EVALUATION OF THE EFFECTS OF DENTAL FLUOROSIS ON CROWN DIMENSIONS OF PERMANENT AND DECIDUOUS TEETH

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SUMMARY: The objective of this study was to investigate the impact of fluorosis on the size of deciduous and permanent teeth, and to compare the data with those of teeth without fluorosis. Plaster molds were obtained from 180 patients between the ages of 8 and 16 (mean 11.9±1.4 years) who were eligible for the study. The molds were divided into deciduous and permanent teeth according to the ages of the patients, and teeth were divided into five groups according to the level of fluorosis. No significant differences were found in the dimensions of deciduous teeth between all groups (p>0.05), even in patients with late mixed dentition. However, for the permanent teeth, the dimensions were generally lower in the fluorosed teeth than in the nonfluorosed healthy teeth. These differences were found between mesio-distal dimensions of permanent maxillary, right, and left central incisors, respectively (p = 0.010 and p = 0.012), and between left second premolars (p = 0.035) and left first molars (p = 0.043). For the mesio-distal dimensions of mandibulary teeth, a significant difference in dimensions of first molars (p = 0.018) and in left central incisors (p = 0.002) was found.

Keywords: Crown dimensions, Deciduous teeth; Dental fluorosis, Permanent teeth.

INTRODUCTION

Morphological characteristics of teeth, especially their size in mesio-distal and bucco-lingual exposure, are the most important factors affecting the arrangement of teeth in the dental arch and the development of occlusion during the transition from primary dentition to permanent dentition.[1] It is generally agreed that the size of teeth is influenced by genetic and environmental factors such as nutrition and disease during formation and development of teeth, especially during the prenatal period.[2-4] Garn et al.[3] reported that the size of teeth in humans varies with the amount of calories or protein intake. Some hereditary diseases also reduce the size of mesio-distal and bucco-lingual surfaces of teeth.[4,5] Moreover, no significant difference was detected between tooth size of premature babies and that of a control group.[6]

Effects of trace elements on the mesio-distal and bucco-lingual dimensions of teeth have also been examined by several groups of other researchers.[7-12] In a study investigating the effect of 1 ppm of fluoride (F) in drinking water on the dental morphology of children who were 10 to 11 years old, mesio-distal and bucco-lingual dimensions of molar teeth were found to be significantly lower in the fluoridated group.[8] In a similar study, Goose and Roberts,[9] who examined the teeth of a group of parents and their children living in a fluoridated region, reported that F caused a decrease in tooth size in both groups.

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Even though the modifying effect of the recommended F level in water on tooth morphology was examined in these investigations, only a few studies have been concerned with the effect of high levels of dietary F. In a study on rats, high F was found to cause significant changes in the morphology of molar teeth.[10] In a study on humans, no difference was found between the mesio-distal dimension of teeth of children living in a region with 2 mg F/L in the drinking water and children in a neighboring region with little F in their drinking water.[11,12] Omar,[13] who examined the tooth dimensions of the children living in two different regions with the recommended 1-ppm and high level of F the drinking water, reported smaller tooth size with increased F.

Although the effects of F in the diet and drinking water on tooth morphology have been investigated, there appear to be few studies on the morphology of teeth with fluorosis, which is a concrete indicator of a high level of F during the period of tooth formation and development. In a study conducted by Şahin Sağlam et al.[12] in a region where fluorosis is endemic, it was found that the mean mesio-distal dimension of fluorotic teeth of children was much lower.

The objective of this study was to investigate the impact of dental fluorosis on the size of deciduous and permanent teeth, and to compare the data obtained with healthy teeth without fluorosis.

MATERIALS AND METHODS

Determining the study groups: For this study, information forms of patients who applied to the clinics of the Department of Pedodontics, Faculty of Dentistry in Süleyman Demirel University, Isparta, Turkey were examined. Based on information on the forms, the study group consisted of patients with dental fluorosis who were born in Isparta. Previously, it has been reported that the prevalence and severity of dental fluorosis among the population in the central part of Isparta are substantially higher than expected for F levels in drinking water in the range of 2.16–4.30 ppm.[14,15] The research ethical committee of S. Demirel University, Faculty of Medicine, approved the study (09.03.2006-02/16).

The control group consisted of patients who applied to our clinic from the surrounding cities with low levels of F (<0.3 ppm) in the drinking water and who did not have dental fluorosis.[16,17] When creating the study and control groups, only children who were living in the same residential area since birth were selected.

During the intra-oral examination, the level of fluorosis on the teeth was determined by the same examiner under standardized conditions for each patient by using the Thylstrup-Fejerskov Index (TFI).[18] Patients whose forms had missing or suspicious information or who had developmental or structural abnormalities (microdontia, macrodontia, congenital absence of teeth, etc.), and who neither had a class I closing nor a proper arrangement of teeth, were excluded from the study. Plaster molds were obtained from 180 patients between the ages of 8 and 16 (11.9±1.4 yr) who were eligible for the study. For examination of the deciduous and permanent teeth, the patients were divided into two groups: those between the ages of 8 and 11 (deciduous teeth group) and patients between the ages of 12 and

16 (permanent teeth group). Teeth were divided into 5 groups according to the level of fluorosis, as follows: 1st group, mild (TFI 1–2–3); 2nd group, moderate (TFI 4–5), 3rd group, severe (TFI 6–7); 4th group, very severe (TFI 8–9); and finally a nonfluorosis control group.

Measuring the size of the teeth: In order to obtain precise and reliable dimensions of the teeth, the impressions of all the molds were made of alginate material. To minimize dimensional deformation risks that may arise from fluid loss, the molds were prepared with fast-setting plaster that hardened in less than 10 min. To ensure quality, molds that broke or had air bubbles were remade. Teeth that were incompletely erupted, had caries, and had conservative treatment or prosthetic restorations were excluded from the study.

Measurements of deciduous and permanent teeth eligible for the study were performed by one examiner (Intraclass correlation coefficient: 0.98) using a digital caliper [Shan Precision Measuring Instruments, 132–325A (range 0–200 mm, resolution 0.01 mm), Guilin Measuring and Cutting Works, Guilin, China]. Mesio-distal and bucco-lingual dimensions of teeth were measured according to the method of Jensen et al.[1] While measuring, tips of the compass were placed either parallel to the long axis of each tooth or perpendicular to the occlusal or incisal surface of each tooth. Mesio-distal measurements of teeth were performed on the largest distance between mesial and distal contact points of each tooth. Also in bucco-lingual width measurements, the largest distance at bucco-lingual direction of each tooth was measured. After each measurement, the digital display was reset and the compass was recalibrated. Teeth for which the compass could not be positioned appropriately were excluded from the study.

Statistical analyses were done with SPSS (Statistical Package for Social Sciences, version 13.0) software. For the evaluation of the data, descriptive statistical analyses such as mean and standard deviation were used as well as the Mann-Whitney U test for the evaluation of binary groups, the one-way analysis of variance (ANOVA) and the mean values were separated using the Tukey's Multiple Range test. The level of statistical significance was set at $p<0.05$.

RESULTS

The distribution of 180 patients included to the study according to the groups is shown in Table 1.

Table 1. Distribution of 180 patients included in the study according to the groups

Group	Deciduous teeth (8–11 years)		Permanent teeth (12–16 years)		Total
	Girls	Boys	Girls	Boys	
Fluorosis (-)	20	20	20	20	80
Fluorosis (+)	25	25	25	25	100
Total	45	45	45	45	180

Size of deciduous teeth: For the 435 deciduous molar teeth [204 female (47%); 231 male (53%)] included in the study, the distribution according to tooth types and fluorosis groups is shown in Table 2 and Figure 1.

Table 2. Distribution of 435 deciduous teeth according to tooth types

Tooth Types	Maxillary		Mandibulary		Total
	Right	Left	Right	Left	
1. Molar	42	46	44	47	179
2. Molar	67	64	59	66	256
Total	109	110	103	113	435

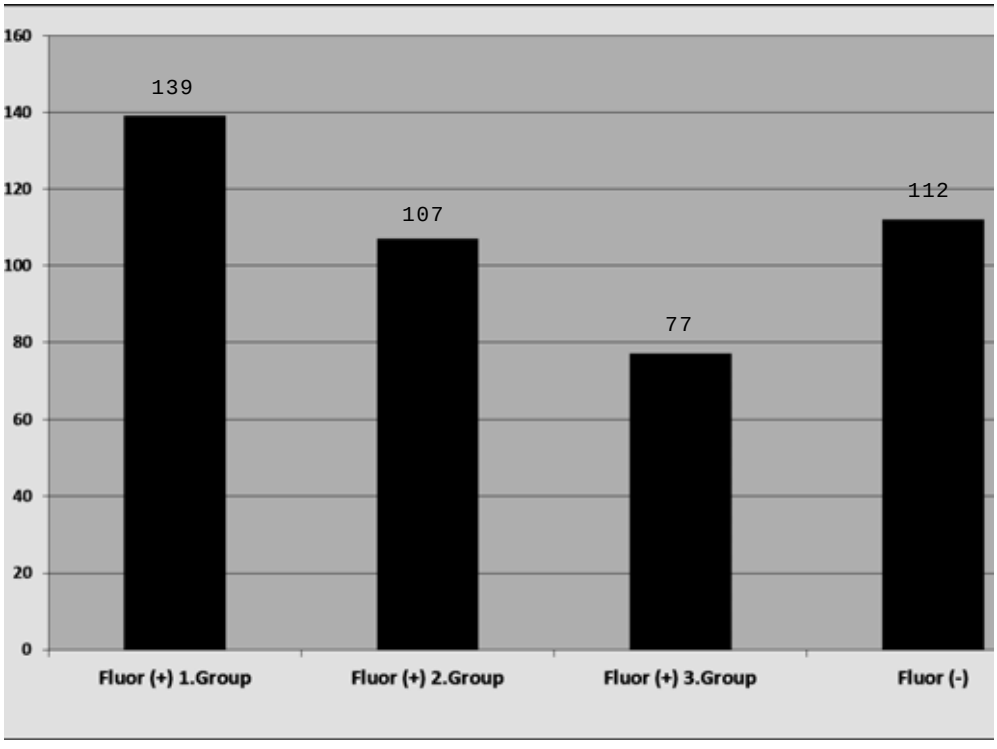

Figure 1. Distribution of 435 deciduous teeth according to fluorosis groups.

Mean and standard deviations of the measurements obtained for the deciduous molars are shown in Table 3. No significant difference was found in the mesio-distal and bucco-lingual size of the teeth between all groups of deciduous teeth with fluorosis and the control group ($p>0.05$). When the results of each group with fluorosis were compared with those of the control group, there was also no statistically significant difference among the binary groups ($p>0.05$). In addition, no statistically significant difference was detected between mesio-distal and bucco-lingual width values of the female and male teeth ($p>0.05$).

Table 3. Mean and standard deviation (SD) of the measurements obtained from the deciduous molar teeth according to the groups

				FLUOR(+) 1.GROUP		FLUOR(+) 2.GROUP		FLUOR(+) 3.GROUP		FLUOROSIS (-)		p-value
				Mean (mm)	S.D.	Mean (mm)	S.D.	Mean (mm)	S.D.	Mean (mm)	S.D.	
Maxillary	M1	Right	M-D	7.05	0.40	7.31	0.69	6.79	0.65	6.832	0.47	0.355
			B-L	8.54	0.40	8.56	0.51	8.57	0.37	8.92	0.37	0.416
		Left	M-D	7.19	0.37	6.87	0.59	6.38	0.14	7.11	0.48	0.101
			B-L	8.60	0.46	8.52	0.28	8.02	0.11	9.05	0.60	0.061
	M2	Right	M-D	8.90	0.40	9.12	0.55	8.76	0.27	8.74	0.53	0.258
			B-L	9.83	0.39	10.03	0.51	9.82	0.39	9.74	0.39	0.422
		Left	M-D	8.80	0.41	8.97	0.62	8.98	0.69	8.76	0.49	0.676
			B-L	9.81	0.42	9.87	0.43	9.97	0.47	9.84	0.57	0.908
Mandibulary	M1	Right	M-D	7.67	0.58	7.55	0.52	7.55	0.13	7.71	0.62	0.952
			B-L	7.49	0.37	7.30	0.23	7.58	0.07	7.52	0.35	0.562
		Left	M-D	7.82	0.41	7.49	0.47	8.08	0.88	7.61	0.46	0.226
			B-L	7.74	0.35	7.51	0.31	7.89	0.96	7.52	0.51	0.392
	M2	Right	M-D	9.85	0.42	9.79	0.48	10.06	0.76	9.67	0.53	0.597
			B-L	9.09	0.36	8.79	0.46	9.04	0.80	8.71	0.51	0.133
		Left	M-D	9.72	0.47	9.96	0.65	9.86	0.58	9.84	0.38	0.642
			B-L	9.07	0.34	9.01	0.45	9.03	0.76	8.86	0.33	0.763

Size of Permanent Teeth: For the 3731 permanent teeth [1785 female (48%); 1946 male (52%)] included to the study, the distribution according to tooth types and fluorosis groups is shown in Table 4 and Figure 2.

Table 4. Distribution of 3731 permanent teeth according to tooth types

	Maxillary		Mandibulary		Total
	Right	Left	Right	Left	
Central	164	162	165	164	655
Lateral	141	143	154	152	590
Canine	99	98	132	130	459
1. Premolar	132	130	127	131	520
2. Premolar	116	114	110	113	453
1. Molar	171	173	170	156	670
2. Molar	94	96	96	98	384
Total	917	916	954	944	3731

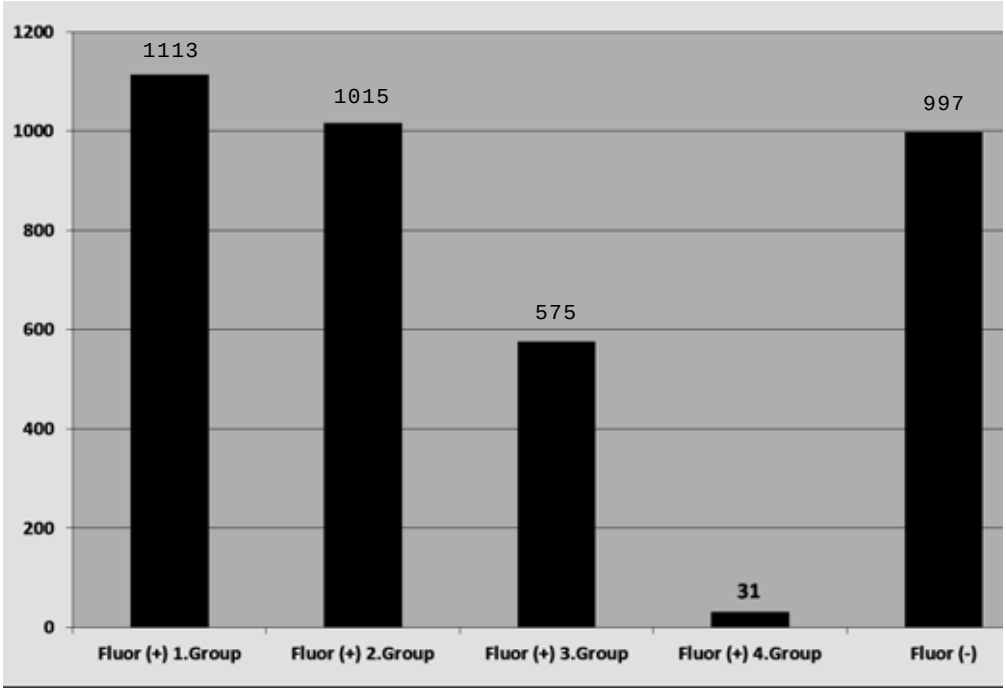

Figure 2. Distribution of 3731 permanent teeth according to fluorosis groups.

Since the number of teeth with very severe fluorosis (TFI 8–9, fluor (+) 4th group) is extremely low compared to the other groups in this study, this group was excluded from the statistical analysis.

Mean and standard deviations of the measurements obtained from the maxillary and mandibulary permanent teeth are summarized in Tables 5 and 6 according to the fluorosis groups.

From the results of statistical analysis, a significant difference is seen between mesio-distal dimensions of maxillary right and left central incisors among the groups, respectively; $p = 0.010$ and $p = 0.012$. For maxillary right central incisor, this difference was due to the results from the fluor (+) 2nd, fluor (+) 3rd, and fluor (–) group ($p = 0.038$). For maxillary left central incisor, this difference was due to the results from the fluor (+) 1st, fluor (+) 3rd, and fluor (–) group ($p = 0.017$).

There was also a significant difference between the mesio-distal dimensions of maxillary left second premolar among the groups ($p = 0.035$). This difference was due to results from the fluor (+) 2nd and fluor (–) group ($p = 0.040$). Similarly, the mesio-distal dimensions of maxillary left first molar showed significant difference ($p = 0.043$), and this difference was due to results of the fluor (+) 3rd and fluor (–) group ($p = 0.023$).

Table 5. Mean and standard deviation (SD) of the measurements obtained from the maxillary permanent teeth

Teeth			FLUOR(+) 1.GROUP		FLUOR(+) 2.GROUP		FLUOR(+) 3.GROUP		FLUOROSIS (-)		*p*-value
			Mean (mm)	S.D.	Mean (mm)	S.D.	Mean (mm)	S.D.	Mean (mm)	S.D.	
Central	Right	M-D	8.51	0.50	8.31	0.54	8.02	0.52	8.65	0.53	0.010**
		B-L	7.24	0.58	7.19	0.56	7.14	0.39	7.29	0.45	0.855
	Left	M-D	8.46	0.52	8.36	0.57	7.81	0.54	8.57	0.45	0.012*
		B-L	7.17	0.52	7.18	0.51	7.62	1.06	7.25	0.40	0.267
Lateral	Right	M-D	6.57	0.51	6.42	0.48	6.49	0.50	6.60	0.59	0.548
		B-L	6.76	0.52	6.50	0.49	6.44	0.47	6.55	0.37	0.107
	Left	M-D	6.64	0.50	6.42	0.52	6.61	0.53	6.58	0.62	0.392
		B-L	6.74	0.53	6.49	0.55	6.32	0.53	6.58	0.51	0.199
Canine	Right	M-D	7.77	0.39	7.52	0.48			7.66	0.37	0.188
		B-L	8.40	0.58	8.19	0.58			8.07	0.47	0.188
	Left	M-D	7.71	0.38	7.49	0.41			7.54	0.46	0.236
		B-L	8.38	0.57	8.24	0.66			8.09	0.56	0.367
1. Premolar	Right	M-D	7.10	0.37	6.93	0.49			70.6	0.38	0.249
		B-L	9.39	0.62	9.27	0.50			9.33	0.53	0.668
	Left	M-D	7.12	0.45	6.96	0.42			7.02	0.37	0.337
		B-L	9.31	0.61	9.24	0.49			9.33	0.54	0.810
2. Premolar	Right	M-D	6.77	0.40	6.57	0.51			6.68	0.35	0.279
		B-L	9.48	0.66	9.32	0.59			9.41	0.60	0.657
	Left	M-D	6.72	0.39	6.49	0.42			6.79	0.42	0.035*
		B-L	9.50	0.65	9.40	0.62			9.45	0.69	0.851
1. Molar	Right	M-D	10.33	0.61	10.36	0.55	10.10	0.49	10.15	0.63	0.369
		B-L	11.38	0.66	11.51	0.52	11.66	0.61	11.39	0.53	0.491
	Left	M-D	10.22	0.42	10.21	0.49	9.70	0.54	10.30	0.58	0.043*
		B-L	11.35	0.61	11.48	0.47	11.31	0.31	11.29	0.51	0.447
2. Molar	Right	M-D	9.78	0.87	9.69	0.55			9.51	0.73	0.546
		B-L	11.52	0.89	11.22	0.61			11.40	0.82	0.510
	Left	M-D	9.76	0.63	9.69	0.60			9.61	0.59	0.796
		B-L	11.46	0.99	11.11	0.60			11.34	0.69	0.339

*p<0.05; **p<0.01.

Table 6. Mean and standard deviation (SD) of the measurements obtained from the mandibulary permanent teeth

Teeth			FLUOR(+) 1.GROUP		FLUOR(+) 2.GROUP		FLUOR(+) 3.GROUP		FLUOROSIS (-)		p-value
			Mean (mm)	S.D.	Mean (mm)	S.D.	Mean (mm)	S.D.	Mean (mm)	S.D.	
Central	Right	M-D	5.44	0.36	5.43	0.83	5.04	0.07	5.60	0.35	0.321
		B-L	5.91	0.50	5.96	0.42	6.07	0.06	6.00	0.37	0.823
	Left	M-D	5.45	0.33	5.27	0.42	4.87	0.01	5.58	0.40	0.002**
		B-L	5.96	0.48	5.94	0.44	6.03	0.07	6.08	0.41	0.584
Lateral	Right	M-D	5.91	0.37	5.79	0.50	5.52	0.26	5.98	0.41	0.172
		B-L	6.22	0.57	6.25	0.37	6.05	0.06	6.23	0.37	0.951
	Left	M-D	5.95	0.41	5.79	0.49	5.42	0.25	6.01	0.45	0.095
		B-L	6.25	0.60	6.21	0.38	6.20	0.24	6.23	0.37	0.987
Canine	Right	M-D	6.66	0.38	6.55	0.33			6.65	0.43	0.545
		B-L	7.45	0.63	7.38	0.56			7.23	0.41	0.421
	Left	M-D	6.64	0.43	6.51	0.32			6.67	0.43	0.391
		B-L	7.42	0.73	7.23	0.52			7.19	0.34	0.358
1. Premolar	Right	M-D	7.13	0.52	6.92	0.48			7.12	0.39	0.148
		B-L	7.87	0.52	7.93	0.53			7.86	0.46	0.838
	Left	M-D	7.00	0.61	6.95	0.39			7.04	0.38	0.759
		B-L	7.90	0.63	7.87	0.53			7.79	0.47	0.754
2. Premolar	Right	M-D	7.15	0.58	6.99	0.42			7.25	0.79	0.341
		B-L	8.57	0.48	8.52	0.45			8.62	0.64	0.822
	Left	M-D	7.11	0.56	7.11	0.50			7.01	0.50	0.722
		B-L	8.74	0.41	8.53	0.52			8.50	0.58	0.266
1. Molar	Right	M-D	10.80	0.72	10.92	0.72	10.39	1.04	10.95	0.79	0.239
		B-L	10.73	0.55	10.77	0.51	10.42	0.77	10.62	0.51	0.291
	Left	M-D	10.88	0.70	11.13	0.75	10.15	0.68	11.03	0.73	0.018*
		B-L	10.73	0.57	10.79	0.49	10.20	0.39	10.77	0.57	0.103
2. Molar	Right	M-D	10.10	0.51	10.06	0.61			10.19	0.90	0.838
		B-L	10.42	0.54	10.35	0.54			10.13	0.63	0.355
	Left	M-D	10.18	0.84	10.10	0.73			10.14	0.67	0.947
		B-L	10.32	0.83	10.43	0.58			10.34	0.62	0.859

*p<0.05; **p<0.01.

Statistical comparisons of the mandibulary teeth revealed a significant difference between the mesio-distal dimensions of the left central incisor among the groups ($p = 0.002$), and this difference was due to results from the fluor (+) 2nd and fluor (–) group ($p = 0.007$). When mesio-distal dimensions of mandibulary left first molars are compared, there was a significant difference among the groups ($p = 0.018$), and this difference was due to results between the fluor (+) 2nd and fluor (+) 3rd group ($p = 0.014$) and the results between the fluor (+) 3rd and fluor (–) group ($p = 0.034$). When mesio-distal and bucco-lingual dimensions of permanent teeth are evaluated according to gender, the dimensions of all teeth groups of females were found to be smaller than those of the same teeth groups of males ($p > 0.05$).

DISCUSSION

It is important for dentists and anthropologists to be able to measure the dimensions of teeth accurately. Various methods have been developed for this purpose.[19-22] Intra-oral methods for measuring the dimensions of teeth do not give reliable results for various reasons, such as the fact that intra-oral environment cannot be standardized, and it is difficult to determine the mesial and distal contacts, especially in the maxillary teeth. In a study comparing the intra-oral measurements with the measurements obtained from plaster models of same permanent teeth, it was found that intra-oral measurement results were significantly less satisfactory than those of the latter.[19] Intra-oral measurements of deciduous teeth are much more difficult since the mouth opening of children in the young age groups is smaller, and the time required for intra-oral procedures is longer. Measurements performed on plaster models were found to give more reliable results than intra-oral measurements.[19]

Through the rapidly advancing technological developments in recent years, 3D digital intra-oral analysis systems have been developed to measure the dimensions of teeth, and investigations have been conducted on the safety and efficacy of these systems.[20-24] Although expensive, these systems are clinically practical and rapid. However, some studies have not found them to be safe.[20-24] In view of this concern, and in order to ensure accurate tooth dimensions, our measurements were performed on plaster molds using a digital compass.

Up to the present, various studies examining the dimension of deciduous and permanent teeth have been conducted to reveal the tooth-arc size mismatch and arc space narrowness, to investigate the differences between the ethnic groups, and to do gender determination in forensic medicine.[25-41] Many of these studies are consistent with our study findings showing that the mesio-distal and bucco-lingual dimensions of teeth of males are higher than those of females.[25-37]

In a study that examined the mesio-distal dimensions of deciduous and permanent teeth of 112 Chinese children, which was performed on plaster models with the help of a compass, it was found that tooth sizes of boys were larger than that of girls in both deciduous and permanent tooth groups.[42] This difference was more pronounced in permanent than deciduous teeth.[42] In our study, although

mesio-distal and bucco-lingual dimensions of permanent teeth showed a difference related to gender, there was no significant difference in mesio-distal and bucco-lingual dimensions of deciduous teeth among girls and boys.

Various studies have been conducted in order to investigate the effects of trace elements on mesio-distal and bucco-lingual dimensions of teeth.[7-12,43] In a study, mesio-distal dimensions of teeth of newborn rats were measured after giving F and molybdenum during pregnancy period. It was found that F decreased the mesio-distal dimensions of teeth, and that molybdenum, which interacted with F did not cause any change in reducing effects in tooth size.[7] In another study on rats, morphologic and dimensional characteristics of the teeth of the young rats were compared after giving approximately 108 µg F/day. Tubercle height and mesio-distal dimension of the teeth of rats given F was reported to be significantly decreased.[43]

In a study investigating the effects of 1 ppm F water on dental morphology among 258 boys between the ages of 10 and 11, the dimensions of permanent first molars and permanent central incisors were measured.[8] Mesio-distal and bucco-lingual dimensions of the first molar were determined to be significantly lower in the fluoridated group, and there was no difference in mesio-distal widths of central incisor teeth in the fluoridated and nonfluoridated group.[8] Similarly, Goose and Roberts[9] investigated bucco-lingual dimensions of teeth of children born after the drinking water was fluoridated, and of the parents whose teeth were not affected by F. They found that bucco-lingual dimensions of most of the permanent teeth of children were lower than that of parents, and they concluded that fluoridated drinking water could therefore reduce the dimensions of teeth.

Omar,[13] who examined mesio-distal and bucco-lingual dimensions of permanent teeth of 122 children living in two different regions (with the recommended optimal and high level of F in drinking water), reported that mesio-distal dimensions, especially of the maxillary central incisor and second premolar teeth, and bucco-lingual dimensions of maxillary second molar teeth significantly decreased with the increased levels of F in the drinking water.

Although the effects of F taken with foods and drinking water on dental morphology have been investigated in various studies, there appears to be a limited number of studies dealing with the morphologic characteristics of teeth with fluorosis.[11,12] In a study investigating the effects of fluoride on deciduous and permanent teeth of total of 364 children [(151 children living in a region with different levels of F in drinking water (≤0.5, 0.6–0.9, 1.0–1.2, and 1.3–2.0 mg/L), and 213 children living in a region with F less than 0.1 mg/L (control group)], mineralization defects of teeth, fluorosis, and changes in mesio-distal dimensions were examined. No significant difference was found between mesio-distal widths of teeth of children with high levels of F in their drinking water and those of the control group, and in the dimension of teeth of the children with and without dental fluorosis.[11] On the other hand, another study that investigated the dimension of permanent teeth of 50 individuals with fluorosis and healthy teeth

found that the mesio-distal dimensions of mandibulary first premolar teeth with fluorosis were lower than those of healthy teeth.[12]

Since some of the structures of deciduous teeth are mineralized during the prenatal period, and enamel of the deciduous teeth is thinner and whiter than that of permanent teeth, fluorosis of deciduous teeth is generally milder than fluorosis of permanent teeth.[44] Furthermore, because the amount of F in deciduous teeth is lower than that of permanent teeth,[45] it was not surprising in our study that no significant difference was detected in the dimensions of deciduous teeth with fluorosis and healthy teeth, as in the report by Grahnen et al.[11] It appears, therefore, that deciduous teeth may be less affected by the negative effects of F than the permanent teeth.

Thus, although some studies have reported no significant difference with F on dimensions of permanent teeth,[9,11] the majority of studies indicate that F is associated with decreased dimensions of these teeth.[7,8,12,13] The data obtained from our study are compatible with these reports.

In conclusion, our investigation of the morphologic characteristics of teeth with fluorosis and those of healthy teeth showed that the dimensions of the maxillary permanent central teeth, second premolar, first molar teeth, and mandibulary permanent central incisor and first molar teeth were significantly smaller than those of the healthy nonfluorosed group. On the other hand, the dimensional characteristics of deciduous teeth of children who were in late mixed dentition period were not affected by fluoride.

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