

Caries Experience in Orthodontically Treated Individuals

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Orthodontic treatment with fixed appliances increases the number of retention areas causing accumulation of bacterial plaque, resulting in a general gingivitis.³⁷ Bacteriological tests^{1,6,7,29} show that the most characteristic feature after band placement is the significant increase in the lactobacillus count. Experiments in gnotobiotic animals,^{13,27,28} as well as in vivo and in vitro studies, have indicated that development of dental caries is caused by an interplay between carbohydrate consumption and micro-organisms in the dental plaque.¹² Thus the increased number of retention areas should be in favor of an increased caries activity in orthodontic patients. Previous studies show, however, that the total number of carious lesions in orthodontically treated and untreated individuals does not differ significantly,^{2,9,14,16,26,36} but the distribution of the lesions may be different, as the bands will protect the proximal surfaces, whereas the buccal and lingual surfaces become more susceptible to decay.^{16,25,36}

It is still doubtful whether orthodontic treatment has any longtime positive or negative effect on the caries activity of the patients.²⁵ This problem is especially interesting, as modern orthodontic treatment should also be accompanied by local fluoride treatment, tooth-brushing instructions, and supervision of the oral hygiene of the patients.

The intention of the present study was to compare the caries experience of a group of untreated controls with orthodontically treated individuals 1.5 to

2 years after removal of fixed appliances.

MATERIAL AND METHODS

The material comprised all children living on an island outside Bergen, who were born in 1957 and 1958, 79 boys and 84 girls. Twenty-six of each sex had received orthodontic treatment with fixed appliances in both jaws, the mean treatment time being 20 months. A light wire edgewise technique had been used.

Caries therapy had been performed in the local state dental clinic once a year since 1967. Previously the children had been referred to different private practitioners once a year since the age of seven.

The dental examinations were carried out by the same dentist after the sixteenth but before the seventeenth birthday of both the orthodontically treated and untreated children, approximately 1.5 to 2 years after removal of orthodontic bands. The caries situation had been checked twice since the end of treatment. With the aid of a mirror and a sharp probe after cleansing the teeth with pumice and drying with warm compressed air the registrations were carried out according to the DMFS count^{8,10,17} which reflects the caries experience. In the lateral segments the examinations were supplemented by bitewing radiographs of the proximal surfaces. The radiographs were evaluated according to the criteria suggested by Leijon.^{20,21}

Extracted teeth were registered from the treatment journals. The upper and lower first premolars were not included in the study as they were frequently removed for orthodontic reasons.

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The orthodontic patients were instructed in toothbrushing with a horizontal scrub technique at the time of band cementation, and were given a prescription for 0.05% sodium fluoride solution for daily rinsing. They brushed their teeth with 0.2% sodium fluoride solution three times a year at school.

The oral hygiene was checked at the appointments every fourth to fifth week and, if necessary, instructions in toothbrushing were repeated and the patients referred to the local dentist for additional checking of the hygiene.

The control children had received no systematic hygienic instructions, but had brushed their teeth with 0.2% sodium fluoride three times a year at school.

The statistical evaluations included calculation of the DMFS counts for the different teeth and surfaces; a chi-square test (X^2) was used in the statistical comparison of the orthodontically treated and untreated individuals.

RESULTS

The total DMFS counts for the different teeth were generally somewhat higher in the untreated than in the treated children (Table I). A chi-square test demonstrated significantly more undestructed surfaces in the maxillary first molars, second premolars, cuspids and central incisors, and mandibular first molars and second premolars in the treated group. The number of untreated carious lesions at the time of examination was significantly higher in the maxillary second molars of the treated group.

The distribution of destructed surfaces for each of the tooth surfaces (Table II) showed significantly more intact surfaces in the treated than in the untreated group. The number of untreated lesions was significantly higher on the mesial and distal surfaces of the untreated group.

DISCUSSION

Orthodontic treatment normally coincides with a period of increased incidence of caries which may be one of the reasons why orthodontists have been criticized for causing increased caries activity.^{2,3} Previous clinical investigations indicate that the total number of carious lesions does not increase, but there may be a reduction in the number of proximal lesions, and an increase in the number of vestibular and lingual cavities.^{2,9,14,16,25,36} Such a shift is disadvantageous as smooth surface cavities may be more difficult to restore properly. They are also more easily observed by parents and patients and a feeling that orthodontic treatment causes tooth destruction may be falsely nourished.

In this material there was a general tendency toward less caries experience in orthodontically treated individuals (Table I) and for some teeth the differences were significant. This finding is partly contradictory to other investigations^{2,9,24-26,36} which have demonstrated only small changes of the caries situation after orthodontic treatment. The differences may have been caused by the regular control of the hygiene during the orthodontic treatment and the daily rinsing with 0.05% sodium fluoride. Such procedures have been reported to reduce the caries incidence,²² even if the results do not always coincide.⁴

The distribution of new carious lesions at the time of examination indicates somewhat less caries activity in treated children for the majority of the teeth.

This might indicate a long-term effect of the hygienic precautions and fluoride application during the orthodontic treatment. If the instructions resulted in a permanent improvement of the oral hygiene, it is likely that a comparison of the caries experience of the

TABLE I
Decayed, missing and filled surfaces (DMFS) in orthodontically treated and untreated children. DS—decayed surfaces. FS—filled surfaces. MS—missing surfaces.
X²—values from the chi-square test.

Teeth	The treated group (n = 52)						The untreated group (n = 111)						X ² Intact surfaces	X ² DS
	Total no. of surfaces	Intact surfaces	DS	FS	MS	DMFS	Total no. of surfaces	Intact surfaces	DS	FS	MS	DMFS		
7+7	520	402	14	99	5	118	1110	836	68	196	10	274	0.66	8.04xx
6+6	520	225	19	241	35	295	1110	410	33	532	135	700	5.71x	0.33
5+5	520	416	12	87	5	104	1110	721	46	333	10	389	37.28xx	2.97
3+3	416	411	3	2	0	5	888	810	17	61	0	78	26.07xx	1.94
2+2	416	337	8	63	8	79	888	724	21	131	12	164	0.02	0.09
1+1	416	340	8	68	0	76	888	598	14	154	0	290	28.34xx	0.05
7-7	520	363	28	129	0	157	1110	759	58	288	5	351	0.27	0.00
6-6	520	203	10	247	60	317	1110	327	23	510	250	783	14.37xx	0.00
5-5	520	430	10	55	25	90	1110	821	24	205	60	289	14.63xx	0.02
3-3	416	415	0	1	0	1	888	882	5	1	0	6	0.35	—
2-2	416	409	0	7	0	7	888	874	3	11	0	14	0.01	—
1-1	416	400	0	8	8	16	888	851	3	26	8	37	0.02	—

x (P<0.05) xx (P<0.01)

After the Haderup system of dental designation, + signifies the maxilla; — the mandible. If the symbol is placed to the right of the figure, the right side is indicated, and vice versa.

TABLE II
Comparison of the decayed, missing and filled surfaces (DMFS) for the different tooth surfaces in orthodontically treated and untreated children. DS—decayed surfaces.
FS—filled surfaces. MS—missing surfaces. X²—values from the chi-square test.

Sur- faces	The treated group (n = 52)						The untreated group (n = 111)						X ² Intact Surfaces	X ² DS
	Total no. of surfaces	Intact surfaces	DS	FS	MS	DMFS	Total no. of Surfaces	Intact Surfaces	DS	FS	MS	DMFS		
Mesial	1248	969	31	218	30	279	2664	1442	110	613	99	822	72.12xx	11.16xx
Distal	1248	1014	37	167	30	234	2664	1581	99	485	99	683	53.77xx	3.91x
Occlusal	624	168	23	407	26	456	1272	279	47	912	94	1053	8.28xx	0.00
Buccal	1248	1110	7	101	30	138	2664	1924	27	216	99	340	10.40xx	2.72
Lingual	1248	1101	14	103	30	147	2664	1911	32	222	99	353	9.27xx	0.33

x (P<0.05) xx (P<0.01)

treated and untreated individuals at a higher age would result in even greater differences.

Well-cemented bands seem to protect the enamel surface against demineralization.^{33,34} It is important that the integrity of the cement layer is maintained and care taken when ultrasonic instruments are used for removal of excess cement.³⁵ The vestibular and lingual surfaces are only partly protected by the orthodontic bands and, if the oral hygiene is neglected, plaque accumulation in the gingival area is inevitable and incipient caries may appear in 2-3 weeks.¹² These surfaces can be inspected readily, and early demineralizations will respond well to intensive fluoride application.^{11,12,15,19,23} It should be possible to keep this problem under control in the majority of patients by hygiene instructions and repeated prophylaxis.³¹

The direct bonding technique may, however, aggravate the problem as there will be no band protection of the usual caries predilection sites of the proximal surfaces, which are also more difficult to inspect.

The increased incidence of buccal and lingual lesions during orthodontic treatment previously reported could not be verified in this study (Table II). This difference may be a result of remineralization of incipient carious lesions in the period after the removal of the orthodontic appliances. This is supported by the fact that the majority of buccal and lingual lesions at the time of debanding can be classified as precarious lesions.^{16,36}

Clinical experience shows that a few patients who are unable to cooperate get relatively many buccal and lingual cavities. Thus the caries situation is not fully controlled. It would be advantageous if these high caries-risk individuals could be identified at an early age⁵ and put on an intensive caries pre-

vention program. It is also likely that all orthodontic patients would benefit from instruction and supervision of the oral hygiene some months prior to treatment^{18,22,31} and thereby uncooperative patients could be excluded. Such a procedure and topical fluoride application before band cementation should further reduce the risk of increased caries activity in any patient during orthodontic treatment.

SUMMARY

The caries experience in 26 girls and 26 boys living on an island outside Bergen, who had received orthodontic treatment with fixed appliances, was examined 1.5 to 2 years after the end of treatment. The children were then between 16 and 17 years old. The remaining children of the same age group, 58 girls and 53 boys, served as controls. The orthodontic patients had received repeated hygiene instructions during the treatment period and were expected to rinse their mouths with 0.05% sodium fluoride daily.

The percentage distribution of DMF-surfaces indicated somewhat less caries experience in the treated group. A chi-square test showed significantly more intact surfaces on the maxillary first molars, second premolars, canines and central incisors, and mandibular molars and second premolars in treated than in untreated children, and also demonstrated significantly fewer new lesions in the upper second molars at the time of examination in the treated groups. A comparison of the caries experience of the different surfaces revealed significantly more intact surfaces in the treated group and significantly fewer new lesions on the mesial and distal surfaces in treated than in untreated children at the time of examination.

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