

# Cleft Palate, An Experiment.

By

**EGIL HARVOLD.**

Norges Tannlegehøgskole.<sup>1</sup>

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Observations on the development of total cleft palate cases show that the two parts of the upper jaw move together when the alveolar process at the left cleft is resorbed (1). Such a resorption takes place after extraction of the teeth near the cleft, and also during the shedding of the teeth when the permanent teeth erupt in a wrong direction or are absent. The absence of permanent teeth in this region is rather frequent, as shown by MILLHON and STAFNE (2) and BØHN (3).

When expanding the upper jaw with orthodontic appliances, a part of the expansion is due to the movement of the teeth in the alveolar process, another part of the expansion seems to be due to the movement of the maxillary bone. If the two parts of the upper jaw are moved together or apart, it must be connected with a transformation of the bones in the suture-region between the upper jaw and the neighbouring bones. It is difficult to register such a transformation on children with cleft palate. The process is therefore reconstructed on monkeys.

## Method and Material.

Two Rhesus monkeys (*Macaca mulatta*) approximately three years old, in good health and in good condition were used in the experiment. They were anaesthetized with ether and then with natriumpentobarbital intravenously. Impressions were taken

<sup>1</sup> Part of this study was made in University of Michigan, Ann Arbor, Mich. and in Harvard University, Boston, Mass.

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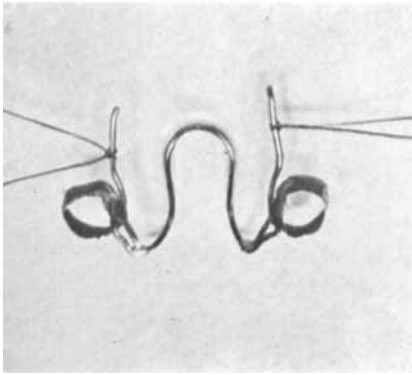


Fig. 1.



Fig. 2.

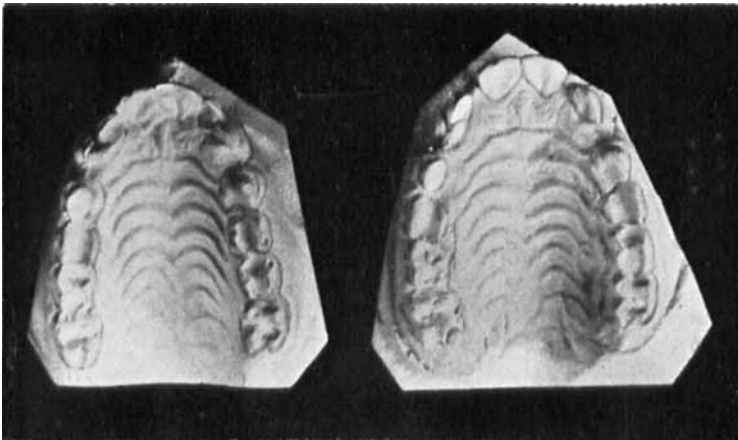


Fig. 3.

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Fig. 4.

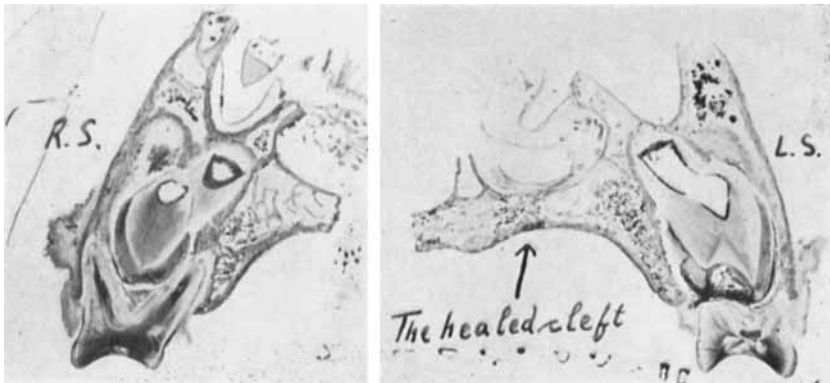


Fig. 5.

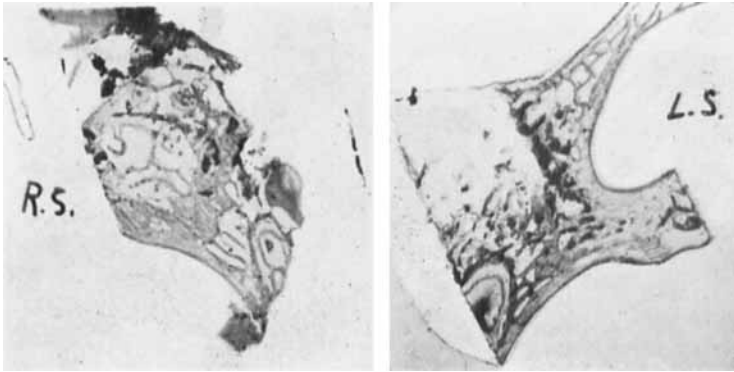


Fig. 6.

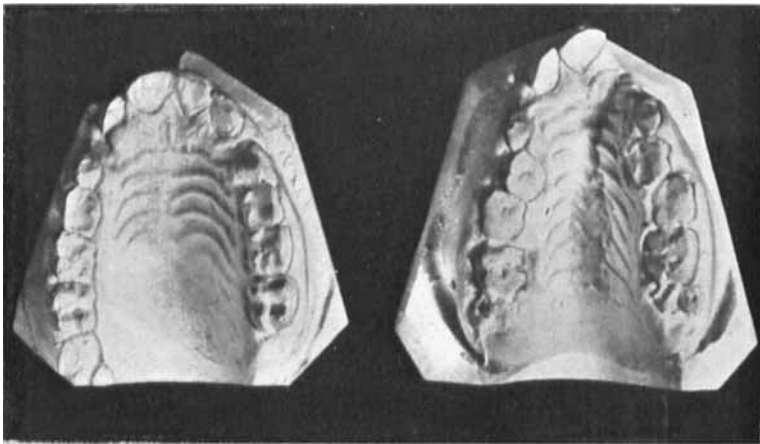


Fig. 7.

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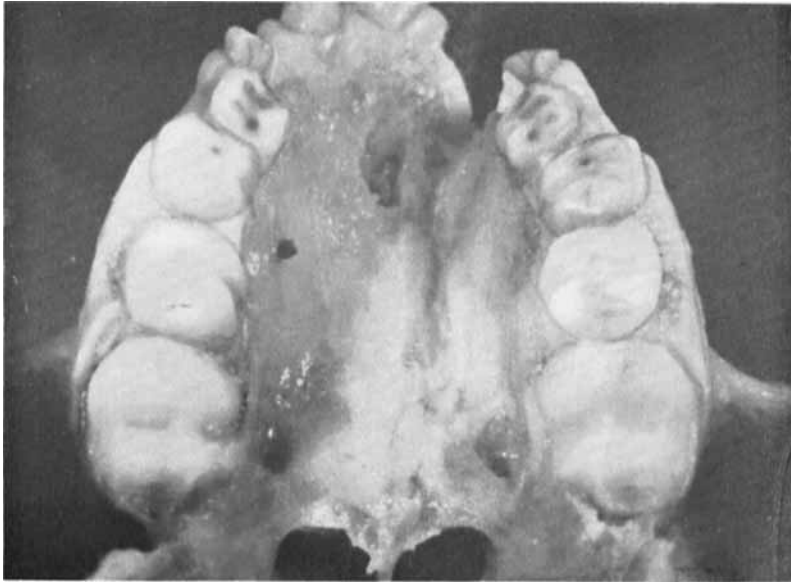


Fig. 8.



Fig. 9.

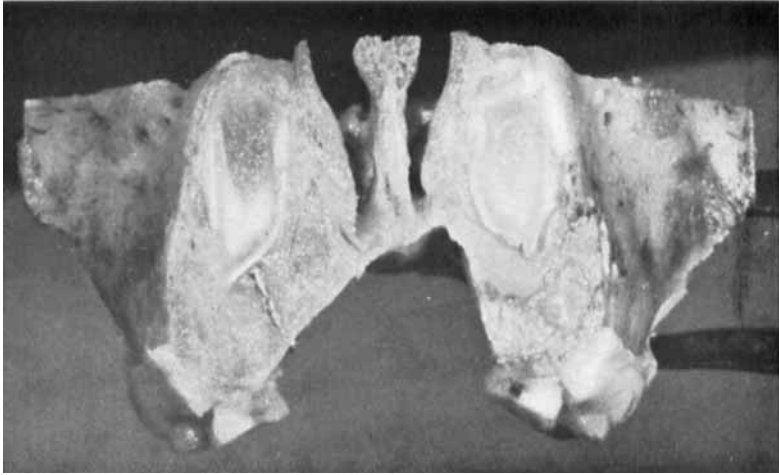


Fig. 10.

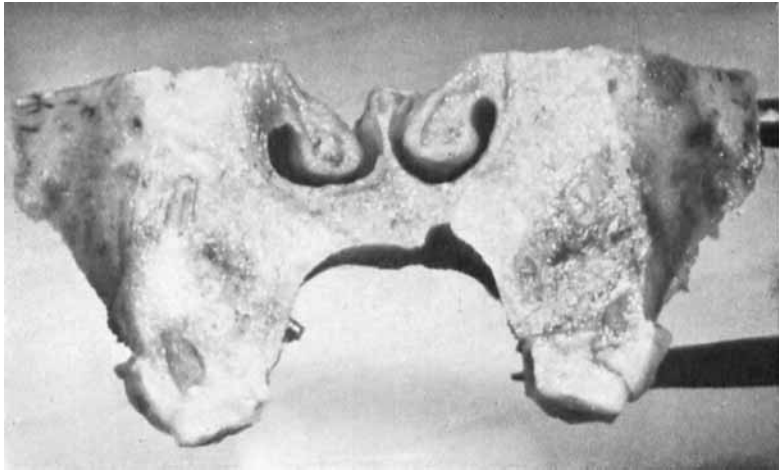


Fig. 11.

HARVOLD: Cleft Palate, An Experiment.

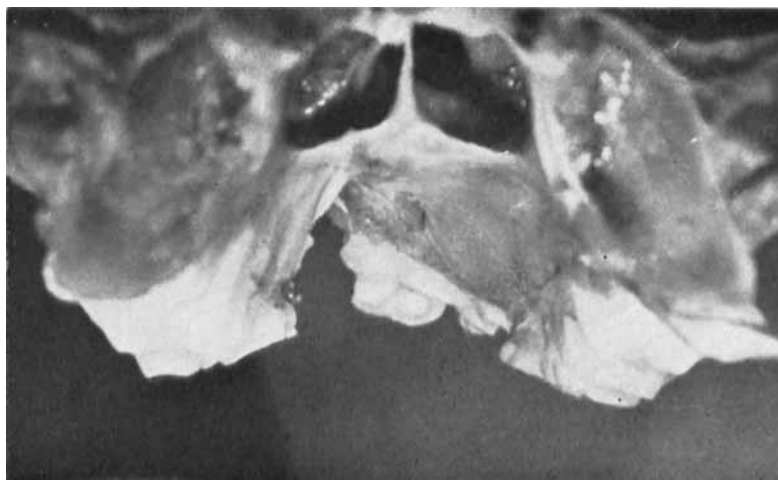


Fig. 12.

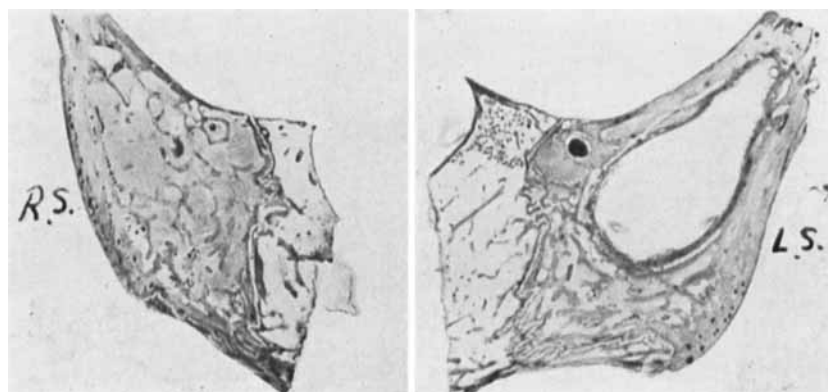


Fig. 13.

and models made. Two steelpoints (0.8 mm.  $\times$  6 mm.) were put in the bony palate on each side lingually of the deciduous canines and of the second deciduous molars. Then x-rays were taken in Higleys headpositioner, and the monkeys were operated on as described later. They got clefts in the palate and orthodontic appliances were inserted, on monkey A for expansion and on monkey B for compression of the jaw. On the third, the seventh, and the tenth day after the operation they both got intraperitoneal injections of Alizarine Red S. as described by SHOUR, HOFMAN and GARNAT (4) (75 mg. per kg. bodyweight). The monkey B, which got the jaw compressed, had another injection seven weeks after the operation.

Eight weeks after the operation the monkeys were killed. New models and x-rays were obtained. The jaws were prepared after the method described by SOGNAES (5). A few sections of the sutures were prepared after the technic described by MORSE (6). The changes in the width of the dental arch and the changes shown on the x-ray were registered and compared with macro- and microscopical findings. The last ones will be described later.

#### **Monkey A. Expansion of the Upper Jaw.**

The mucous membrane was elevated from the alveolar process labially and lingually to the central incisors and from the palate on the left side. An elevator through the incisive canal lifted the mucous membrane from the floor of the nasal fossa on the same side. A complete cleft was made in the alveolar process between the two central incisors and on the left side of the hard palate. The width of the cleft in the palate was approximately 2 mm. The orthodontic appliance (fig. 1) was anchored to the first permanent molars with bands and ligatured to the first deciduous molars (fig. 2). The expanding force was approximately 60 grams. Fig. 3 shows models of the upper jaw before and after treatment. (See table p. 003.)

Further examination of the upper jaw showed a complete healing of the cleft in the alveolar process and in the hard palate (fig. 4). The healing procedure is here obtained under tension and will be the subject for further investigation.

A frontal section of the upper jaw at the level of the first deciduous molars showed no evident asymmetry (fig. 5). A frontal section at the level of the keyridge showed normal macroscopical conditions (fig. 6). The findings on the x-rays were not significant.



*Monkey A.*

Distance in mm. betw.	Not in contact with the appliance.			In contact with the appliance		
	III—III	Steelpoints		IV—IV	V—V	6—6
		anterior	poster.			
Before treatment . . . . .	18.2	13	13.9	17.7	19.4	18.8
After treatment . . . . .	20.3	14.6	15.6	20.3	21.3	20.7
Difference . . . . .	2.1	1.6	1.7	2.6	1.9	1.9

**Monkey B. Compression of the Upper Jaw.**

The mucous membrane was elevated from the alveolar process in the region of the central and lateral incisors and from the hard palate and the floor of the nasal fossa on the left side.

A complete cleft was made in the premaxilla including the left central and lateral incisors and their bony sockets. The width of the cleft made in the hard palate was approximately 3 mm.

An appliance of the same type as used on monkey A was anchored to the first permanent molars with bands and to the first deciduous molars with ligatures. The appliance forced the two teeth on each side lingually. The total strength of the force was approximately 65 gr. Fig. 7 shows models of the upper jaw before and after treatment.

*Monkey B.*

Distance in mm. betw. . . . .	Not fixed to the appliance		Fixed to the appliance	
	III—III	V—V	IV—IV	6—6
Before treatment . . . . .	18.0	20.4	19.1	20.8
After treatment . . . . .	13.6	17.0	11.4	17.8
Difference . . . . .	4.4	3.4	7.7	3.0

The steelpoints at the side of the cleft had disappeared during the eight weeks of treatment.

Further investigations of the upper jaw showed no healing tendency of the bone at the cleft. On the contrary resorption must have taken place at the border of the cleft (fig. 8).

A front view of the skull (fig. 9) showed that the right central

incisor was moved to the left and the apical base was narrowed. It also showed a deformity of the left piriform aperture.

In a frontal section of the upper jaw at the level of the first deciduous molars a marked deformity was evident (fig. 10). A frontal section at the level of the second deciduous molars (fig. 11) showed the same deformity, and this was also significant at the choanae (fig. 12).

There was a red zone of Alizarine R. S. visible on the maxilla, close to the zygomatico-maxillary suture. The Alizarine R. S. deposition in the corresponding part of the zygomatic bone was less remarkable (fig. 9). A frontal section at the level of the key-ridge showed a thorough reconstruction of the maxilla and no macroscopic alterations in the zygomatic bone (fig. 13). The x-rays showed the altered dental arch, and on a frontal view an altered outline of the upper jaw was visible on the left side. Other findings were not significant.

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Address:

Tannlegehøgskolen,

Oslo,

Norway.