The Effect of Early Orthodontic Treatment on Facial Growth in Cleft Lip and Palate

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The cleft lip and palate anomaly usually includes dental malocclusion and, occasionally, gross disturbances in jaw relationships. These problems, although not usually severe in a young child, tend to worsen as the child grows older.

There are often valid reasons for correcting malocclusions in a young child with a cleft lip and palate. The improvement in facial and dental esthetics following incisor alignment may be considerable, and there may be some improvement in speech as a result. Masticatory efficiency will probably be improved and any abnormal functional movements of the mandible can be eliminated.

Despite these considerations, there are often practical reasons for favoring postponement of treatment until adolescence. Cooperation during treatment can be a major problem in many families where there is a very limited dental appreciation. If treatment subjects the child to multiple periods of appliances and interim retainers, there is the danger of exhausting his and his parents' cooperation before the most important phase of treatment in the permanent dentition. There are many additional complications such as distance from the treatment centre, mental retardation, the presence of other severe congenital anomalies, and several other factors which tempt the orthodontist to postpone treatment until the situation improves or until treatment can be rendered with a minimum of time and effort. Many orthodontists, however, are inclined to begin treatment at an early age in the belief that establishing a more normal oral environment will promote more normal jaw growth. Objective evidence to confirm this belief has not been presented.

This study of facial morphology in children with cleft lip and palate attempts to determine whether early orthodontic treatment had an influence on facial growth.

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Subjects

The sample consisted of 93 children with permanent dentition who had either complete unilateral or complete bilateral cleft lip and palate (Table 1). Only complete clefts were used, since that deformity is greatest and presumably the changes resulting from treatment would be greatest. The unilateral treated sample, 33 subjects, consisted of 15 children who received orthodontic correction in the deciduous dentition at age four to six years and 18 children who received orthodontic correction in the mixed dentition at age seven to ten years. These were compared to 27 children with the same type of clefts who received no orthodontic treatment. The bilateral sample consisted of 15 cases treated prior to the permanent dentition (4 to 10 years) and 18 who received no orthodontic treatment. A sample of 40 noncleft controls was randomly drawn from the Burlington Orthodontic Research Centre. The sex ratio of the children with cleft lip and palate closely approximated two males to one female, and this ratio was established for each of the five groups.

The children were typical of our clinic population, except that children with multiple tooth loss, unusual cases (that is, with other facial anomalies), or non-Caucasians were eliminated from the study. The orthodontic result achieved in each case was judged to be satisfactory (cases exhibiting mild relapse were considered acceptable).

Methods

Cephalometric radiographs were traced, identifying various key structures (Figure 1). From these tracings, composite facial diagrams were constructed for each group. The advantage of diagrams is that they can be superimposed in various ways, and relationships can be established that would otherwise require a great many linear or angular measurements. Differences which appeared by inspection to be of significance were examined further by individual measurements and statistical analysis.

Since size differences between groups would tend to confuse the com-

TABLE 1. Distribution of the sample according to cleft type, age (in years and months), and whether orthodontic treatment had been received.

Groups	*Treated*		*Untreated*		*Totals*
	N	*mean age*	*N*	*mean age*	
Cleft lip and palate					
Unilateral	33	12:8	27	12:11	60
Bilateral	15	13:4	18	13:6	33
Noncleft			40	12:0	40
Total	48		85		133

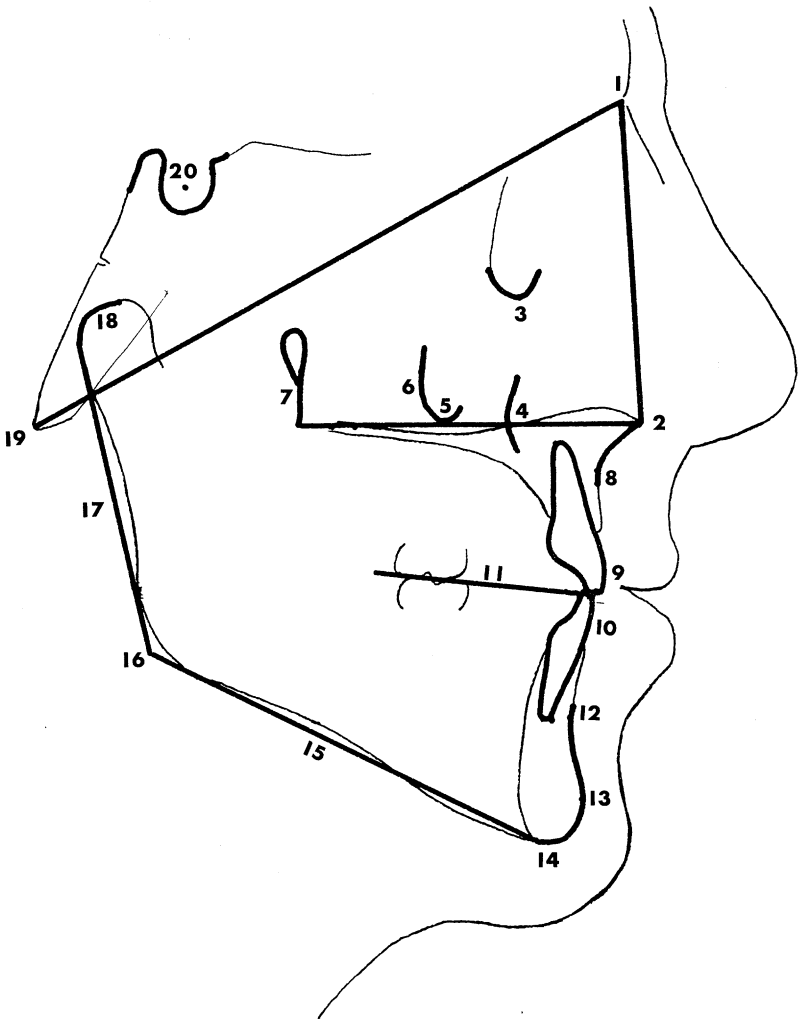

FIGURE 1. Tracing of lateral cephalometric radiograph (in fine lines) with superimposed diagram (heavy lines), showing the land marks and the diagram used in this study. Landmarks are as follows: 1. nasion; 2. anterior nasal spine; 3. orbitale; 4. anterior point on maxillary lateral segment (bilateral cleft sample only); 5. zygomatic ridge, most inferior point; 6. zygomatic ridge, most posterior point; 7. pterygo-maxillary fissure; 8. 'A' point; 9. maxillary incisor; 10. mandibular incisor; 11. occlusal plane; 12. 'B' point; 13. pogonion; 14. menton; 15. mandibular body plane; 16. gonial angle; 17. mandibular ramus plane; 18. mandibular condyle; 19. basion; 20. sella turcica.

parison of their facial morphology, the facial diagrams were enlarged to a common cranial base length (for example, in Figure 2). This was considered to be justified on the basis of a previous study (*3*).

Findings

The mean facial patterns for each of three groups are shown in Figure 2, to illustrate the basic differences between them.

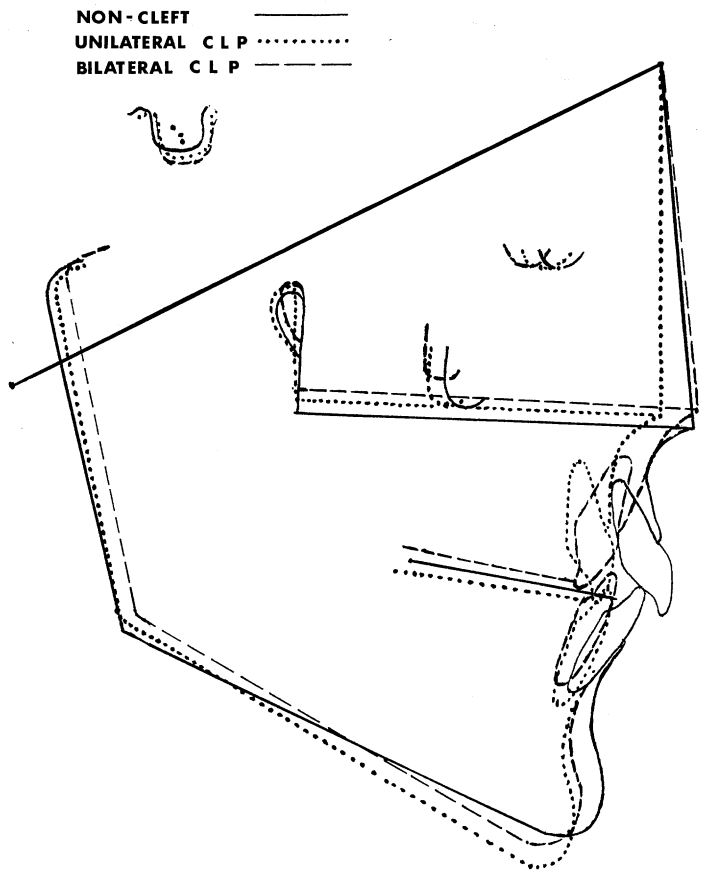

FIGURE 2. Size-adjusted composite facial diagrams of noncleft children, untreated bilateral cleft lip and palate children, and untreated unilateral cleft lip and palate children.

UNILATERAL CLEFT LIP AND PALATE. When the diagrams (not shown here) of the two treated unilateral groups (deciduous dentition, four to six years, and mixed dentition, seven to nine years) were compared, the only appreciable difference noted was that the mandible seemed smaller in the younger group. However, the difference was not statistically significant and the two treated groups were therefore combined and compared to the untreated group (Figure 3). A difference between the treated and untreated groups was noted in the gonial angle and the difference was statistically significant (Table 2). In addition, there were other minor differences in the morphology of the mandible and maxilla. The relationships of the incisor teeth were improved in the treated cases when compared to the untreated group. Otherwise, the remarkable observation was the similarity of the diagrams.

BILATERAL CLEFT LIP AND PALATE. Comparisons of the diagrams for the treated and untreated bilateral cases (Figure 4) showed a marked

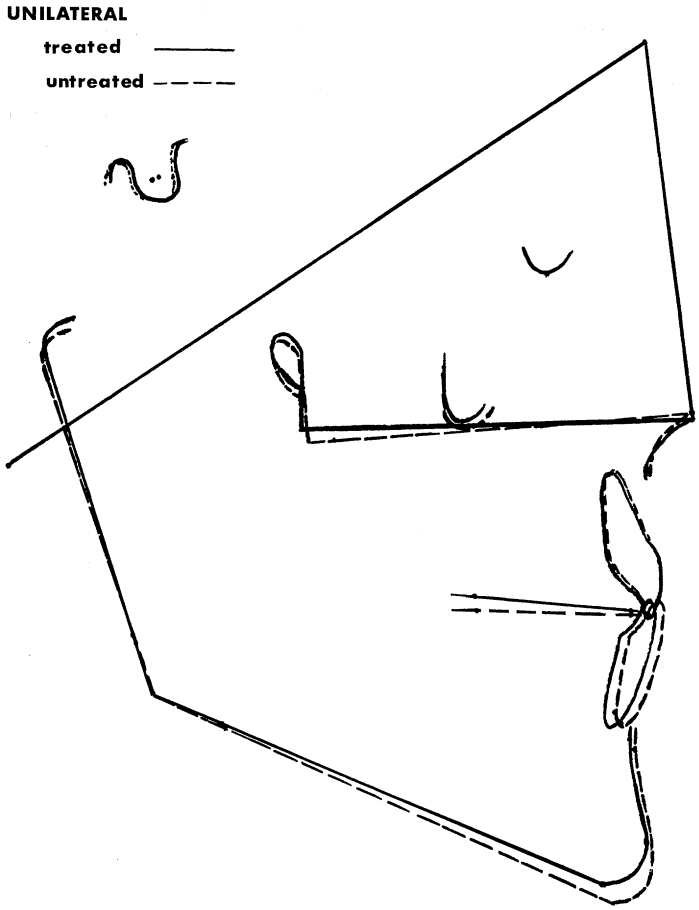

FIGURE 3. Size-adjusted composite facial diagrams of children with complete unilateral cleft lip and palate. The solid line represents orthodontically treated cases, the interrupted line represents untreated cases.

TABLE 2. Gonial angle and freeway space values for the various groups included in the study. For the analysis of freeway space differences, the two cleft types are combined.

Groups	*Gonial angle (in degrees)*					*Freeway space (in mm)*				
	untreated	*N*	*treated*	*N*		*untreated*	*N*	*treated*	*N*	
Cleft lip and palate										
Unilateral	133.7	27	129.1	33	$P < .05$	5.6	16	4.2	25	$P < .01$
Bilateral	132.5	18	132.1	15	$P > .1$	5.4	12	4.2	10	$P < .01$
Noncleft	127.5	40				4.4	39			

difference in the positions of the maxillary incisiors and premaxilla. The growth of the lateral maxillary segments was appreciably increased in the treated group, as indicated by the zygomatic process and the anterior point of the lateral segments. The difference in the length of the lateral maxillary segment (PTM—anterior maxillary point) was highly significant.

Discussion

In many cases of cleft lip and palate, both unilateral and bilateral, the collapse of the maxilla and maxillary teeth prevents the tongue from assuming its normal resting place in the palatal vault. The tongue then tends to assume a position, when the mandible is at rest, either between the maxillary and mandibular teeth or relatively low in the mouth,

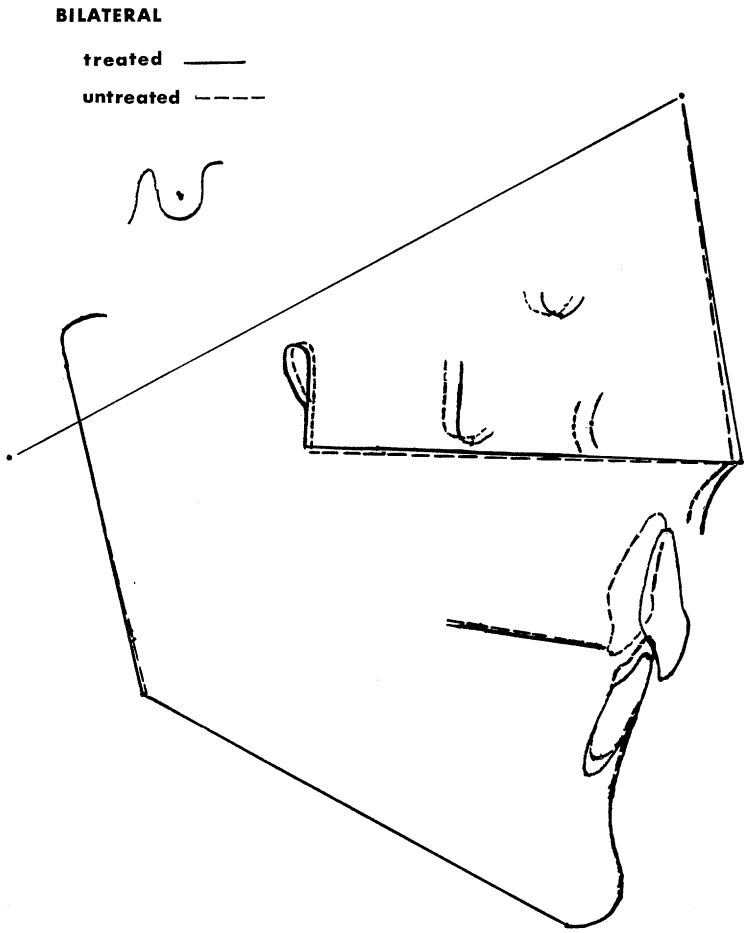

FIGURE 4. Size-adjusted composite facial diagrams of children with complete bilateral cleft lip and palate. The solid line represents orthodontically treated cases, the interrupted line represents untreated cases.

confined by the mandibular arch but acting as a platform upon which the maxillary teeth rest. In either position the eruption of the teeth is inhibited, leading to an excessive freeway space (that is, the teeth are too far apart when the mandible is in its postural or rest position). This causes the mandible to overclose when the teeth are brought into contact, giving the individual a prognathic appearance and a reduced facial height.

Our clinical impression was that there were fewer cases in the permanent dentition with great excess freeway amongst those that had earlier treatment than amongst similar cases that had not been treated. In theory, expansion of the maxilla would increase oral volume and permit the tongue to resume a normal position, thus permitting the teeth to erupt more normally. The difference in freeway space between treated and untreated patients proved to be statistically significant when the two groups were combined and the difference tested by analysis of variance (Table 2).

Another result of the improvement in tongue position would be a change in the gonial angle of the mandible. Harvold (*1*) observed that if the mandible is held open by faulty tongue position, the gonial angle area will show remodeling of the bone to avoid muscle stretching, thus changing the shape of the mandible and increasing the gonial angle.

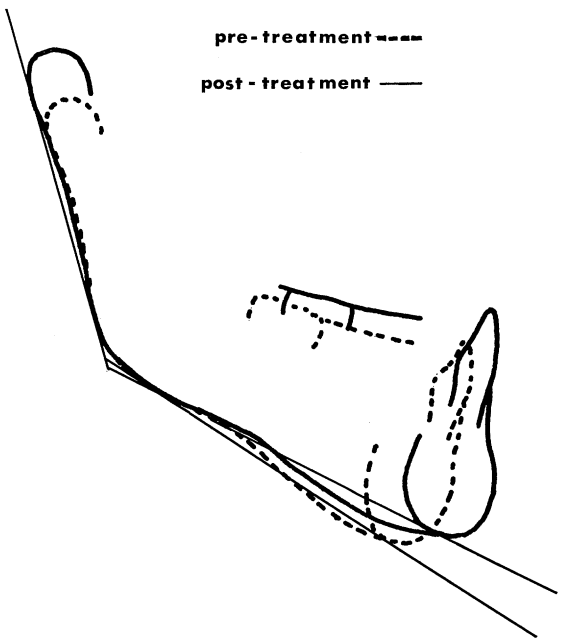

FIGURE 5. Tracings of the mandible of a child with a complete unilateral cleft lip and palate. The dotted line is a tracing at age 8 years, 9 months, just prior to orthodontic treatment; the solid line at age 12 years, 8 months. The gonial angle is decreased considerably (5°).

Treatment, by increasing oral volume, should reverse this process and result in a smaller gonial angle. In this study the gonial angle was smaller in the treated cases, but only in the unilateral group (Table 2).

Cases in which the maxilla was not severely collapsed would have little change in oral volume and therefore little change in rest position or gonial angle would be expected. Several of the more severely collapsed cases were examined before treatment and then again several years after treatment. A considerable change in gonial angle was usually seen (illustrated in Figure 5). All of these severe cases showed some degree of decrease in the gonial angle, although a previous study (*2*) has shown that the gonial angle increases with age in orthodontically untreated children with cleft lip and palate.

Most of these changes in rest position and gonial angle resulting from early orthodontic treatment are of little clinical significance. In some dramatic cases, the mandible may 'close up' (Figure 5), thereby eliminating the excess freeway. On the other hand, such closure of the mandible advances the chin, and may worsen the facial profile of a case that has some degree of mandibular prognathism. Thus, even the pronounced mandibular changes that may occur in severe cases are not always desirable.

Summary

The effects of early orthodontic treatment were studied by means of cephalometric radiographs. Ninety-three children with unilateral or bilateral cleft lip and palate, forty-eight of whom had previously received orthodontic treatment, were analysed. There were differences in the facial skeleton which indicated that early treatment was beneficial for children with bilateral cleft lip and palate. Other differences were noted in a few children with severe unilateral cleft lip and palate which might be beneficial or harmful, depending on individual facial morphology. However, for most children with unilateral cleft lip and palate, orthodontic treatment prior to the permanent dentition had no appreciable effect on the facial growth pattern.

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