

Some Observations on Rapid Expansion Followed by Bone Grafting in Cleft Lip and Palate

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Incidence

It is a regrettable fact that the number of infants born with clefts of the lip and or palate is increasing. MacMahon and McKeown (10) reported after a survey in Birmingham an incidence of 1.3 per thousand total births. Fogh-Andersen (4) has kept very careful records of the incidence in Denmark for many years now. He reported that the number of patients operated upon in the years 1938-42 was 1.31 per thousand and this increased in the succeeding years rising to 1.64 per thousand in the years 1953-57 corresponding to 1.7-1.8 per thousand births. More recently Lowe (9) has recorded a figure of 2.06 per thousand births in South Wales.

Types of Cleft

A variety of different types of cleft occur in the upper jaw, the cleft may involve the primary palate alone, the secondary palate alone or both may be affected and to a varying degree.

Clefts of the lip and palate are the most disfiguring and unfortunately occur most often (in 41.7% of the sample reported by Fogh-Andersen). Clefts of the lip occurred in 33.5% and cleft palate in 24.8%.

Management

It is now generally accepted that the treatment of children with clefts will involve several specialists grouped together to form a team. This approach was pioneered at the Lancaster, Pennsylvania, Cleft Palate Clinic by Cooper (2).

Commenting on the recent improvements in cleft palate treatment Stark (19) says "but the longest strides have come since the Second World War. They can be laid at the door of increased skill perfected by the plastic surgeons in and after the war as well as to the concept of the interdependence and inter-digitation of disparate skills of many special-

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ists working together as a team to make normal a child with this most complex anomaly."

The surgical developments are dealt with in the appropriate textbooks and journals, Craig (3), Jolleys (6, 7), Millard (14, 15), to which those wishing further details are referred.

Broadly speaking there are two different approaches followed in the treatment of cleft infants in the various centers throughout the world. These are: (1) Surgical repair followed by orthodontic care. (2) Presurgical orthodontics (or oral orthopaedics) followed chronologically by surgical repair.

The second approach was introduced by McNeil (11) and Kjellgren (8) almost simultaneously in different parts of Europe—a not uncommon phenomenon. McNeil's approach has since been taken up in many centers, one of its best known advocates being Burston (1).

It would seem that few ideas are entirely new since Griswold and Sage (5) have reported that Louis (a French surgeon) advocated presurgical treatment in 1768, as did Chaussier in 1776, in respect of patients with bilateral clefts and prominent premaxillae.

All workers in the field of cleft lip and palate by no means are agreed that presurgical oral orthopaedics is either necessary or beneficial. It seems to the writer that the burden of proof lies with those who advise the introduction of a new technique or the adaptation or modification of an older method. In a recent paper by Robertson (16) an attempt was made to outline recent developments in the early orthodontic treatment of infants with clefts of the lip and palate.

One form of later orthodontic care for the child with a complete cleft which has been advocated by Matthews and Grossman (12) and Matthews et al. (13) is the rapid expansion of the upper arch followed by the insertion of bone grafts. In their view, this treatment might be commenced at any age after eight years and the expansion should be completed in three weeks or less. After the desired expansion had been achieved, bone grafts were inserted using a buccal approach. Patients were normally in the hospital for two weeks. The retaining splint (normally the active appliance left in situ) was worn for seven weeks and after its removal a removable plate was used for a further period of night retention of three months. Any deficient teeth were later replaced with a prosthesis or bridge. Matthews and Grossman had treated 25 cases over a period of 3½ years without relapse.

As mentioned, some workers, of whom the best known are probably Matthews and Grossman, have suggested that the malocclusion in children whose cleft was repaired in infancy may be best treated by the rapid expansion of the upper arch to correct any crossbites and that when this has been completed bone grafts may be inserted in the alveolar areas. A method of treatment will be outlined for such children and the results obtained discussed.

TABLE 1. Distribution of patients in groups A and B by age.

	<i>age, years</i>									<i>totals</i>
	3+	4+	5+	6+	7+	8+	9+	10+	11+	
Group A	2	2	4	5	5	5	3	2	4	32
Group B	—	3	—	2	2	—	1	—	—	8
Totals	2	5	4	7	7	5	4	2	4	40

Material

Some forty children aged from three years, seven months to eleven years, six months have been treated over a period of six years. All had previously had the surgical repair of either a complete unilateral or bilateral cleft performed in infancy. All the orthodontic treatment was carried out under the aegis of one consultant and the majority of the day-to-day treatment by the same individual. The surgery was done by two surgical colleagues; Surgeon A was responsible for treating 32 cases and surgeon B for 8 cases. Few of the children lay at either end of the age range and the average ages were:

Group A	7.1 years
Group B	5.9 years
Total group	6.9 years

The age distribution is given in Table 1.

Figure 1 shows a typical case before the commencement of the treatment to be described.

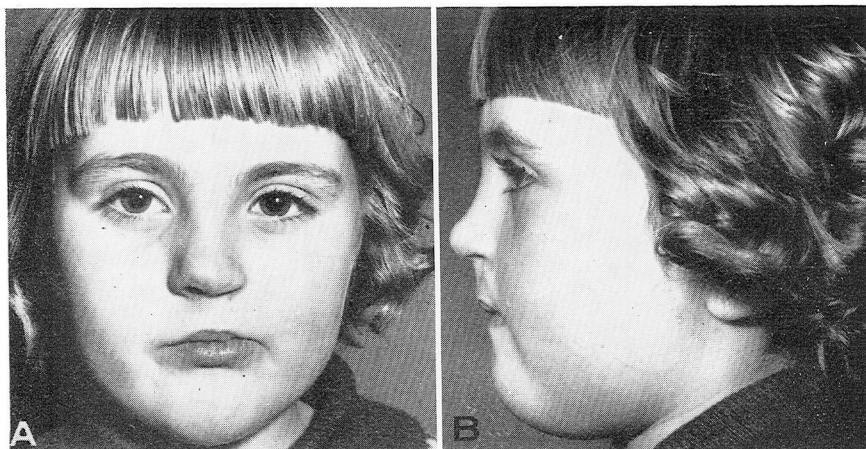


FIGURE 1 A and B. Patients in this study all had repaired complete unilateral or bilateral clefts.

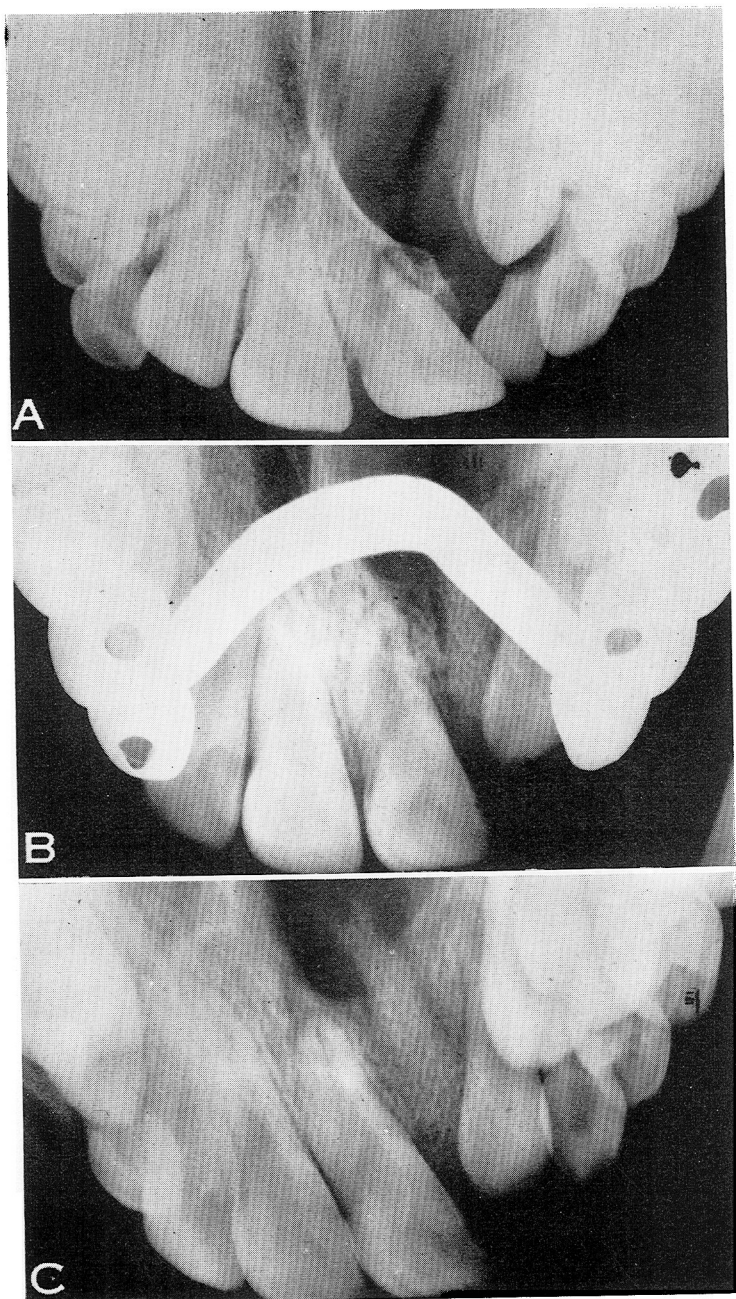


FIGURE 2. Occlusal radiographs of typical patient, (a) before treatment, (b) during retention, (c) post retention.

Method

Rapid enlargement of the maxillary dental arch laterally (and antero posteriorly if called for) was carried out using fixed appliances constructed of cast cap splints fitting over the teeth in buccal segments and

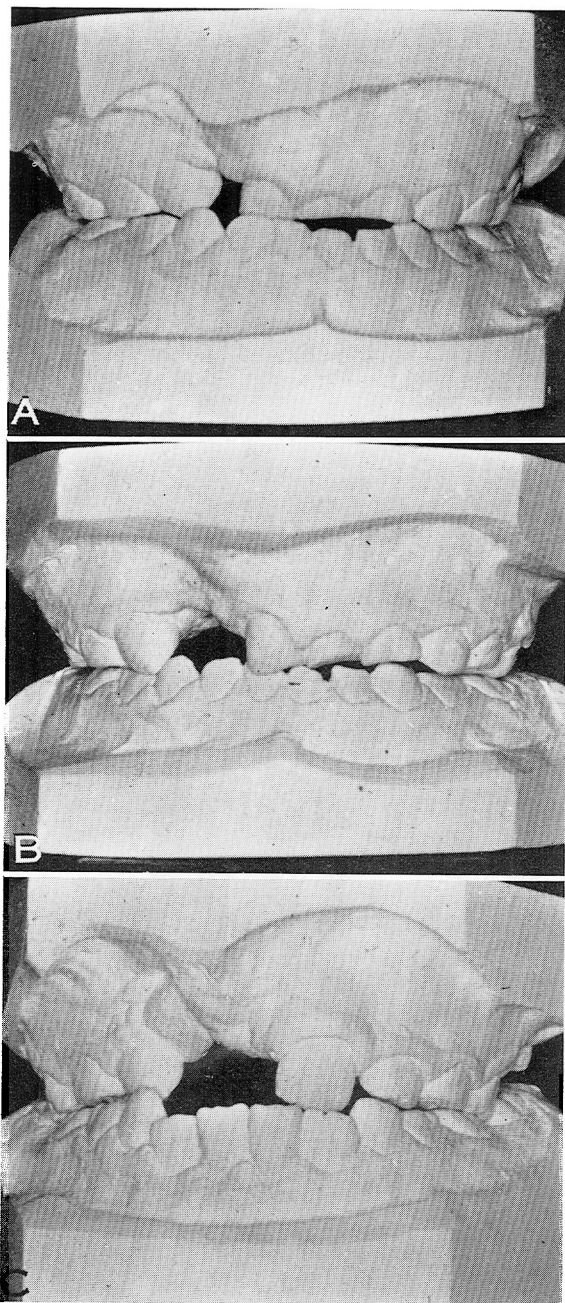


FIGURE 3. Record models of occlusion were obtained, (a) initially, (b) after arch expansion, (c) post retention.

with an acrylic palatal portion containing an expansion screw. If the patient's home was a considerable distance from the center then the patient was admitted for in-patient treatment, the screw being turned up to $3 \times$ day. It had been noted early in the management of such patients on an outpatient basis that if the appliance became dislodged then there was rapid collapse back to the original condition and the patients from some distance were admitted to try to avoid this problem. After the introduction of zinc polyacrylate cements (18) this material was used for cementing with a considerable reduction in the number of splints becoming loose. If the treatment was on an out-patient basis, turning was limited to once per day. Other than a sensation of tightness, none of the patients in the group complained of discomfort. The time taken to correct the malocclusion naturally varied according to the severity of the original malpositioning.

TABLE 2. Intercanine arch width of patients in group A*, (1) initially, (2) after expansion, (3) after retainer was discontinued.

arch width and case no.	record model no.		
	1	2	3
<i>C + C</i>			
1	31.2	—	—
2	33.8	33.8	31.8
3	29.6	35.0	32.7
4	28.0	35.4	31.5
5	33.0	33.0	32.5
6	28.8	30.8	31.4
7	—	—	—
8	31.5	41.0	30.8
9	31.5	—	—
10	26.8	32.5	—
11	27.5	28.0	—
12	35.5	—	—
13	30.0	32.4	31.6
14	32.0	40.0	—
15	29.4	38.0	32.4
16	25.8	31.2	25.8
17	27.2	31.2	28.5
18	21.2	29.2	—
19	28.6	28.6	28.2
20	28.6	34.6	32.4
21	36.4	38.0	—
22	30.0	30.5	29.8
23	26.8	34.4	—
24	26.6	30.0	24.2
25	29.2	35.2	32.4
26	30.0	31.0	31.0

* Total of 32 in group A, 1 patient did not attend for review clinics, 5 were not over 12 months out of retention.

On achieving the desired correction, records were made (study models, occlusal radiographs, frontal and lateral cephalometric radiographs and standard facial photographs) in order to allow comparison with similar records made both previously (at the commencement) and subsequently.

Normally, the last expansion splint was used for retention although in a proportion of patients a fresh fixed retainer was inserted.

Rib bone grafts were inserted by either surgeon A or B using a buccal approach and packing the alveolar defect with bone. After some ten to fourteen days the patients were discharged home. They continued with a soft diet for twelve weeks.

The retaining appliance was normally used for 6–8 months before being removed, although in a few cases it was continued for up to 18 months.

Each patient was examined regularly at an outpatient clinic and referred for routine occlusal films to check on the amount of bone remaining in the area where the cleft formerly existed.

TABLE 3. Intermolar arch width ($D + D$) of patients in group A, (1) initially, (2) after expansion, (3) after retainer was discontinued.

arch width and case no.	record model no.		
	1	2	3
$D + D$			
1	39.4	—	—
2	39.6	39.6	38.2
3	39.4	43.2	40.9
4	36.4	43.6	40.4
5	45.2	45.2	45.5
6	—	—	—
7	35.5	35.5	—
8	40.6	43.0	39.2
9	—	—	—
10	36.0	42.0	—
11	35.0	35.0	—
12	—	—	—
13	39.8	41.6	40.0
14	40.6	—	—
15	37.5	44.4	39.2
16	36.6	41.2	37.6
17	36.8	40.0	36.7
18	29.4	40.0	32.5
19	—	—	—
20	—	—	—
21	42.5	44.2	—
22	34.6	36.4	36.8
23	37.0	45.0	—
24	34.2	37.2	31.6
25	—	—	—
26	37.8	39.2	—

Results

Of the 40 patients, 8 were bilateral and in all 48 grafts were inserted. In the follow up of the patients some lost small fragments of bone in the first few months. Healing was usually uneventful and radiographs taken up to 5 years after the operation showed that most of the bone inserted had remained after an initial period of modeling resorption (Figure 2). Although the bone remained in situ it did not prevent some collapse in a relatively high proportion of the patients. This is contrary to the claims made by Matthews and Grossman for their series. This is illustrated by the serial models of a typical case (Fig. 3). A possible explanation is that the soft tissue band on the outside of the dental arch formed by the lips and cheeks applies a contracting force on the arch. In a proportion of cases there was a return to a crossbite situation.

No differences could be detected in the results of the patients in group A and group B.

TABLE 4. Intermolar arch width ($E + E$) of patients in group A, (1) initially, (2) after expansion, (3) after retainer was discontinued.

arch width and case no.	record model no.		
	1	2	3
$E + E$			
1	46.5	—	—
2	45.5	—	—
3	46.4	49.8	47.2
4	42.6	51.5	46.7
5	45.2	45.2	45.5
6	43.2	45.2	43.5
7	—	—	—
8	47.6	47.2	45.8
9	—	—	—
10	44.6	46.8	—
11	42.0	42.0	42.0
12	—	—	—
13	48.4	49.4	47.8
14	46.8	54.0	—
15	42.5	47.6	43.5
16	—	—	—
17	45.0	45.6	45.0
18	38.8	46.2	40.6
19	40.8	40.8	40.0
20	44.0	46.0	45.0
21	50.0	51.0	—
22	40.0	43.2	42.4
23	46.4	53.6	48.8
24	39.8	41.2	37.8
25	48.6	—	—
26	43.3	44.2	—

The arch width in the area of the deciduous canines, first molars and second molars was measured using a Boley gauge and the method described by Sillman (17). The measurements are given for the patients in groups A and B before treatment, at the completion of expansion and not less than twelve months out of retention (Tables 2-5). In some cases it was not possible to record all the measurements due to early loss of the deciduous teeth.

Conclusions

1. Later bone grafting after preliminary rapid arch expansion does not prevent collapse and the recurrence of crossbites in the buccal segments.

TABLE 5. Inter canine and intermolar arch widths of patients in group B, (1) initially, (2) after expansion, (3) after retainer was discontinued.

arch width and case no.	record model no.		
	1	2	3
<i>C + C</i>			
A*	21.6	35.4	33.3
B	19.4	35.7	—
C	23.2	33.6	31.0
D	29.5	36.6	32.4
E	34.7	—	—
F	23.2	33.6	33.0
G	25.4	35.0	32.2
H	—	—	—
<i>D + D</i>			
A	32.4	44.3	41.6
B	30.2	41.7	35.7
C	32.0	41.4	37.6
D	40.5	46.4	41.5
E	38.8	—	—
F	33.0	41.4	41.2
G	34.2	42.2	40.4
H	33.6	41.4	40.2
<i>E + E</i>			
A	44.0	53.2	50.8
B	41.6	47.4	42.6
C	39.6	49.5	43.2
D	48.4	51.9	48.4
E†	44.4	—	39.7
F	43.4	48.7	48.6
G	42.2	48.7	46.5
H	41.2	47.8	47.1

* Arch collapsed after retainer was discontinued but could not be measured since deciduous teeth were shed.

† No arch expansion employed.

2. The degree of collapse occurring may be related to the tension in the soft tissue of lip and cheek.
3. Over expansion might prevent relapse occurring but it is suggested that the method described is of limited value when considered in relation to the production of a better occlusion.
4. The later bone grafts remain *in situ* and do not cause interference to the antero-posterior growth in the maxilla. This may be related to the fact that not a great deal of antero-posterior growth is occurring at the ages studied.

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