Longitudinal occlusal changes from primary to permanent dentition in children with normal primary occlusion

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Abstract: This purpose of this research was to examine the stability of normal occlusion during the transition from primary to permanent dentition. The sample consisted of 128 children (83 boys and 45 girls) 4.5 to 5.5 years old with normal occlusion in the primary dentition. The subjects were reexamined at 12.5 to 13.5 years. None had received orthodontic treatment. Although all the subjects had normal occlusion in the primary dentition, 72.7% (73.5% boys and 71.1% girls) had developed anomalies following eruption of the permanent teeth. These anomalies included crowding, Class II Division 1 or Class II Division 2 malocclusion, mesial occlusion complex, lateral crossbite, anterior crossbite, premature tooth loss, openbite or other anomalies.

Key Words: Normal occlusion, Longitudinal study, Primary dentition, Permanent dentition

The dentition develops in important ways during childhood and adolescence. This development is characterized by phases of intense activity and periods of rest. The mixed dentition period is a time of unfinished growth and development, and deserves special attention. Features of the primary occlusion may improve or worsen as an individual moves from the primary to the permanent dentition. These features include mesiodistal crown diameter of unerupted teeth, relationship between crown size of permanent teeth and their predecessors, direction of tooth eruption as well as its sequence and timing, rhythm and direction of jaw development, development of the alveolar processes, and balance within the chewing musculature.

The purpose of this research was to determine which features of normal occlusion in the primary dentition remain stable and which change as the permanent dentition develops.

Materials and methods

The sample consisted of 128 individuals (83 boys and 45 girls). The subjects were examined initially between ages 4.5 and 5.5 years and were found to meet the criteria for normal occlusion in the primary dentition.[9] The subjects were reexamined at ages 12.5 to 13.5 years; none had received orthodontic treatment.

At the second examination, the following conditions were considered characteristics of malocclusion: crowding (discrepancy between existing dental arch space and crown size); Class II Division 1 or Class II Division 2 relationship; mesial occlusion complex (true mesial occlusion or Class III relationship); prenormal forced bite; crossbite of one or more anterior teeth; lateral crossbite; openbite; premature tooth loss; anomalies of space, shape, size or number; and deep overbite.

Statistical analyses

Sex differences were tested using the *t*-test to determine the proportion with statistical significance of $p<0.01$.

Results

Although all the subjects had normal occlusion in the primary dentition, 72.7% (73.5% boys and 71.1% girls) developed anomalies by the permanent dentition. These anomalies included crowding, Class II Division 1 or Class II Division 2 malocclusion, mesial occlusion complex, lateral crossbite, openbite, premature tooth loss, or other anomalies (Table 1). The anomalies that occurred most frequently were crowding (19.5%) and Class II Division 2 malocclusion (18%).

Throughout the mixed dentition period, 16.4% of subjects maintained the characteristics of normal occlusion but, because of dental caries and its consequences, at least one permanent tooth had to be extracted. From normal occlusion during the mixed dentition, Class II Division 1 and Class II Division 2 malocclusion and other anomalies developed more frequently in boys, while crowding, mesial occlusion, premature tooth loss, and openbite developed more frequently in girls. However, these sex differences were not statistically significant ($p>0.01$).

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Table 1
Anomalies of the permanent dentition found in subjects having normal occlusion during the primary dentition

Occlusion of permanent dentition developing from normal occlusion in primary dentition	Boys		Girls		Sex differences		Boys and girls	
	n	%	n	%	*t*	*p*	n	%
Normal occlusion	22	26.5	13	28.9	0.3	n.s	35	27.3
Malocclusion (1-8)	61	73.5	32	71.1	0.3	n.s	93	72.3
1. Crowding	13	15.7	12	26.7	1.4	n.s	25	19.5
2. Class II:1	6	7.2	2	4.4	0.7	n.s	8	6.3
3. Class II:2	19	22.9	4	8.9	2.2	n.s	23	18.0
4. Mesial occlusion complex	1	1.2	1	2.2	0.4	n.s	2	1.6
5. Lateral crossbite	2	2.4	2	4.4	0.6	n.s	4	3.1
6. Premature tooth loss	13	15.6	8	17.8	0.3	n.s	21	16.4
7. Open bite	-	-	1	2.2	-	n.s	1	0.8
8. Other anomalies	7	8.4	2	4.4	0.9	n.s	9	7.0

Boys n 83 = 100%, Girls n 45 = 100%
Boys and girls n 128 = 100% n.s. $p > 0.01$

Table 2
Stability of Class I from primary to permanent dentition

Stability of Class I from primary to permanent dentition	Boys		Girls		Sex differences		Boys and girls	
	n	%	n	%	*t*	*p*	n	%
Remained Class I	49	59.0	31	68.9	1.30	n.s	80	62.5
Changes of Class (1-2)	34	41.0	14	31.1	1.13	n.s	48	37.5
1. Class II	33	39.8	13	28.9	1.06	n.s	46	35.9
2. Class III	1	1.2	1	2.2	0.40	n.s	2	1.6

Boys n 83 = 100%, Girls n 45 = 100%
Boys and girls n 128 = 100% n.s. $p > 0.01$

According to the results shown in Table 2, 37.5% of the subjects who had Class I occlusion in the primary dentition developed Class II (35.9%) or Class III (1.6%) malocclusion in the permanent dentition. Stability of Class I occlusion from the primary to the permanent dentition was more common in girls, although sex differences were not statistically significant.

Discussion

During the mixed dentition phase, 72.7% of the subjects who had normal occlusion in the primary dentition developed malocclusion (most frequently crowding, then Class II Division 2 malocclusion, then premature tooth loss). Sex differences were not statistically significant.

Milicic et al.[5] reported similar results, namely that 76.3% of subjects who had normal occlusion in the primary dentition developed anomalies by the permanent dentition, most commonly crowding and Class II Division 2 malocclusion.

Henselove's results[2] refer to children from the primary dentition to the end of mixed dentition and show that 41.9% of the occlusions remained unchanged, 40.3% developed new dental anomalies, and 17.7% improved or corrected their orthodontic anomalies.

The increase in orthodontic anomalies during the mixed dentition stage has been established by Rehagel[7] (16.3% increase, from 65.8% to 82.1%), Keep[3] (11.6% increase, from 47.2% to 58.8%), Legovic[4] (8.3% increase, from 41.2% to 49.5%), and others.[1,6,8]

During the mixed dentition, 37.5% of Class I subjects develop Class II (35.9%) or Class III (1.6%) malocclusion.

Valentini,[10] tracking the development of dentition in 103 subjects from 5 to 16 years, found a 5% decrease in the frequency of Class I occlusion, a 4% increase in Class II malocclusion and a 1% increase in Class III.

In longitudinal studies, two groups of authors[11,12] analyzed the changes in molar relationship between the deciduous and permanent dentition. Ayra et al.[11] pointed out that the initial occlusion of the first permanent molar was dependent on the deciduous terminal plane relationships; in almost half the sides studied, the first permanent molars erupted in cusp-to-cusp initial occlusion and most of the first permanent molars that erupted in distal or normal occlusion did not change their occlusion. When the first permanent molars erupted in cusp-to-cusp initial occlusion, Class I occlusion developed in the permanent dentition in 70% of the cases and

the remainder became Class II.

Bishara et al.[12] used step-wise regression analysis to substantiate the variables of primary dentition that can be employed to predict changes in molar relationship. For males, that included the following independent variables: maxillary molar width, SWPog, Wits appraisal, 1:1, maxillary arch length, and the ratio N-Ans'/N-Me; and for females: mandibular deciduous tooth size, SWA, Ar'-Go, ratio of S-Go/N-Me, and the difference between maxillary and mandibular leeway spaces.

Conclusions

The changes in orthodontic findings from the primary to the permanent dentition pinpoint the need for longitudinal tracking of all examinees. Only in this way can the early symptoms of some anomalies be corrected. Under these circumstances, treatment effects can be augmented by the effects of growth.

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