditiog	L	-2.54 ± 1.58		0.00 ± 1.03		-2.54**
	R	-2.47 ± 2.18		-0.13 ± 1.31		-2.34***
Original molar space	L	14.54 ± 2.13		15.11 ± 2.53		-0.57
	R	13.57 ± 2.19		15.33 ± 2.36		-1.76**
Change molar space	L	7.09 ± 1.69		4.02 ± 1.76		3.07***
	R	7.11 ± 1.11		4.01 ± 1.80		3.11***
Change 6 position	L	3.80 ± 1.71		2.28 ± 1.56		1.52**
	R	3.92 ± 2.10		1.96 ± 1.33		1.96***

*P<0.05, **P<0.01, ***P<0.001, obtained by "t"-tests and Mann-Whitney "U" tests.

Table 3

	Original space condition	Change molar space	Change 6 position
Original space condition			L 0.31*
	R 0.61***		
Original molar space		L -0.50***	
	R -0.40*	R -0.58***	
Change molar space			L 0.49***
			R 0.46**

*P<0.05, **P<0.01, ***P<0.001, obtained by "t"-tests and Mann-Whitney "U" tests.

Table 4

	Change molar space	Change 6 position
Original molar space	L - 0.62***	
	R - 0.37*	R - 0.38**
Change molar space		L 0.46***
		R 0.43**

*P<0.05, **P<0.01, ***P<0.001

Table 3
Significant correlation
coefficients (Pearson)
extraction group n = 40
left, 35 right.

Table 4
Significant correlation
coefficients (Pearson)
non-extraction group
n = 46 left, 42 right.

difference in original molar space may be accounted for by growth. On the other hand, the more crowded condition found in the extraction groups may also be reflected in the molar region.

The change in molar space and in the first molar position in the extraction group as a whole and in the sub-group was significantly greater than in the non-extraction group indicating that first premolar extraction permits more forward movement of the first molar and creates more space in the third molar region. This would account for the reduced incidence of third molar impaction in premolar extraction cases found by Faubion¹ and Richardson.²

The significant correlation coefficients in both extraction and non-extraction groups on left and right sides between original molar space and change in molar space and between change in molar space and change in first molar position, have been noted previously in non-extraction subjects.⁵ They suggest that cases with a small original molar space have a greater increase in this space during the observation period which might be regarded as a late growth change or catching up process. The significant negative correlation coefficient in the non-extraction group on the right side between original molar space and change in first molar position reinforces this idea. The correlation between change in molar space and change in first molar position suggests that forward movement of the first molar is partly responsible for creation of space in the third molar region.

In the extraction group all the variables were significantly correlated with the original space condition; these correlations are of some interest although they were significant only on one side.

On the right side original space condition was negatively correlated with original molar space suggesting that a larger molar space is present in association with a large amount of crowding anteriorly. This might be explained by early mesial shift of the dentition, following early loss

of deciduous molars, creating more space in the molar region at the expense of crowding the dentition further forward.

Significant positive correlations between original space condition and change in molar space on the right and between original space condition and change in first molar position on the left, suggest that less increase in molar space and less forward movement of the first molar occurs in the presence of severe anterior crowding. This could be interpreted to mean that, in cases of marked crowding, first premolar extraction spaces will be used up in its relief leaving little or no space for forward movement of molars. When anterior crowding is less severe the excess extraction space may be transferred to the molar region by mesial movement of molars.

The correlation coefficients, although significant, are low so that other factors must be involved to explain why some third molars become impacted in first premolar extraction cases.

Conclusions

1. A greater increase in molar space occurs in mandibular first premolar extraction compared with non-extraction cases.
2. Change in molar space in extraction cases is to some extent influenced by original space condition.

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