Size and Shape Modification of Molars in Children with Down Syndrome

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INTRODUCTION

The permanent molars of individuals with Down syndrome (DS) display a significant decrease in intercusp distances (Prahl-Anderson and Oerlemans 1976; Townsend, 1986). Peretz et al. (1996) showed that these differences were chiefly due to the altered position of the disto-lingual cusp and developed a multivariate probability model for DS and normal individuals.

The general decrease in the intercusp distances of maxillary molars in DS individuals suggests a disturbance in the early stage of formation of the permanent teeth. The change in shape was considered to occur in a late stage of crown formation, and is mainly expressed in reduced growth of the distolingual cusp. In the lower permanent molar, Brown and Townsend (1984) found that the lower permanent molar of DS individuals also showed reduced intercuspal distances and shape changes, with the distal cusps most affected.

This study was conducted in order to examine differences between the upper and lower molars of DS individuals with respect to the severity of the changes observed. We measured the intercusp distances and angles of the left mandibular first permanent molars in individuals with DS, and in a control group and developed a multivariate probability model for DS and normal individuals, which was compared to the model previously carried out for the first maxillary molar.

METHODS

All intercuspal distances and angles of 25 permanent mandibular first molar teeth of DS children (14 boys, 11 girls aged 7-14 years) and 30 permanent mandibular first permanent molars of normal children (12 boys, 18 girls aged 10-14) were measured from dental casts, taken in the course of routine treatment.

A video camera, monitor, and a computer with an image analyzer program were used for the measurements. Each tooth was analyzed separately. The casts were put on a wooden plate and adjusted to be parallel to the plate and perpendicular to the camera. The cusp tips, reflected by the highest points, were then marked with a graphite pencil. The images of the occlusal surfaces of the teeth were then transferred to the monitor on which the variables were measured with the image analyzer program. All intercusp distances were significantly smaller in the DS group.

Wilcoxon nonparametric test was used for univariate comparisons of the groups. Significance level was chosen at 0.05.

RESULTS

All teeth in both groups displayed five cusps. All intercusp distances were significantly smaller in the DS group (Table 1). Significant differences between DS and normals were found in three angles: the d-mb-dl angle was smaller than in normals, the mb-d-dl angle was higher in DS, and the mb-dl-d angle was smaller in DS. Stepwise logistic regression, applied to all intercusp distances was used to design a multivariate probability model for DS and normals.

Table 1. Means and SD of variables on the mandibular teeth (mm for intercusp distances).

	Down (n=25)	Normal (n=30)
Distance		
mb-db	4.26 ± 0.44	4.60 ± 0.54 *
mb-d	7.02 ± 0.45	7.69 ± 0.60 *
mb-dl	6.90 ± 0.57	8.00 ± 0.54 *
mb-ml	4.66 ± 0.46	5.04 ± 0.48 *
db-d	3.14 ± 0.45	3.39 ± 0.41 *
db-dl	5.06 ± 0.54	5.69 ± 0.42 *
db-ml	6.43 ± 0.56	6.94 ± 0.62 *
d-dl	3.80 ± 0.56	4.65 ± 0.44 *
d-ml	7.48 ± 0.55	8.36 ± 0.56 *
dl-ml	4.92 ± 0.42	5.68 ± 0.51 *
Angle		
db-mb-ml°	91.86 ± 4.95	92.15 ± 6.12
mb-db-ml°	46.37 ± 3.34	46.47 ± 3.19
mb-ml-db°	41.76 ± 4.79	41.37 ± 4.51
d-mb-db°	31.52 ± 3.98	34.37 ± 3.73*
mb-d-dl°	76.22 ± 6.10	69.00 ± 5.12*
mb-dl-d°	72.26 ± 4.53	76.64 ± 5.55*

* $P < 0.05$, Wilcoxon test.

A model based on only two intercusp distance (mb-dl and mb-db), proved sufficient to discriminate between the teeth of DS and the normal population ($p = 0.0001$). Thus, the probability for DS in the lower molar is as follows:

$$p\,(DS) = e^{30.6-5.6(mb\text{-}dl)+25(mb\text{-}db)} \;/\; 1+ e^{30.6-5.6(mb\text{-}dl)+25(mb\text{-}db)} .$$

The probability for DS is higher when mb-db is relatively higher in the mb-db/mb-dl ratio. The scaled model shows that for low values of mb-dl (< 7.0 mm), the probability for DS is high. For values of mb-dl (> 7.7 mm), the probability of DS is very low. In the "grey zone" (mb-dl distances between 7.2 and 7.6 mm), the probability for DS is proportional to the mb-db distance (Figure 1a).