Changes In Untreated Class II Type Malocclusions

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This study is concerned with a comparison of dental development in children with Class II type malocclusions who did not undergo orthodontic treatment with normative data reported by Moorrees[1]. Moreover, differences in dental development are determined between four subgroups into which the sample of Class II type malocclusions has been divided.

MATERIAL AND METHODS

Serial dental casts of 51 children were selected from a total of 405 children studied in a longitudinal survey conducted at the Forsyth Dental Infirmary by Dr. Edward I. Silver[2] and Dr. Henry C. Beebe.

Care was taken to exclude dentitions with pseudo Class II malocclusion that, according to Angle, actually belong to the Class I group when the drifting of the permanent maxillary first molars from neutro into distoclusion is taken into consideration. To ensure proper classification, the canine relationship was always carefully examined. A few mutilated dentitions have been studied because of their typical and undisputed Class II configuration, but measurements pertaining to the affected arches were not used for the statistical analysis.

This material is not completely satisfactory for a longitudinal growth analysis because of the small (51) sample size, the variations in the time interval between the first and last dental casts, and the differences in the total number of casts for each child studied. In general, the period of observation included the transition from the deciduous to the permanent dentition.

Repeated critical screening of the material resulted in the gradual emergence of a spectrum that could be divided into four subgroups conforming essentially to Angle's two divisions of the Class II category (Fig. 1). Classification in these subgroups was based on the last dental cast in each individual series. The subgroups are described as follows:

1. Class II, Division 2 (sample size 13): characterized by the typical lingual inclination of the permanent maxillary central incisors and flaring of the lateral incisors, broad maxillary dental arch and deep overbite.
2. Class II, borderline between Division 2 and Division 1 (sample size 10): characterized by an upright position and good alignment of the maxillary incisors and ellipsoid maxillary dental arch. The remaining two groups split from the "borderline" category like the two arms of the letter *Y*.
3. Class II, Division 1 *V*-shaped (sample size 8): characterized by an overjet and severe crowding of the permanent maxillary incisors as well as *V*-shaped maxillary dental arch.
4. Class II, Division 1 flaring and spacing (sample size 20): characterized by flaring and spacing of the permanent maxillary incisors, marked overjet and parabolic maxillary arch shape.

For this study quantitative observations were made of arch length, the

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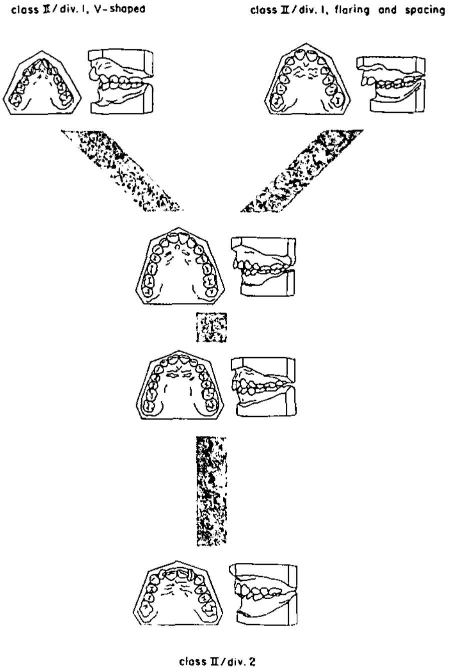

Fig. 1. Classification of Class II type malocclusions into four subgroups.

intercanine and intermolar distances, overjet, overbite, and the dental arch relations in the sagittal plane. The shape of the dental arch was evaluated qualitatively.

Measurements were obtained with a sliding caliper equipped with a vernier scale permitting readings to 0.1 mm. All measurements were made independently by two investigators and, in most instances, the findings coincided. When a variation of more than one-tenth of a millimeter occurred, the measurement was rechecked and it turned out invariably that a gross error was responsible for the aberrant entry.

Since the findings are compared with the normative data of Moorrees[1], the same methods of measurement have been used. Their definitions will be reviewed briefly (Fig. 2) and the reader is referred to the original report for more detailed information.

Dental Arch Length

The distance between a line tangent to the labial surface of the central incisors and a line connecting the most dorsal points on the distal surface of the deciduous second molars or the second premolars. In the case of crowding of the incisors, the midvalue of the two possible measurements was used. The distance from the labial surface of the central incisors to the line connecting the cusp tips of the canines was obtained also as a measure of the anterior arch length. Posterior arch length was determined by subtracting anterior arch length from the total length.

Arch Breadth

The distance between the cusp tips of the canines and that between the mesiolingual cusps of the permanent first molars. When the cusp tips were worn, the centers of the facets were used as landmarks. These points could be located accurately with a pointed pencil. Care was taken to use the same landmarks throughout each series.

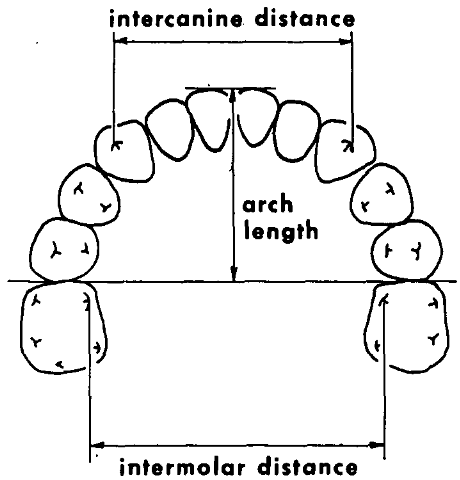

Fig. 2. Method of measuring arch length as well as the intercanine and the intermolar distances.

Overjet

The distance from the incisal edge of the maxillary central incisors to the labial crown surface of the mandibular central incisors, holding the caliper parallel to the occlusal surfaces of the deciduous molars or the permanent molars and premolars with the teeth in occlusion. The midvalue of several possible measurements was taken when crowding of the incisors was encountered.

Overbite, or Depth of Bite

The overlapping of the labial surfaces of the mandibular central incisors by the maxillary incisors. This measurement was obtained by holding the occluded maxillary and mandibular dental casts firmly together. To study relative changes, the degree of overbite was expressed as a percentage of the crown height of the mandibular central incisors.

Sagittal Molar Occlusion

The relation of the dental arches in the sagittal plane was studied in terms of a half or full cusp distal or mesial deviation from neutroclusion following Angle's classification. In order to standardize the determination of the sagittal relationship, the dental casts were examined by holding the median plane of the palate perpendicular to the axis of vision.

Arch Shape

The shape of the dental arches was subjectively classified in five different categories — semicircular, parabolic, hyperbolic, trapezoid, and *V*-shaped.

The findings are presented in terms of standard scores for each individual measurement computed with reference to the norms for each sex by Moorrees[1]. Mean standard scores were also computed for the data of each individual and for the data of all individuals in each of the four groups at different chronological ages. The use of standard scores is particularly suitable for the analysis of these data because it affords a method for combining the findings of males and females. The small sample size in each subgroup precluded sex differentiation in the dental development of these maloccluded children. The formula used for computation of standard scores is as follows:

$$\text{Standard score} = \frac{\text{measurement - mean}}{\text{standard deviation}}$$

The actual age at which the impressions for the dental casts were taken was transformed to the nearest half or full birth year. Fisher's "*t*" test was used to determine the level of statistical significance when comparing differences between the findings of the four groups.

FINDINGS

The absolute dental arch lengths and arch breadths of these children with Class II malocclusions do not differ appreciably from the normative data because the greatest percentage of standard score values are within the two standard deviation limits[3]. However, differences between the four subgroups can be demonstrated when the sign of these mean standard score values is taken into consideration (Fig. 3).

The equal distribution of positive and negative standard scores for maxillary arch length in the *V*-shaped and "borderline" groups is in contrast to the highly statistically significant difference ($p < 0.001$) between the mean standard score values of the Division 2 and the flaring and spacing group. As expected, the arch length is short in the Division 2 group, all standard scores having a negative sign, and larger than average (85 per cent) in the flaring and spacing group. The *V*-shaped and borderline groups have an intermediate status in this respect differing significantly in statistical sense ($p < 0.05$) from the other two groups.

The maxillary intercanine distances of the borderline and the Division 2 group exceed those of both Division 1 groups as shown by the distribution of positive and negative standard scores in Figure 3, the differences being statistically significant ($p < 0.05$ and < 0.03, respectively). For the maxillary intermolar distance, statistical significance ($p < 0.02$) is reached only for the difference between the Division 2 and the flaring and spacing groups.

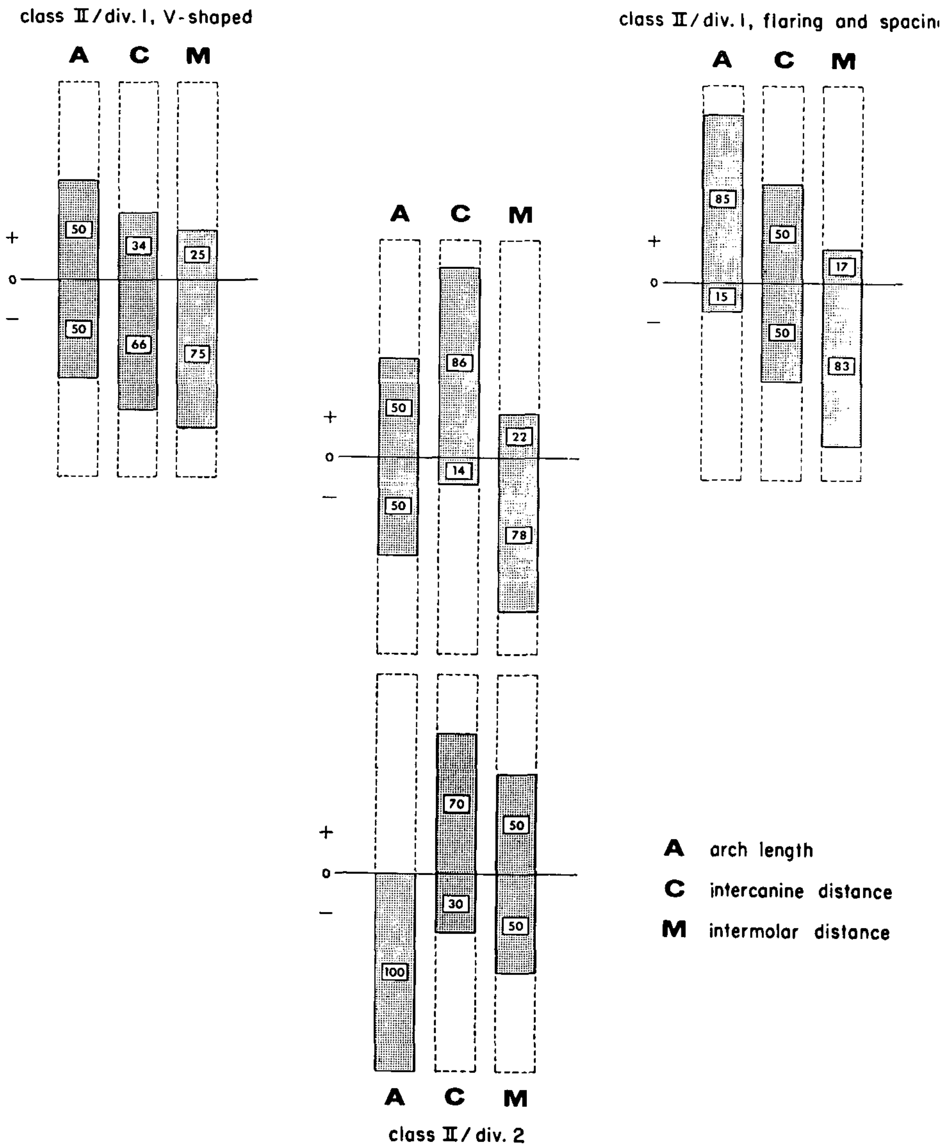

Fig. 3. Percentage frequencies of positive and negative individual mean standard scores values for arch length, the intercanine and intermolar distances in children with Class II type malocclusions.

No specific trends characterize the dimensions of the mandibular dental arch other than a statistically significant shorter arch length of the Division 2 group compared with the borderline group ($p < 0.02$).

The mean standard scores obtained, for children with observations at the ages of six and twelve years (Table I), confirm the findings described above, all deviations being even smaller or less than one standard score at these two age levels, except for maxillary arch length of the Division 2 group at age six and of the flaring and spacing group, as well as of the mandibular intercanine distance in the borderline group at twelve years that just exceed the one standard score level.

The data contained in Table I also provide a measure of assessing the developmental pattern of this sample of Class II malocclusions in terms of the norm. For the Division 2 group, the greatest deviation is found at six years of age, the arch being relatively shorter than at twelve years, while the longer than average arch length in the flaring and spacing group continues to deviate or enlarge with age. Although statistical significance could not be demonstrated, it is probably justified to conclude that the increments in the maxillary and mandibular arch lengths in these children with untreated Class II malocclusions tend to be greater between six and twelve years than those of children with normal dentitions.

The increments in the maxillary and mandibular arch breadths, obtained as intercanine and intermolar distances, conform to the normative pattern inasmuch as the mean standard score values at six and twelve years do not differ in a statistically significant manner.

Arch Shape

After the emergence of the permanent maxillary incisors, three distinct maxillary dental arch shapes (trapezoid, parabolic, and *V*-shaped) develop from a semicircular arch that occurs in the majority (64 to 100 per cent) of the deciduous dentitions. The shape of the mandibular dental arch is very similar in the four categories of Class II type malocclusions.

This change in maxillary arch shape can be explained by the differences of the anterior arch length in the deciduous dentition, between five and six years of age, and in the permanent dentition, between twelve and thirteen years of age, when the premolars and canines have erupted. The mean posterior arch lengths in the deciduous and permanent dentitions of four groups are similar, ranging from 19.2 to 19.9 mm and from 18.7 to 19.9 mm, respectively (Table II).

The mean anterior arch length in the deciduous dentition varies from 6.8 to 9.2 mm. The Division 2 and the *V*-shaped group correspond in this dimension (6.8 mm), whereas the borderline group and the flaring and spacing group are characterized by a large anterior arch length in the deciduous dentition (8.3 mm and 9.2 mm, respectively).

In the permanent dentition the mean anterior arch length of the Division 2 (6.0 mm) and of the flaring and spacing group (12.6 mm) differ markedly from each other. The borderline and the *V*-shaped group assume intermediate values within this range, namely 10.9 mm and 10.6 mm (Table II).

Thus, in contrast to the stability of the posterior arch length, the anterior arch length increases markedly during the transitional period (+3.8 mm in the *V*-shaped group, +3.4 mm in the flaring and spacing group and +2.6 in the borderline group) except for the Division 2 group (—0.8 mm). These findings are derived from mixed longitudinal and cross-sectional analysis and therefore only indicate probable de-

TABLE I

Mean standard scores of dental arch measurements in children with Class II malocclusions at 6 and 12 years of age.

Measurement	Age (Yrs.)	Division 2 (6 Individuals) Mean Standard Score	Division 2 (6 Individuals) Standard Deviation	Borderline (7 Individuals) Mean Standard Score	Borderline (7 Individuals) Standard Deviation	*V*-shaped (6 Individuals) Mean Standard Score	*V*-shaped (6 Individuals) Standard Deviation	Flaring and Spacing (6 Individuals) Mean Standard Score	Flaring and Spacing (6 Individuals) Standard Deviation
					Maxilla				
Arch length	6	—1.55	0.45	—0.42	0.94	—0.66	1.85	+0.48	0.29
	12	—0.69	0.35	+0.55	0.65	+0.48	0.60	+1.06	0.32
Intercanine distance	6	—0.66	0.51	—0.22	0.72	—0.21	0.54	—0.86	0.91
	12	+0.24	0.38	+0.39	0.59	—0.43	0.22	—1.17	1.06
Intermolar distance	6	+0.71	1.21	—0.14	0.87	—0.49	1.05	—0.51	0.80
	12	+0.45	1.01	—0.72	1.05	—0.55	0.97	—0.65	0.94
					Mandible				
Arch length	6	—0.84	0.71	—0.01	1.41	—0.51	0.41	—0.51	1.58
	12	—0.29	0.16	+0.85	1.67	—0.05	0.86	+0.67	1.70
Intercanine distance	6	—0.44	0.76	+0.74	1.54	+0.20	1.01	+0.12	1.13
	12	+0.57	1.69	+1.21	1.64	+0.12	1.05	+0.10	1.91
Intermolar distance	6	+0.17	0.48	*—0.09	0.48	*—0.24	0.58	—0.53	1.59
	12	—0.21	0.67	*—0.20	0.74	—0.19	0.57	—0.57	1.05

*Only five individuals studied for intermolar distance in the borderline and *V*-shaped groups.

TABLE II

Anterior and posterior arch lengths in children with Class II malocclusions at 6 and 12 years of age.

Group	Anterior Arch Length Mean (mm)	Anterior Arch Length Standard Deviation (mm)	Anterior Arch Length Number of Individuals	Difference Between Total Arch Length and Anterior Arch Length Mean (mm)	Difference Standard Deviation (mm)	Difference Number of Individuals
	Deciduous Dentition at 5 and 6 Years of Age					
Division 2	6.8	1.06	4	19.2	0.99	4
Borderline	8.3	1.18	7	19.7	1.65	7
V-shaped	6.8	0.73	4	19.7	0.76	4
Flaring and spacing	9.2	1.00	14	19.9	1.91	14
	Permanent Dentition at 12 and 13 Years of Age					
Division 2	6.0	1.69	9	19.9	1.84	9
Borderline	10.9	1.93	6	19.4	1.97	6
V-shaped	10.6	1.33	5	18.7	1.27	5
Flaring and spacing	12.6	2.30	8	19.8	1.06	8

velopmental trends.

A dental arch index (breadth/length x 100) has not been computed because its descriptive value is questionable according to Moorrees[4] who observed in his study of the Aleut dentition that two dissimilar maxillary dental arches, one hyperbolic and one parabolic, had the same index of 144.

The shape of the *dental* arch is not necessarily related to the basic arch shape and it is possible that the five different types of dental arch shape distinguished in this study share a common arch form at the apical base.

Individual Dental Arch Development

For arch length two longitudinal records have been selected for review. In a girl (No. 34, Class II, borderline between Division 2 and 1, age range: 3-12 years) maxillary arch length decreases between three and five and one half years of age at a rapid rate (—1.1 to —1.9 st. sc.) in the first year and subsequently at a decreased rate (Fig. 4). Between five and one half and eleven years there is a marked increase in arch length (from —1.8 to +0.3 st. sc.) that is followed by a slight decrease resulting from the exfoliation of the deciduous molars. Statistically, arch length reaches the mean at ten years of age

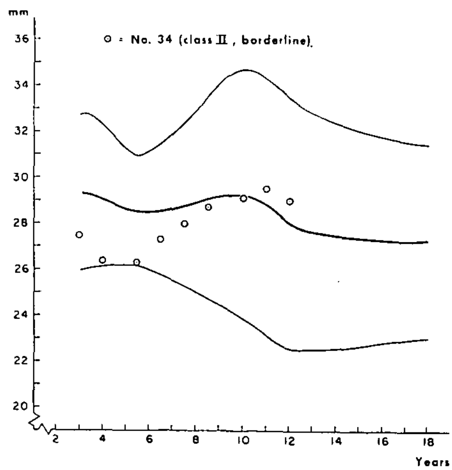

Fig. 4. Longitudinal record of arch length in the maxillary dentition of a girl having untreated Class II malocclusion with reference to normative data of Moorrees (mean ± 2 S. D.) in females.

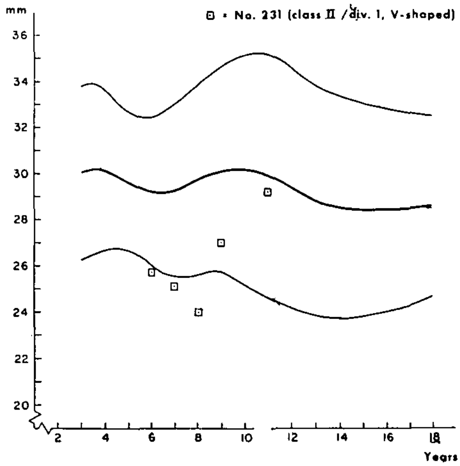

Fig. 5. Longitudinal record of arch length in the maxillary dentition of a boy having untreated Class II malocclusion with reference to normative data of Moorrees (mean ± 2 S. D.) in males.

and at twelve years of age it has a value of +0.4 standard scores because the peak of the growth curve of this individual occurs one year later than for the norm.

In a boy (No. 231, Class II, Division 1, *V*-shaped, age range: 6-11.5 years) the maxillary arch length decreases markedly between six and eight years of age (Fig. 5). This decrease is shown statistically by an increase in the negative values of the standard scores, particularly between seven and eight years (from —2.3 to —2.8 st. sc.) After the eruption of the maxillary central incisors at eight years, arch length increases markedly and it approaches the mean due to the protrusive axial inclination of the permanent incisors.

The maxillary and mandibular intercanine distances of two individuals are presented to demonstrate variations in the increments of arch breadth. The maxillary intercanine distance of a girl (No. 140, Class II, Division 2, age range: 8-15) does not deviate greatly from the norm at age eight (Fig. 6). In absolute size a steady increase is noted between eight and eleven and a half years. After the eruption of the permanent canines the intercanine distance decreases slightly.

The mandibular intercanine distance is smaller at fifteen than at eight years of age (Fig. 7). The period between eight and eleven and a half years is characterized by marked fluctuations owing to distal tilting of the left canine following premature loss of the deciduous first molar at eight years. The upright position of this tooth is regained after the eruption of the premolars.

In another longitudinal record, also of a girl (No. 178, Class II, Division 2, age range: 7.5-15), the late eruption of the maxillary canines is preceded by a marked increase in the intercanine distance conforming to the second and third growth phases described by Moorrees[1]. This increase is exaggerated by the labioversion of the canines resulting from crowding in the incisor segment.

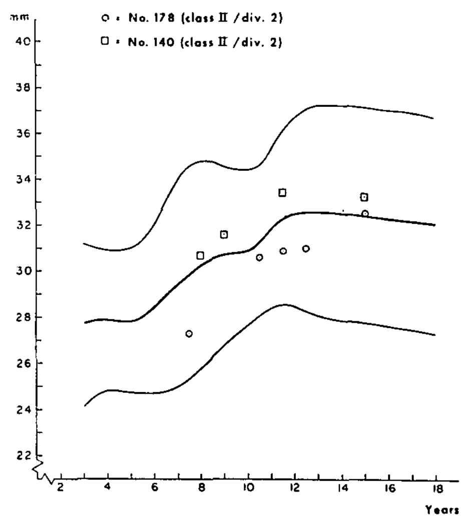

Fig. 6. Longitudinal records of the intercanine distances in the maxillary dentitions of two girls having untreated Class II, Division 2 malocclusions with reference to normative data of Moorrees (mean ± 2 S. D.) in females.

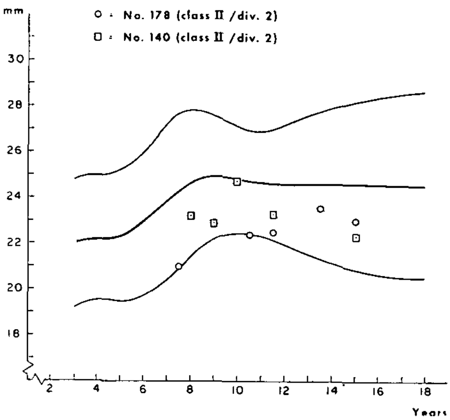

Fig. 7. Longitudinal records of the intercanine distances in the mandibular dentitions of two girls having untreated Class II, Division 2 malocclusions with reference to normative data of Moorrees (mean ± 2 S. D.). The maxillary intercanine distance of these girls is shown in Figure 6.

The maxillary intercanine distance improves statistically (from —1.1 to approximately 0 st. sc., Fig. 6).

The mandibular intercanine distance of this girl varies between —1.9 and —0.9 standard scores at 7.5 and 15 years of age, respectively. Two growth spurts, one between 7.5 and 10.5 and the other between 11.5 and 13.5 years of age, precede the emergence of the permanent canines. Subsequently, the intercanine distance decreases slightly (Fig. 7).

The individual records presented have been chosen to reveal the combined influence of internal factors (growth) and external factors (dental caries and malpositions of teeth) on dental development. The influence of these factors on dental development must be evaluated in each instance, and it must be borne in mind that the normative data are obtained exclusively from dentitions with excellent anatomical position of the teeth.

Overjet and Overbite

From the serial data increments in overjet and overbite were determined between six and twelve years, as well as between nine and twelve years. The age of nine years was chosen arbitrarily on the assumption that the maxillary and mandibular permanent incisors are more or less completely erupted at that age. The Class II, Division 2 malocclusions were not studied for overjet since the mandibular incisors are always in contact with the lingual surfaces of the maxillary ones.

The mean overjet in the two Division 1 groups increases markedly (48 per cent) between six and twelve years of age. This increment occurs mainly before the eruption of the permanent incisors in the flaring and spacing group, while it is seemingly continuous in the *V*-shaped group[3].

TABLE III

Overbite calculated as a percentage of the clinical crown height of the left mandibular incisors in children with Class II malocclusions at 6 and 12 years of age.

Group	Number of Individuals	Age Level 6 Years Mean	6 Years Standard Deviation	12 Years Mean	12 Years Standard Deviation	Change Mean	Change Standard Deviation
		(Percent)	(Percent)	(Percent)	(Percent)	(Percent)	(Percent)
Division 2	6	84.00	11.94	103.50	13.56	+19.5	6.82
Division 1*	11	48.81	31.59	63.09	13.97	+14.27	25.96

*Borderline group excluded

Changes in overbite are slight to moderate (14 to 20 per cent) for the Division 2 and the two combined Division 1 groups (Table III). Following the emergence of the permanent central incisors (> 9 years) the overbite deepens slightly (2, 8 or 12 per cent) and markedly (21 per cent) in the borderline group owing to the fact that three out of seven individuals in this group had an open bite at age nine that closed in the next three years[3].

Thus, overbite and especially overjet increase in untreated Class II malocclusions, but a wide range of individual variations exist as expressed by the magnitudes of the standard deviations[3].

It must be remembered in interpreting these findings that the position of the incisors is influenced by the loss of other teeth and the pressure exerted by fingers, tongue and lips. Since mutilated dentitions are excluded for evaluation of the data, at least one of these environmental factors is eliminated. For the assessment of other factors no adequate records are available.

At twelve years of age, overjet ranges, in the majority of instances, from 6 to 10 mm and overbite from one to two-thirds of the crown height of the mandibular incisors, except in the Division 2 group where it always exceeds the two-thirds level.

Sagittal Molar and Canine Relationship

With the exception of a slight improvement in two individuals out of eighteen belonging to the Class II, Division 1 group, children in the Division 2 and 1 categories show no improvement in their canine relationship. In ninety per cent of all the individuals of the Class II, Division 2 group, the canine relationship became progressively worse during the observation period probably due to the severely increasing crowding in that area with age (i.e. from 6 to 12 years of age, Table IV). Self-correction of the sagittal molar and canine relations from full distoclusion in the deciduous dentition to neutroclusion occurs in one individual of the borderline group, and it is accompanied by an improvement of the sagittal and vertical incisor relationship. This improvement is explained by the marked increase of the mandibular arch length between 5.5 (+0.2 st. sc.) and 14.5 (+2.2 st. sc.) years of age that has not resulted in a procumbency of the mandibular incisors.

Generally, the sagittal relation of the dental arches as determined by the molar and canine relationships following Angle's classification does not improve with age in children with untreated Class II malocclusion, and it either remains the same or distoclusion is intensified: It is therefore of no advantage to postpone therapeutic measures once the distoclusion is observed.

Identification of the Four Subgroups At an Early Age

The classification of the fifty-one individuals with Class II type malocclusions in the four subgroups was based on the last dental cast in each individual series and it was determined by the position and alignment of the maxillary incisors and the maxillary arch shape. The question arises if these four subgroups can be distinguished from each other at an early age.

In general, most of the individuals examined at five to six years of age reveal a semicircular maxillary arch shape, upright or retrusive positions of the maxillary incisors, and various amounts of interdental space in the anterior segment regardless of their classification into four distinct groups at a later age. These observations are confirmed by the findings concerning the anterior arch length in the deciduous dentition (Table II), inasmuch as the Division 2 and the Division 1 *V*-shaped group correspond in their maxillary mean anterior arch length (6.8 mm).

TABLE IV

Percentage frequency of changes in the sagittal molar and canine relationships.

Group	Symptom	Molar Relationship (10 Individuals)	Canine Relationship (10 Individuals)
Division 2	Aggravation of distoclusion	30%	90%
	No Change	70%	10%
		Molar Relationship (12 Individuals)	Canine Relationship (18 Individuals)
Division 1 (*V*-shaped and flaring and spacing)	Aggravation of distoclusion	66%	61%
	No Change	34%	28%
	Improvement of distoclusion	—	11%
		Molar Relationship (6 Individuals)	Canine Relationship (8 Individuals)
Borderline	Aggravation of distoclusion	33%	38%
	No Change	50%	50%
	Improvement of distoclusion	17%	12%

Two out of seven individuals of the borderline group and four out of fourteen individuals of the flaring and spacing group have a parabolic maxillary arch shape accompanied by a protrusive position, of various degrees, of the deciduous maxillary incisors. Consequently, the maxillary anterior arch length of the deciduous dentition of these two groups (8.3 and 9.2 mm, respectively) is larger than that of the Division 2 and *V*-shaped groups. On the basis of anterior arch length it is possible to predict that these individuals will belong to the Division 1 group at a later age, and probably in either the borderline or flaring and spacing group.

On the average, an individual belonging to the Class II, Division 2 group has a definitely greater overbite than an individual belonging to one of the Class II, Division 1 groups. However, because of the great variation of overbite in the Division 1 group, the prediction whether an individual will turn out to belong to the Division 2 or Division 1 group is not a very reliable method if based solely on overbite.

In general, it is very difficult to distinguish between the four subgroups at an early age. They seem to have a rather similar morphologic pattern in the deciduous dentition (semicircular maxillary arch shape, retrusive positions of the maxillary deciduous incisors, and spacing of the anterior segment) that is common to most of the individuals at an early age. The four groups can be differentiated only after the eruption of the maxillary permanent incisors.

Measuring arch length and breadth, computing standard score values, and comparing the findings with the tabulation of the mean standard scores obtained at the age of six may offer possible clues in an attempt to classify the Class II malocclusion of a child in one of the four subgroups suggested in this report.

Summary and Conclusions

Measurements of serial dental casts of fifty-one individuals with untreated Class II malocclusions are compared with normative data. The material has been divided into four subgroups conforming essentially to Angle's two divisions of the Class II category. The following conclusions are obtained:

1. The absolute dental arch length and arch breadth of these children with Class II malocclusions do not differ appreciably from the normative data because the greatest percentage of standard score values are within the two standard deviation limits.
2. Differences between the maxillary arch dimensions of the four subgroups are revealed when the sign of the mean standard score values is taken into consideration.
3. No specific trends characterize the dimensions of the mandibular dental arch in these children with Class II malocclusions.
4. The increments in the maxillary and mandibular arch lengths in children with untreated Class II malocclusions between six and twelve years tend to be greater than those of children with normal dentition.
5. The increments in the maxillary and mandibular arch breadths between six and twelve years conform to the normative pattern.
6. The four subgroups are difficult to distinguish at an early age. They seem to have a similar morphologic pattern in the deciduous dentition (semicircular arch shape, retrusive positions of the maxillary incisors, and spacing of the anterior segment).
7. The four subgroups can be differentiated only after the eruption of the permanent maxillary incisors.
8. In the maxilla, the canines separate the more variable anterior segment from the more stable posterior segment.
9. Both overbite and especially overjet increase in untreated Class II malocclusions.
10. Generally, the sagittal relation of the dental arches, as determined by the molar and canine relationships following Angle's classification, does not improve with age in children with untreated Class II malocclusions and either remains the same or the distoclusion is intensified.
11. Since the malrelation of the dental arches increases, as determined by overjet and by the canine and molar relationships, it is of no advantage to postpone therapeutic measures once the distoclusion is observed.
12. A wide range of individual variations exists as expressed by the magnitudes of the standard deviations of the features studied and by the presentation of four individual records.

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Bibliography

1. Moorrees, C. F. A.: The Dentition of the Growing Child — A Longitudinal Study of Dental Development Between 3 and 18 Years of Age. *Harvard University Press*, Cambridge, Mass. (1959)
2. Silver, E. I.: Forsyth Orthodontic Survey of Untreated Cases. *Am. J. Ortho. and Oral Surg.*, 30: (1944)
3. Fröhlich, F. J., (1962): A Longitudinal Study of Untreated Class II Type Malocclusions. Report of the 37th Congress of the European Orthodontic Society, (*in press*).
4. Moorrees, C. F. A.: The Aleut Denti-

tion — A Correlative Study of Dental Characteristics in an Eskimoid People. *Harvard University Press*, Cambridge, Mass. (1957)

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