The Size of the Dentition in Complete Cleft Lip and Palate

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Introduction

A number of studies have provided evidence that the dimensions of the jaws differ between cleft palate and non-cleft palate subjects, (*1, 6, 7, 9, 16*) although such differences may be due in part to the effects of operative procedures. Attention has also been paid to the form and dimensions of the dentition in cleft lip and palate subjects, both in the region of the cleft and outside the cleft region. Dixon (*5*) has pointed out that the teeth in cleft lip and palate can show defects in number, form and structure. The prevalence of supernumerary and missing teeth in the region of the alveolar cleft has been studied by Millhon and Stafne (*13*) and by Bøhn (*2, 3*) among others. Bøhn found that 75 per cent of 168 alveolar clefts showed either missing or supernumerary teeth, there being 113 supernumerary teeth and 80 missing teeth in the permanent dentitions. Outside the cleft area, hypodontia seems to be more prevalent than hyperdontia. Bøhn (*3*) found hypodontia in 76 and hyperdontia in only 3 out of 198 cleft lip and palate subjects, and Dixon (*5*) found that 26 per cent of subjects with a post alveolar cleft had one or more missing premolar teeth.

With regard to the form and structure of the teeth, defects have been noted both within and outside the cleft region (*2, 3, 5, 10, 11*). The most common defects are abnormalities in form of the lateral incisor and hypoplasia of the central incisor in the cleft region. However, Jordan, Kraus and Neptune (*10*) found a high degree of tooth malformation in all areas of the jaws.

Studies of tooth size in cleft lip and palate have usually included the malformed teeth and have covered subjects with varying types of cleft. It was therefore decided to make an assessment of tooth size in one specific type of cleft, excluding all teeth which showed macroscopic malformations, with the object of comparing tooth dimensions in cleft lip and palate with those in non-cleft subjects and of assessing sex differences in tooth dimensions.

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TABLE 1. Dimensions of teeth in normal and cleft palate subjects

	Right							*Left*						
	I_1	I_2	C	PM_1	PM_2	M_1	M_2	I_1	I_2	C	PM_1	PM_2	M_1	M_2
Normal Maxilla														
Mesiodistal Diameter														
Male *n*	40	40	40	40	40	40	40	40	40	40	40	40	40	40
x	0.859	0.698	0.866	0.680	0.703	1.168	1.186	0.859	0.696	0.847	0.678	0.705	1.173	1.195
S.E.	0.0131	0.0086	0.0092	0.0057	0.0084	0.0135	0.0165	0.0146	0.0078	0.0102	0.0078	0.0072	0.0056	0.0078
Female *n*	40	40	40	40	40	40	40	40	40	40	40	40	40	40
x	0.786	0.677	0.745	0.702	0.667	1.147	1.179	0.785	0.670	0.739	0.712	0.660	1.144	1.190
S.E.	0.0100	0.0082	0.0063	0.0059	0.0058	0.0053	0.0161	0.0079	0.0084	0.0074	0.0060	0.0102	0.0074	0.0074
Percentage difference	+4.42*	+1.51	+7.49*	−1.59*	+2.65*	+0.92	+0.28	+4.51*	+1.93*	+6.83*	−2.44*	+3.30*	+1.23*	+0.21
Buccolingual Diameter														
Male *n*	40	40	40	40	40	40	40	40	40	40	40	40	40	40
x	0.693	0.591	0.874	0.811	0.994	1.215	1.189	0.689	0.597	0.869	0.824	0.957	1.205	1.198
S.E.	0.0092	0.0063	0.0028	0.0038	0.0023	0.0151	0.0191	0.0134	0.0074	0.0055	0.0042	0.0049	0.0047	0.0087
Female *n*	40	40	40	40	40	40	40	40	40	40	40	40	40	40
x	0.679	0.577	0.748	0.919	0.935	1.188	1.135	0.669	0.549	0.761	0.929	0.935	1.165	1.138
S.E.	0.0070	0.0089	0.0100	0.0066	0.0060	0.0179	0.0111	0.0052	0.0094	0.0079	0.0083	0.0081	0.0079	0.0061
Percentage difference	+1.04	+1.20	+7.77*	−6.23*	+3.04*	+1.12	+2.32*	+1.51	+4.23*	+6.64*	−5.96*	+1.18*	+1.68*	+2.58*
Normal Mandible														
Mesiodistal Diameter														
Male *n*	40	40	40	40	40	40	40	40	40	40	40	40	40	40
x	0.525	0.613	0.658	0.687	0.695	1.179	1.191	0.528	0.605	0.660	0.685	0.692	1.174	1.189
S.E.	0.0053	0.0048	0.0047	0.0082	0.0081	0.0142	0.0113	0.0042	0.0039	0.0044	0.0118	0.0187	0.0099	0.0182
Female *n*	40	40	40	40	40	40	40	40	40	40	40	40	40	40
x	0.498	0.514	0.648	0.664	0.733	1.260	1.137	0.490	0.515	0.640	0.665	0.725	1.256	1.125
S.E.	0.0068	0.0033	0.0098	0.0098	0.0027	0.0022	0.0060	0.0059	0.0078	0.0083	0.0083	0.0069	0.0070	0.0045
Percentage difference	+2.64*	+9.09*	+0.81	+1.70	−2.61*	−3.32*	+2.32*	+3.74*	+8.07*	+1.55*	+1.50	−2.30	−3.38*	+2.80*
Buccolingual Diameter														
Male *n*	40	40	40	40	40	40	40	40	40	40	40	40	40	40
x	0.589	0.617	0.711	0.868	0.912	1.117	1.134	0.586	0.610	0.724	0.889	0.916	1.126	1.124
S.E.	0.0079	0.0050	0.0054	0.0078	0.0027	0.0121	0.0031	0.0079	0.0061	0.0087	0.0061	0.0047	0.0047	0.0089
Female *n*	40	40	40	40	40	40	40	40	40	40	40	40	40	40
x	0.596	0.599	0.654	0.819	0.873	1.161	1.155	0.589	0.585	0.653	0.829	0.875	1.155	1.136
S.E.	0.0123	0.0109	0.0156	0.0136	0.0117	0.0114	0.0133	0.0065	0.0038	0.0095	0.0063	0.0089	0.0083	0.0070
Percentage difference	−0.62	+1.53	+4.17*	+2.94*	+2.18*	−1.91*	−0.90	−0.26	+2.09*	+5.21*	+3.50*	+2.29*	−1.25*	−0.53

Cleft Palate Maxilla														
Mesiodistal Diameter														
Male	*n*	36	36	36	21	21	30	14	36	6	36	21	21	30	14
	x	0.875	0.688	0.695	0.648	0.626	1.066	0.947	0.813	0.662	0.714	0.655	0.630	1.087	0.968
	S.E.	0.0110	0.0072	0.0070	0.0075	0.0095	0.0140	0.0249	0.0109	0.0096	0.0072	0.0112	0.0121	0.0151	0.0281
Female	*n*	19	18	15	19	19	16	15	19	7	15	19	19	16	15
	x	0.904	0.732	0.767	0.670	0.634	1.023	0.880	0.887	0.693	0.734	0.676	0.654	1.042	0.875
	S.E.	0.0178	0.0189	0.0129	0.0103	0.0138	0.0095	0.0047	0.0185	0.0174	0.0156	0.0129	0.0181	0.0094	0.0100
Percentage difference		−1.66	−3.06*	−4.97*	−1.65	−0.66	+2.08*	+3.67*	−4.36*	−2.30	−1.36	−1.56	−1.85	+2.12*	+5.05*
Buccolingual Diameter														
Male	*n*	36	36	36	21	21	30	14	36	6	36	21	21	30	14
	x	0.393	0.447	0.496	0.866	0.887	1.130	1.070	0.505	0.585	0.552	0.886	0.903	1.123	1.079
	S.E.	0.0103	0.0035	0.0081	0.0094	0.0093	0.0139	0.0173	0.0136	0.0089	0.0076	0.0219	0.0125	0.0159	0.0164
Female	*n*	19	18	15	19	19	16	15	19	7	15	19	19	16	15
	x	0.518	0.464	0.552	0.894	0.814	0.995	0.973	0.531	0.677	0.571	0.890	0.830	1.020	0.945
	S.E.	0.0174	0.0071	0.0147	0.0157	0.0261	0.0206	0.0278	0.0121	0.0272	0.0108	0.0178	0.0258	0.0167	0.0262
Percentage difference		−13.67*	−1.84*	−5.39*	−1.58	+4.32*	+6.35*	+4.73*	−2.49	−7.30*	−1.67	−0.25	+4.23*	+4.78*	+6.62*
Cleft Palate Mandible														
Mesiodistal Diameter														
Male	*n*	36	36	36	36	36	36	36	36	36	36	36	36	36	36
	x	0.449	0.555	0.663	0.689	0.659	1.107	0.958	0.439	0.539	0.699	0.700	0.656	1.148	0.994
	S.E.	0.0042	0.0040	0.0088	0.0119	0.0057	0.0104	0.0224	0.0044	0.0046	0.0082	0.0105	0.0063	0.0102	0.0222
Female	*n*	19	19	19	19	19	19	19	19	19	19	19	19	19	19
	x	0.468	0.547	0.673	0.645	0.682	1.058	0.990	0.478	0.555	0.672	0.650	0.690	1.071	1.008
	S.E.	0.0093	0.0101	0.0133	0.0094	0.0117	0.0137	0.0165	0.0056	0.0138	0.0128	0.0111	0.0111	0.0186	0.0169
Percentage difference		−2.01	+0.69	−0.73	+3.32*	−1.70	+2.23*	−1.67	−4.17*	−1.43	+1.99	+3.70*	−2.56*	+3.49*	−0.70
Buccolingual Diameter														
Male	*n*	36	36	36	36	36	36	36	36	36	36	36	36	36	36.
	x	0.554	0.448	0.648	0.722	0.856	1.038	0.990	0.546	0.451	0.644	0.738	0.848	1.070	0.971
	S.E.	0.0035	0.0041	0.0048	0.0166	0.0176	0.0094	0.0167	0.0042	0.0039	0.0044	0.0118	0.0187	0.0100	0.0182
Female	*n*	19	19	19	19	19	19	19	19	19	19	19	19	19	19
	x	0.538	0.527	0.722	0.702	0.793	0.980	0.975	0.527	0.535	0.713	0.741	0.817	1.007	0.985
	S.E.	0.0123	0.0110	0.0156	0.0136	0.0117	0.0114	0.0133	0.0114	0.0106	0.0143	0.0171	0.0099	0.0115	0.0137
Percentage difference		+1.47	−8.08*	−5.42*	+1.44	+4.02*	+2.90*	+0.76	+1.77	−8.49*	−5.11*	−0.23	+1.87	+3.03*	−0.70

n = Number of teeth in sample. x = mean dimension in cms. S.E. = standard error. Percentage difference = percentage difference between mean tooth dimensions of both males and females. + = male value greater than female. − = female value greater than male. * = difference statistically significant at the 5% level.

I_1, first incisor; I_2, second incisor; C, canine; PM_1, first premolar; PM_2, second premolar; M_1, first molar; M_2, second molar.

Material and Methods

Fifty five patients with repaired complete unilateral cleft of the lip and palate formed the subjects of this study. There were 36 males and 19 females. They were compared with a control group of 80 subjects, none of whom had cleft lip and palate and who all had a full complement of permanent teeth excluding the third molars. There were 40 males and 40 females in the control group.

Upper and lower study casts were made from alginate based hydrocolloid impressions of the dental arches of all the cleft palate and control group subjects. The following dimensions of the permanent teeth were then measured on the study casts, using vernier callipers reading to the nearest 0.1 mm.

a) Mesiodistal crown diameter. This was measured as the distance between the approximal tooth surfaces.
b) Buccolingual crown diameter. This was measured as the maximum distance between the buccal and lingual surfaces of the tooth at right angles to the mesiodistal crown diameter.

All teeth showing macroscopic malformation were rejected from the study. In addition, some of the cleft palate subjects had one or more congenitally missing teeth, notably the maxillary lateral incisor.

As a check on accuracy the study casts from 5 male and 5 female cleft palate subjects and a similar number of control subjects were measured 5 times on consecutive occasions. The mean error of the measuring technique was in the order of 2 per cent which, from analysis of variance, proved statistically insignificant. ($P > 0.2$)

Results

The results are presented in Tables 1, 2, and 3. Table 1 shows the mesiodistal and buccolingual diameter of the permanent teeth in the male and female cleft palate and control subjects. Table 2 shows the percentage difference in tooth dimensions between the cleft palate and control subjects. Table 3 shows those teeth for which there was a significant difference in dimension between males and females.

Differences between Male and Female Tooth Dimensions. It can be seen from Table 1, that for the normal control subjects, the dimensions of the teeth of the males exceed those of the females with the exception of the dimensions for the upper first premolars and the lower first molars, the mesiodistal diameter of the lower second premolars and the buccolingual diameter of the lower second molar. Most of these differences between the sexes were statistically significant at the 5% level. In the cleft palate subjects, however, the sex differences were to some extent reversed. The upper incisors, canines and first premolars were larger in both dimensions in the females than in the males. In addition the lower incisors, canines, second premolars and second molars were larger in either the mesiodistal or the buccolingual dimension in the females. The first molars and upper

TABLE 2. Comparison between tooth diameters of normal and cleft palate subjects

	Right							*Left*						
	I_1	I_2	C	PM_1	PM_2	M_1	M_2	I_1	I_2	C	PM_1	PM_2	M_1	M_2
Maxilla														
Male														
Percentage difference of Mesiodistal diameters	−0.92	+0.68	+10.96*	+2.37*	+5.86*	+4.55*	+11.22*	+2.77*	+2.51*	+8.49*	+1.75	+5.61*	+3.78*	+7.78*
Percentage difference of Buccolingual diameters	+27.59*	+13.86*	+27.64*	−3.30*	+5.66*	+3.62*	+5.28*	+15.44*	+1.05	+22.36*	−3.59*	+2.88*	+3.53*	+5.24*
Female														
Percentage difference of Mesiodistal diameters	−6.99*	−3.88*	−1.48	+2.31*	+2.56*	+5.70*	+14.55*	−6.10*	−1.71	+0.31	+2.64*	+0.46	+4.67*	+15.24*
Percentage difference of Buccolingual diameters	+13.44*	+10.87*	+15.08*	+1.35	+6.93*	+8.84*	+7.72*	+11.52*	+10.46*	+14.32*	+2.12	+5.93*	+6.63*	+9.27*
Mandible														
Male														
Percentage difference of Mesiodistal diameters	+7.81*	+5.01*	−0.36	−0.19	+2.69*	+3.17*	+11.03*	+9.11*	+5.75*	−2.95*	−1.05	+2.72*	+1.12*	+8.94*
Percentage difference of Buccolingual diameters	+3.10*	+15.86*	+4.65*	+9.19*	+3.21*	+3.64*	+6.78*	+3.54*	+14.90*	+5.91*	+9.31*	+3.85*	+2.57*	+7.29*
Female														
Percentage difference of Mesiodistal diameters	+3.18*	−3.14*	−1.91	+1.43	+3.58*	+8.70*	+6.90*	+1.23	−3.76*	−2.50*	+1.16	+2.46*	+7.97*	+5.46*
Percentage difference of Buccolingual diameters	+5.18*	+6.36*	−4.94*	+7.70*	+4.80*	+8.44*	+8.43*	+5.56*	+4.41*	−4.41*	+5.61	+3.43	+6.84	+7.11

Percentage difference = percentage difference between mean tooth dimensions of normal and cleft palate subjects. − = cleft dimensions greater than normal. + = normal dimensions greater than cleft. * = Difference being statistically significant at 5% level.

TABLE 3. Teeth showing significant differences in size between males and females

	Right							*Left*						
	I_1	I_2	C	PM_1	PM_2	M_1	M_2	I_1	I_2	C	PM_1	PM_2	M_1	M_2
Mesiodistal diameter														
Non-cleft subjects														
Maxilla	+		+	−	+			+	+	+	−	+	+	
Mandible	+	+			−	+	+	+	+	+			−	+
Cleft subjects														
Maxilla		−	−			+	+	−					+	+
Mandible				+		+		−			+	−	+	
Buccolingual diameter														
Non-cleft subjects														
Maxilla			+	−	+		+		+	+	−	+	+	+
Mandible			+	+	+	−			+	+	+	+	−	
Cleft subjects														
Maxilla	−	−	−	−	+	+	+		−			+	+	+
Mandible		−	−		+	+			−	−			+	

+ indicates male larger than female. − indicates female larger than male.

second molars were larger in the males than in the females. Again, many of the sex differences in tooth dimension in the cleft palate subjects were statistically significant at the 5% level as can be seen from Table 1.

Differences between Normal and Cleft Tooth Dimensions. *Males.* It can be seen from Table 2 that the dimensions for the normal control subjects were greater than for the cleft subjects, with the exception of the mesiodistal diameters of the upper central incisors and the lower canines and first premolars and the buccolingual diameters of the upper first premolars. Most of the differences were statistically significant at the 5% level.

Females. In the females all the dimensions for the molars, premolars and lower central incisors were greater in the normal subjects than in the cleft subjects. The dimensions for the lower canine teeth were greater in the cleft subjects and mesiodistal tooth diameters for the upper incisors and canines and the lower lateral incisors were also greater in the cleft subjects. Most of the differences were statistically significant at the 5% level as can be seen from Table 2.

Thus, essentially tooth dimensions for the cleft palate subjects were smaller than those for the normal subjects for most of the permanent teeth, but the female cleft subjects exhibited more tooth dimensions greater than those of the normal controls than did the male cleft subjects.

Discussion

The sex differences in tooth dimensions of normal subjects have been reported by several authors (*4, 14, 15*), males usually being shown to have

larger teeth than females. The normal control subjects of the present study followed this pattern and to some extent the sex difference was reversed in the cleft palate subjects. Bøhn (*3*), who studied the mesiodistal diameters of the permanent upper incisors and canines in cleft palate, found that for the most part the usual sex difference existed, but that the sex difference was practically obliterated in bilateral clefts involving the alveolar process and was reversed for the lateral incisors in subjects with isolated cleft lip. It has been suggested by Meskin et al (*12*) that in cleft palate the female tends to exhibit more severe clefts than the male, and Foster (*6, 7*) has found evidence that maxillary growth is more adversely affected in the female than in the male in unilateral cleft lip and palate. From the present study it would seem that this sex difference is not extended to the dentition.

The differences in tooth dimensions between the cleft palate subjects and the normal controls which were found in the present study suggests that the factors responsible for producing the cleft may also have an adverse effect on dental development. Jordan, Kraus and Neptune (*10*) have pointed to the fact that the whole dentition in cleft lip and palate is subject to anomalies of form. Teeth showing macroscopic anomalies of form were omitted from the present study, as were supernumerary teeth, but the remaining teeth of normal shape were significantly smaller in the cleft subjects. It could be argued that the diminution of tooth size may be a result of the repair operation on the palate although this would not explain the sex difference observed. However, such reduction in size of the dentition has been found by Garn et al (*8*) in subjects with hypodontia affecting the third molars and it is therefore possible that a factor other than that of operative interference is present in cleft lip and palate which causes the dentition to be smaller than normal.

Summary

The dimensions of the permanent teeth were examined in 55 subjects with repaired complete unilateral cleft lip and palate and were compared with those of 80 non-cleft control subjects. All supernumerary teeth and teeth showing macroscopic malformation were omitted from the study. It was found that the teeth of the cleft lip and palate subjects were significantly smaller than those of the control subjects. Furthermore, the normal sex differences in tooth dimensions were to some extent reversed in the cleft palate subjects, several of the dimensions for the females proving significantly larger than for the males.

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