The Eruption Of The Lower Incisor And The Accompanying Development Of The Symphysis And Point B

JOHN DUANE JONES, B.A., D.D.S.
San Francisco, California

Serial studies by Björk[1] using pin implants in the mandible have demonstrated the active sites of differential growth of the jaw. In these studies it was demonstrated that the area of pogonion is relatively stable after the approximate age of 6 to 7 years. Accordingly, the development of the chin and cephalometric point B must be explained by some other mechanism.

It is commonly believed that the so-called mesial component of force always tends to carry the teeth forward to maintain interdental contact. Wylie and Foster[2] have shown evidence suggesting that the lower incisor tends to tip backward in the final stages of the mixed dentition concomitantly with the development of point B (the juncture between alveolar and so-called basal bone at the anterior aspect of the mandibular symphysis).

In this study I will try to evaluate the developmental relation of the chin point and lower incisor.

MATERIALS AND METHODS

Serial headfilms taken at ages 6, 8, 10 and 15 years on twenty-two sets of identical twins were traced and evaluated to follow the development of the symphyseal area of the mandible and the eruption of the lower incisor.* Some twin sets did not have a complete series of films due to their being older than six years of age when the study was initiated. Cephalometric records were incomplete in other instances where children dropped from the study.

Mandibular superimpositions were made using the lower anterior border of the mandible as the reference. Templates were made of the lower incisor of each child from the headfilm that most clearly exhibited the tooth, and an arbitrary long axis was drawn on the template.

In each case the mandible was traced completely including the symphysis and lower border. The lower incisor was included by superimposing the template on the coronal portion of the incisor in the x-ray, and transferring this and the arbitrary long axis to the mandibular tracing.

A line representing the mandibular plane was drawn on each of the tracings connecting the inferior border of the symphysis and the posterior inferior border of the mandible, as in Figure 1. Björk has shown that remodeling of the anterior one-third of the lower border of the mandible is minimal, thus rendering the line representing mandibular plane relatively stable.

A line tangent to the mandible at the chin point was drawn at right angles to the line representing mandibular plane.

Point B development was followed by measuring the distance from the point on the anterior aspect of the

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* The headfilms used were part of a twin-study of Dr. J. Rodney Mathews, Department of Orthodontics, University of California Dental School.

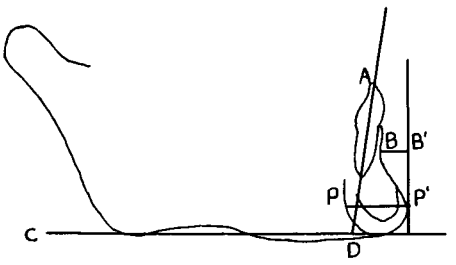

Fig. 1 Changes in positions of the most anterior incisor, changes in thickness of the symphysis, and the development of point B were measured on the tracings of the serial cephalometric roentgenograms as follows: angulation that the incisor makes with the mandibular plane, angle ADC; horizontal development of point B, B-B'; width of symphysis, P-P'.

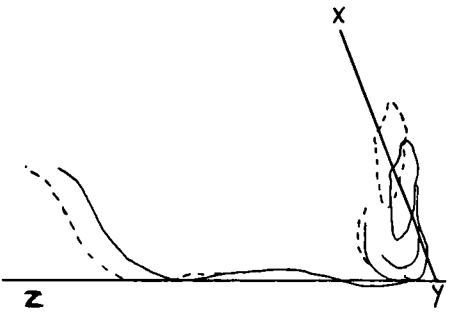

Fig. 2 The overall path of eruption of the lower incisor was plotted by superimposing tracings at ages 6 and 15 years and connecting the centers of the long axes of the teeth. The angulation that the line representing the path of eruption makes with the mandibular plane was represented by angle XYZ.

mandible that was farthest horizontally from the line tangent to chin point, just described.

Changes in the thickness of the symphysis were followed by measuring the greatest anteroposterior diameter at the various ages described.

The chronological angular variations that the long axis of the lower central incisor makes with mandibular plane were measured.

The path of eruption of the lower incisor was plotted relative to the mandibular plane. This was done by superimposing tracings at ages 6 and 15 years. A line connecting the centers of the long axes of the teeth would then represent the path of eruption of the lower incisor and intersect the mandibular plane producing an angular measurement, as in Figure 2.

TABLE I

Numbers of cases exhibiting labial or lingual tipping of the lower incisor for selected age groups for both boys and girls.

	6 Through 7 Years	8 Through 9 Years	10 to 15 Years
Tipped Labially	25	16	7
Tipped Lingually	1	9	19

Results

1. Results relative to the angular variations with age that the long axis of the lower central incisor makes with the mandibular plane were recorded in Table I. There was indeterminate error involved in making the tracings, making the measurements, distortions in the x-rays, error due to any remodeling of the mandible, and any errors in making superimpositions.

The results indicate that the lower incisor, as it erupts between the ages of 6 to 8 years, tends to tip labially. From 8 through 9 years of age, the incisor still is tipping labially as it erupts, although 36 per cent of the subjects exhibit lingual tipping at this point. The incisor tends to tip lingually in the 10 to 15 year old range.

The Chi Square test was used in the analysis of the data and proved the results observed for the 6 through 7 year range to be significant at the .001 level. It could be stated, using this information, that this result or distribution could be expected routinely 999 times in 1,000. For children 8 through 9 years of age, the distribution would occur by chance 10 to 20 times in a hundred. The results in the 10 to 15 year range

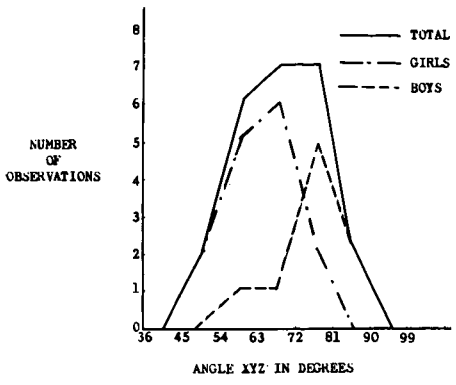

Fig. 3 This frequency polygon relates the number of observations with the angle that the overall path of eruption of the lower incisor makes with the mandibular plane (angle XYZ in Fig. 2).

are significant at the .01 to .001 level meaning that these results could be expected by chance only once in a hundred to once in a thousand. The overall change noted as the children progressed from age 6 to 15 was highly significant at the .001 level.

2. Results relative to the direction of eruption of the lower incisor were tabulated using the frequency polygon represented in Figure 3.

The mean of the total observations was 75.8 degrees in a lingual direction to the mandibular plane, while observations ranged from 55 degrees to 90 degrees. The calculated mean for boys was 82.8 degrees; that for girls was 71 degrees. The ranges were 69 to 90 degrees and 55 to 82 degrees respectively. However, it was found that, in the case of boys, the incisor erupted 16 mm in a vertical direction on the average as compared with 7 mm in the case of girls. The ranges were 7 to 24 mm and 0 to 16 mm, respectively. This would account for the steeper eruption pattern noted in the above frequency polygon.

TABLE II

Numbers of cases with increased point B development or no development for selected age groups for both boys and girls.

	6 Through 7 Years	8 Through 9 Years	10 to 15 Years
Increase	22	21	25
No Change	6	8	2

3. The development of point B was observed to proceed smoothly from 6 to 10 years of age. However, an increase in the amount of point B development was noted between the ages of 10 to 15 years. This happens concomitantly with the lingual tipping of the lower incisors noted during this time period. The results are recorded in Table II.

The Chi Square test was applied to the data and showed the results to be highly significant. The data in the 6 through 7 and 8 through 9 year ranges were significant at the .01 to .001 level and for the 10 to 15 year range significant at the .001 level.

The only differences noted concerning sex as related to point B development were quantitative and not qualitative (Table III). Boys were observed to develop point B to a greater degree than girls during the 10 to 15 year age range.

4. The symphysis was observed to increase most in thickness during the

TABLE III

Range and average increase of point B development for selected age groups.

	Range of Increase		Average Increase		Total Ave.
	Boys	Girls	Boys	Girls	Increase
6 Through 7 Years	0-3 mm	0-2 mm	1.2 mm	1.2 mm	1.2 mm
8 Through 9 Years	0-2 mm	0-2 mm	.8 mm	.7 mm	.8 mm
10 to 15 Years	0-5 mm	1-3 mm	2.8 mm	2.0 mm	2.3 mm

TABLE IV

Numbers of cases with increases in thickness of the symphysis and no increase for selected age groups for both boys and girls.

	6 Through 7 Years	8 Through 9 Years	10 to 15 Years
Increase	18	13	22
No Change	10	16	5

time period from 10 to 15 years and 6 through 7 years (Table IV).

The Chi Square test was again applied to the data and showed the results to be highly significant in the 10 to 15 year age range. The data in the 6 through 7 year range and 8 through 9 year range were not significant at the .05 level. The data in the 10 to 15 year range, however, were significant to the .01 to .001 level.

Again, the only differences noted as related to sex were quantitative and not qualitative. These results are tabulated in Table V.

Boys were observed to increase symphysis to a greater degree than girls during the 6 through 7 and 10 to 15 year age range.

5. An effort was made to correlate cases that didn't tip lingually during the final stages of the mixed dentition with crowding of the teeth in the anterior region. This was done on the supposition that if the lower anterior teeth were crowded, it would impede or prevent the lingual tipping. In doing this, a case was considered to be crowded if any contact was broken producing rotation and labial and lingual displacements of teeth. It was found that of the cases thus described to be crowded, twenty-two did not tip lingually during the final stages of mixed dentition whereas five did. When the Chi Square test was applied to this data, it was found to be highly significant at the .01 to .001 level.

6. The twins within a set were observed to vary quite often as to when certain developments took place chronologically. The final growth achieved by the twins in a set was usually quite similar, however.

Summary and Conclusions

1. In the age range of 6 through 7 years, the symphysis, or the base upon which the alveolus is situated, is undergoing a "growth spurt" and increasing its anteroposterior dimension with boys tending to have more increase than girls. The incisor, as it erupts in a lingual direction relative to the lower border of the mandible, tips labially. Point B is undergoing a developmental spurt during this time also.

2. In the age range of 8 through 9 years the symphyseal increase diminishes in rate. The lower incisor, while still erupting in a lingual direction relative to the lower border of the mandible, is usually still tipping labially. However, in 36 per cent of the cases noted, lingual tipping was evident at this point. It was noted that the rate of point B development also slows down during this time period.

3. Between 10 and 15 years the symphysis undergoes another "growth spurt", again with boys developing to

TABLE V

Range and average increase of symphysis development for selected age groups.

	Range of Increase		Average Increase		Total Ave.
	Boys	Girls	Boys	Girls	Increase
6 Through 7 Years	0-2 mm	0-1 mm	.9 mm	.6 mm	.8 mm
8 Through 9 Years	0-1 mm	0-1 mm	.5 mm	.4 mm	.4 mm
10 to 15 Years	0-5 mm	0-2 mm	2.2 mm	1.1 mm	1.5 mm

about twice the degree that girls do on the average. The incisor continues along a lingual path of eruption. During this time period the incisor tips lingually concomitantly with an increase in the rate of development of point B, thus rendering the chin point more prominent. When this tipping didn't occur, it could be attributed to crowding in the lower anterior region. Again, boys develop point B to about twice the extent that girls do, on the average.

4. The lower incisors of boys were found to erupt at a more obtuse angle to the mandibular plane than girls and to erupt more in a vertical direction than girls. In both girls and boys, the amount of horizontal movement of the incisors relative to the mandibular plane was nearly the same.

5. The findings suggest caution in early extraction of lower deciduous cuspids in serial extraction procedures. This could conceivably allow the incisors to move lingually more than they normally would, thus decreasing arch length.

The Medical Center

University of California

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