The Use of Tomography in the Diagnosis of Unusual and Occult Clefts of the Palate

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The majority of patients seen at cleft palate treatment centers demonstrate well-defined orofacial defects that are easily described and readily classified. Less frequent are those complex deformities that are not easily categorized. Patients with midline clefts of the face, for example, usually show multiple defects, so that the cleft must be considered as only one manifestation of a more generalized problem (*4, 5*). Concomitant malformations noted in midline cleft individuals include heart, central nervous system, and musculoskeletal defects (*1, 2, 6, 8*). Bifidity of the nose, hypertelorism, and cranial defects help to establish the clinical diagnosis of midline cleft; clefts of the lip vary in extent, while palatal defects are still more variable and sometimes undetectable clinically. Therefore, we turned to the use of roentgenographic techniques as an aid in the diagnosis of the position and extent of palatal defects in midline facial clefts.

Methods

Tomography (otherwise referred to as body section radiology, laminography, stratigraphy and planigraphy) has been used diagnostically in medicine and dentistry for many years (*3*). This is a method of blurring the roentgen image of tissues above and below the area of interest so that specific structures may be visualized more clearly. To accomplish this, the film and the x-ray tube must be moved in opposite directions simultaneously, using the area of interest as the effective axis of rotation.

The motion of the tube may be linear, circular, oval, or hypocycloidal, depending on equipment design. In the studies reported here we used

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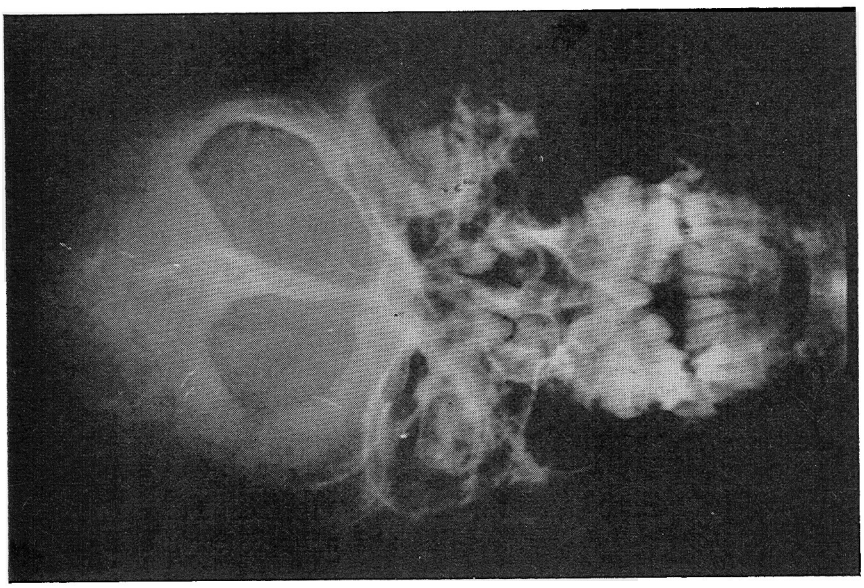

FIGURE 2. Routine P-A skull roentgenogram of the patient shown in Figure 1.

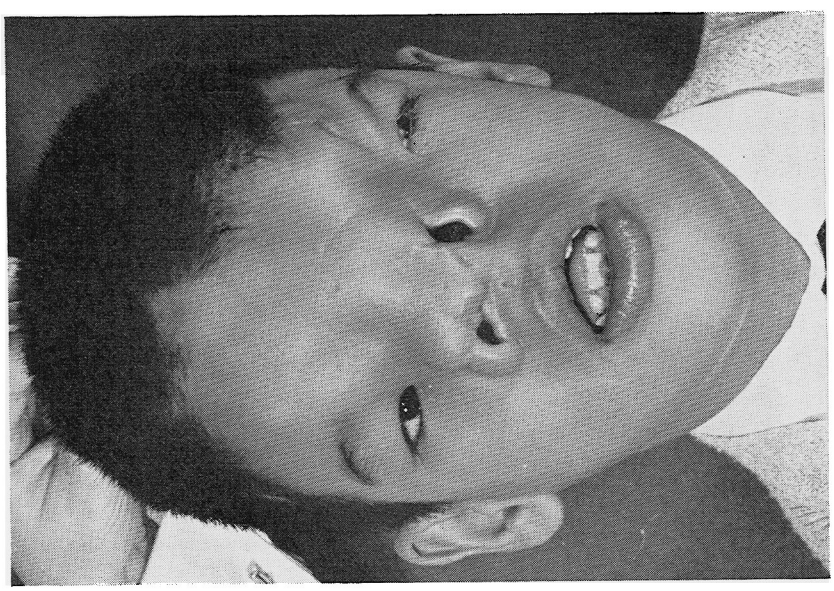

FIGURE 1. Bifid nose, hypertelorism, frontal bone defect, microphthalmos and cleft lip in a 14-year-old Filipino male (Case 1).

a Massoit Polytome, in which the motion of the tube is hypocycloidal (7). This technique produces a radiographic image with 1 mm of tissue in focus, making it possible to avoid the artifacts that are obtained when other types of tube motion are employed (7). Estimated radiation dose to the entry skin using this method is about 1 r per exposure. The following three cases have been selected from a larger series particularly to illustrate the possible use of tomography for improved diagnosis of unusual palatal defects.

Case Reports

CASE 1. This patient, a 14-year-old Filipino male, was born with a bifid nose, encephalocele, microphthalmos, hypertelorism, median cleft of the lip, cleft of the primary palate and partial cleft of the secondary palate (Figure 1). The routine posterior-anterior skull roentgenogram shows evidence of frontal bone defects, and cleft palate (Figure 2). Since we were aware from clinical observation that

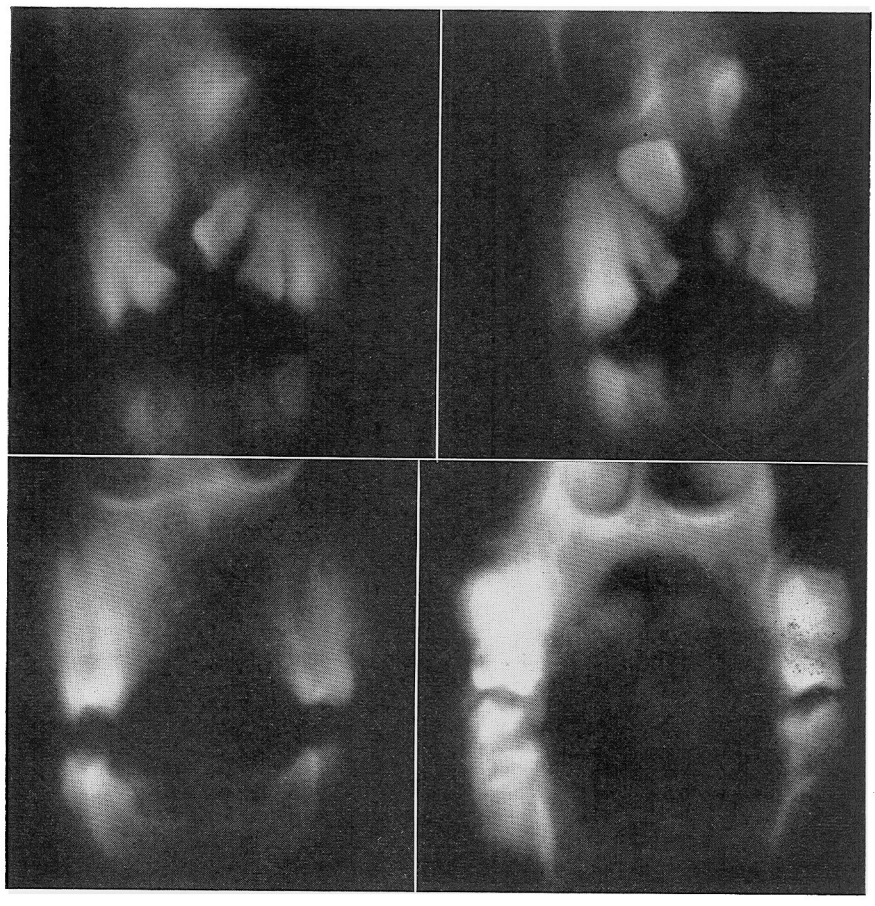

FIGURE 3. A-P tomograms of Case 1, shown in Figure 1. Distances from the back of the head are upper left, 17.5 cm, upper right, 16.5 cm, lower left, 15.5 cm, and lower right, 13.5 cm.

this was not a complete cleft, tomographic studies were made in the anteroposterior projection to determine the true extent of the bony defect.

The series of films shown in Figure 3 illustrates 1 mm "cuts" of the skull that permit us to follow the course of the cleft in the palate in an anterior to posterior direction. Figure 3, upper left, taken at a distance of 17.5 cm from the back of the head shows the extent of the palate and frontal bone defects in detail. An inverted central incisor adjacent to the cleft line (also seen in Figure 2) is located accurately at the level of 16.5 cm from the back of the head in Figure 3, upper right. The tomogram in Figure 3, lower left (15.5 cm from the back of the head, at the level of the maxillary premolar teeth), shows a high palate arch and a well-defined nasal floor which is tilted mediolaterally. The final film in this series, Figure 3, lower right, taken at 13.5 cm from the back of the head (at the level of the maxillary molar teeth), shows the nasal turbinates, a deviated nasal septum, and clear evidence of the intact hard palate.

CASE 2. The patient shown in Figure 4 is a 17-year-old male with bifid nose, hypertelorism, encephalocele and a high arched palate. As distinguished from most midline clefts, in this case there was no clinical evidence of a frank cleft of either the lip or palate. The anteroposterior tomograms taken at 20 cm, 19.5 cm, and 19.0 cm, respectively, from the back of the head (Figure 5), show an anterior centrally located cleft of the hard palate beneath the intact mucous membrane.

CASE 3. A somewhat different diagnostic problem was presented in the case of

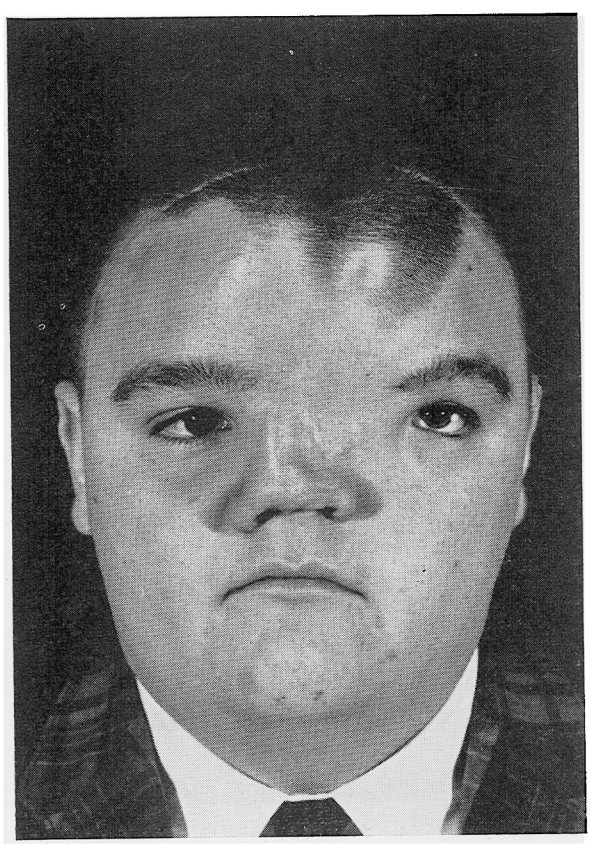

FIGURE 4. Bifid nose, hypertelorism and frontal bone defect in a 17-year-old male (Case 2).

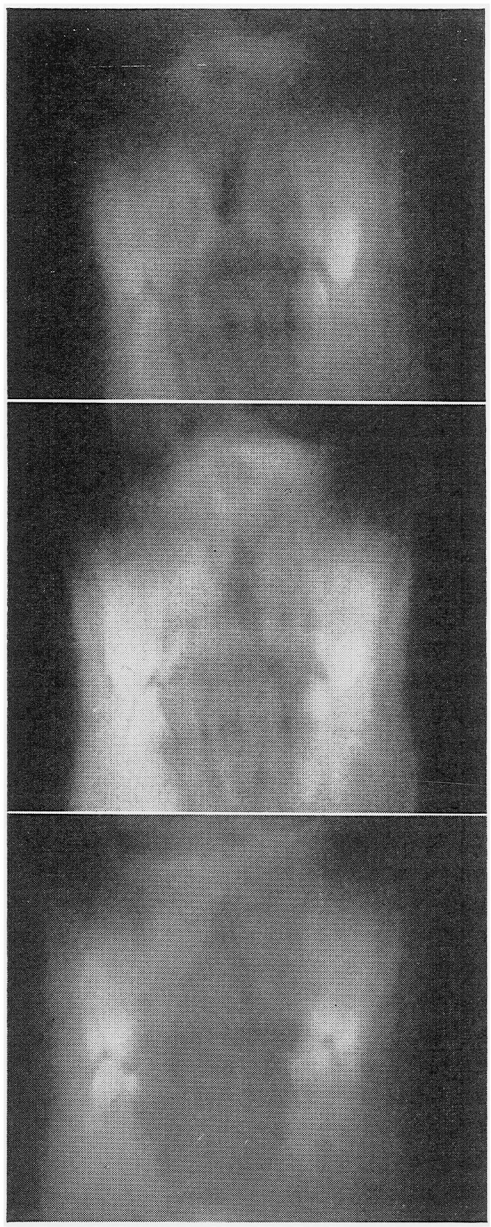

FIGURE 5. A-P tomograms of Case 2, shown in Figure 4. Distances from the back of the head are left, 20 cm, middle, 19.5 cm, and right, 19 cm.

a 21-year-old female with Klippel-Feil syndrome. Although the lip and palate were intact and although the soft palate showed no clinical signs of bifidity or submucous cleft, this patient had distinctly hypernasal speech. The results of previous tomographic studies suggested that the technique might be of value, and here, too, a midline defect of the hard palate was found in the anteroposterior tomogram taken at 16 cm from the back of the head (Figure 6).

FIGURE 6. A-P tomogram showing previously undetected palatal defect in a 21-year-old female with Klippel-Feil syndrome (Case 3).

Summary and Conclusions

While in most patients seen in a cleft palate clinic, the routine use of tomographic roentgenography is not necessary (or perhaps warranted) because of the cost, time, and radiation exposure involved, it is an invaluable diagnostic aid in the detection of occult or unusual clefts of the hard palate such as those seen in the three cases presented here. Using refined techniques, roentgenographic images of skull sections only 1 mm in thickness may be obtained. When such a series of tomograms is available, it is possible to determine both the position and extent of the bony defect.

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References

1. Burian, F., Median clefts of the nose. *Acta chir. Plasticae, 2,* 180–189, 1960.
2. Esser, E., La fissure mediane du nez. *Plast. Chirurg.*, Milan, *1,* 40–51, 1939.
3. Hodes, P. J., de Moor, J., and Ernst, R. In *Radiologic Clinics of North America.* Philadelphia: W. B. Saunders Co., *1,* 229–243, 1963.
4. Kitamura, H., and Kraus, B., Visceral variations and defects associated with cleft lip and palate in human fetuses: a macroscopic description. *Cleft Palate J., 1,* 99–115, 1964.
5. Kraus, B., Kitamura, H., and Ooe, T., Malformations associated with cleft lip and palate in human embryos and fetuses. *Amer. J. obst. Gyn., 86,* 321–328, 1963.
6. Rogers, B. O., Rare craniofacial deformities. In *Reconstructive Plastic Surgery,* J. M. Converse (Ed.). Philadelphia: W. B. Saunders Co., 1213–1305, 1964.
7. Stieve, F. E., The advantages of multidirectional tube/film movement in comparison with unidirectional movement in tomography. *Medimundi* (Phillips), *10,* 49–52, 1965.
8. Webster, J. P., and Deming, E. G., Surgical treatment of the bifid nose. *Plastic reconstr. Surg., 6,* 1–37, 1950.