Abnormalities Found on Cephalometric Radiographs

STUART BISK, D.D.S.

FRED A. LEE, M.D.*

With the introduction of the cephalometer by Broadbent in 1931 orthodontists were given a valuable tool for investigation of facial and cranial growth. This instrument has also enabled the orthodontist to better understand the position of the dentition in relation to the craniofacial skeleton.

Through the use of cephalometrics a number of analyses have been developed to help the practicing orthodontist in clinical evaluation and treatment planning for his patients. Most of these analyses are based on measurements obtained from detailed cephalometric tracings of the major dentofacial structures. In recent years the computer is being utilized for interpretation of the measurements obtained from cephalometric tracings. Thus, the orthodontist is provided with a "print-out" data sheet from which the diagnosis, prognosis, and treatment plan is derived.

However, orthodontists also have the responsibility to carefully examine the cephalometric radiograph, not only to observe facial patterns or verify accuracy of the tracing or computer "print-out," but also to determine if other abnormalities are present. We must not forget that the field of orthodontics is concerned with the health of the entire individual.

The purpose of this study is to review lateral cephalometric head films of 513 orthodontic patients for abnormalities of interest to the physician.

REVIEW OF THE LITERATURE

Early articles in the field of cephalometric radiography were concerned with methods for standardizing techniques.[3-6,13,18] Significant investigations of human growth and development were then undertaken by Broadbent[5] and Brodie;[7-9] this literature was followed by articles in the field of diagnosis.[6,15] In the early cephalometric literature Higley mentioned areas of interest on the lateral head roentgenogram which were not usually revealed otherwise. Among those items listed by him were internal and external cranial development including sinuses, pituitary fossa, and excessive adenoid growth. The diagnostic literature was mainly concerned, however, with the relation of the dentition to the craniofacial structures.[12,16,28]

Cephalometric roentgenology has also been adapted for the study of the temporomandibular joint.[14] Cephalometric roentgenograms, although yielding a complete and undistorted image of the cranium, have the disadvantage of obscuring the glenoid fossa and its relation to the mandibular condyle.[29] Brader[2] and Ricketts[21] have established the necessity for trustworthy methods for unobstructed viewing of the temporomandibular joint. Cephalometric laminagraphy with lateral and oblique views fulfilled the requirements of a superior technique.[2,21-24]

Cephalometric radiographs as well as cephalometric laminagrams of the midsagittal plane have been used by

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*Associate Radiologist, Children's Hospital, Los Angeles and Clinical Associate Professor of Radiology, Univ. of Southern California School of Medicine.

Ricketts[25,27] and Linder-Aronson[17] to investigate the tonsillar and adenoidal lymphoid tissue. The relation of this lymphatic tissue to the nasopharynx has been linked to the clinical symptoms of tongue posture and mouth breathing. This in turn influences the particular characteristics of the dentition and facial skeleton.[17]

Surveys have been made on the incidence of abnormalities noted on periapical radiographs.[1,11] Panoramic radiographs have also been utilized for studies involving abnormalities present.[19] However, there is little material concerning surveys for pathoses on the cephalometric radiograph.

Nanda[20] reported on four cases in which conditions found on the routine lateral cephalometric orthodontic radiograph were findings, he believed, to be of major medical significance. These findings included the presence of a foreign body in the nostril, a benign retention cyst of the maxillary sinus, an intrasellar cyst in the area of the tuberculum sella, and a basal cell nevus syndrome of the mandible and maxilla.

Method and Materials

Beginning lateral cephalometric radiographs of 513 orthodontic patients, representing the total population of the author's practice (patient's ages ranged from 7.3 to 27.0 years of age), were used in this study. The films were divided into groups based on sex and age as follows: Girls under 10, 10-11.11, 12-13.11, 14-15.11 and above 16. Boys' X-rays were divided into similar age groups.

The lateral cephalometric radiographs were taken with a Continental Medical X-ray machine at a film target distance of 65 inches. This machine utilizes a rotating anode at a current of 100 milliamperes. Exposure time was ¼ second at 82 KV. The film cassette included a Par Speed intensifying screen. In addition, a grid consisting of 110 lines per inch was employed.

The films were examined using the standard fluorescent view box and scanned for abnormalities or pathology which would be significant to the medical radiologist. At this time it should be noted that every effort was made to label as normal as many of the findings as possible. In addition, any other interesting observations were recorded.

The lateral head roentgenograms were studied in a systematic manner to prevent the clinician's attention from being diverted by one specific finding. First, the cranium was observed. Inspection of sella turcica and the paranasal sinuses followed by the nasal pharynx and cervical area was the sequence for examination in this study.

Areas on the lateral cephalometric radiograph which were of particular interest to the pediatric radiologist were the mastoids, paranasal sinuses, sella turcica, nasal pharynx including adenoid and tonsillar tissue, prevertebral area, soft palate, uvula, tongue, epiglottis, hyoid bone, vallecula, aryepiglottic fold, arytenoid, cervical spinal canal and spinal column, and calvarium.

Findings

Eighteen or 3.5 percent were classified as having abnormalities or pathology present. The standard error of 3.5 is .8. The 95% confidence interval is $3.5 \pm 1.6\%$.

In addition to the 18 abnormal findings there were seven findings of incidental interest noted on the lateral head films.

Table I indicates the distribution of abnormal findings according to age.

Table II indicates distribution according to pathology present.

The seven findings labeled as interesting included calcification of the interclinoid ligaments, ear lobes, external

TABLE I

Age	No.	Abnormal
Under 10	57	4
10-11.11	174	3
12-13.11	194	8
14-15.11	62	0
16 & above	36	3
Total	513	18

TABLE II

DISTRIBUTION OF ABNORMALITIES OR PATHOLOGY

Pathology		No.
Adenoid tissue enlargement		5
Failure in segmentation of C4 & C5		1
Impacted cuspid at the symphysis		1
Interstitial emphysema		1
Osteoma of frontal sinus		1
Polyp of maxillary sinus		1
Sinusitis		8
Maxillary	5	
Sphenoidal	2	
Pan	1	
Total		18

occipital spur, two ponticulus posticus, poorly developed sphenoidal sinus, and thyroid cartilage calcification.

Discussion

Very few articles in the field of cephalometrics pertain to nondental abnormalities or pathoses present on the films. It is true that in orthodontics the clinician is, for the most part, working with a healthy population. However, this does not eliminate the possibility of uncovering an important medical finding on the lateral cephalometric radiograph.

The present study was undertaken for the purpose of investigating the incidence, types, and clinical features of pathoses on the cephalometric radiograph.

As might have been predicted, the incidence was low, 3.5 percent. In addition, there was nothing remarkable about the distribution of pathology as to sex or age group.

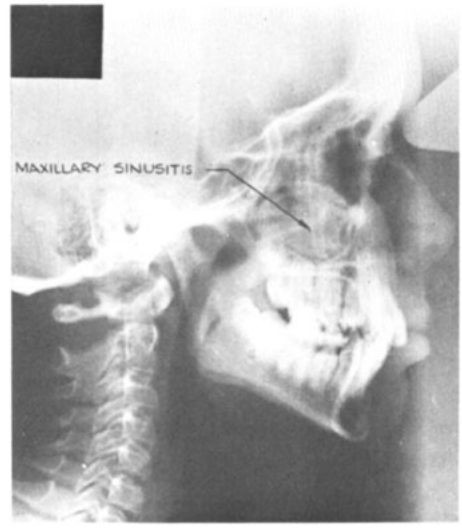

Fig. 1

The majority of findings were either sinusitis, eight subjects, or enlarged adenoid tissue, five subjects. Six of the eight patients exhibiting sinusitis did not show similar findings on previous or subsequent films. One subject did not have additional films while the other subject exhibited persistent maxillary sinusitis on a subsequent film (Fig. 1).

The adenoids are normally quite prominent in pre- and early-adolescent children; nevertheless, five subjects were felt to have excessively large adenoids (Fig. 2). Of these five patients two had been asked to consult their pediatricians because of the associated symptoms of mouth breathing and bimaxillary crossbite. Orthodontic treatment for these five patients was difficult because of their steep palatal and mandibular plane angles. Their palatal-mandibular plane angles ranged from 28 to 38 degrees while their GoGn-SN angles ranged from 34 to 48 degrees. The patient having the relatively low GoGn-SN angle, 34 degrees, exhibited a relatively high palatal-mandibular plane angle of 31 degrees.

Fig. 2

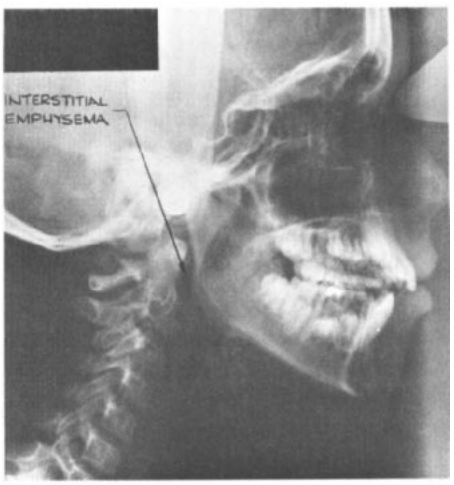

Fig. 3

The finding of interstitial emphysema in the cervical prevertebral tissues in one patient was of great interest (Fig. 3). Interstitial emphysema in the neck may develop as a result of a direct puncture wound in the posterior pharynx, following dental extraction or operative procedures, as a result of infection with abscess formation by a gas forming organism or, most commonly, by upward dissection from a pneumomediastinum. The latter is the likely cause in this patient with a family and past medical history of allergy. This

Fig. 4

was a transitory finding and was not observed on subsequent films.

The patient with the impacted cuspid at the symphysis was referred to the oral surgeon (Fig. 4). Routine full mouth radiographs would not have revealed this unusual horizontally-impacted mandibular tooth.

Congenital failure in segmentation of C4 and C5 does not require treatment (Fig. 5).

Subsequent films have not as yet been taken for the probable osteoma of the frontal sinus (Fig. 6). This is likely an isolated finding of no clinical signifi-

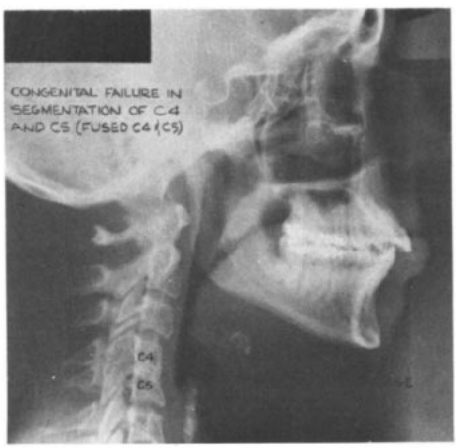

Fig. 5

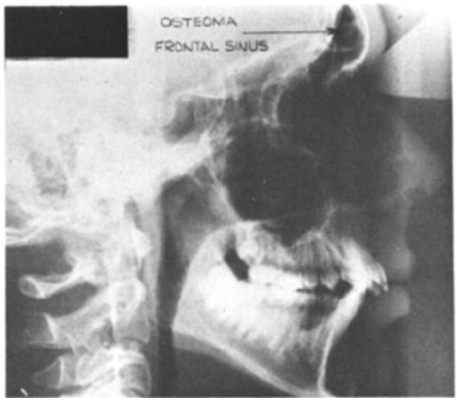

Fig. 6

cance, although it can be part of Gardners syndrome of multiple osteomas, soft tissue fibromas, and intestinal polyposis.

Seven findings were labeled as items of interest because they are not usual findings. However, they should not be interpreted as abnormalities. They are merely variations of normal anatomy.

Summary

The films of 513 consecutive patients from a private practice were brought to Children's Hospital, Los Angeles for reading in their Radiology Department.

Eighteen films, 3.5 percent, were classified as having abnormalities or pathologies present. In addition, there were seven findings labeled as interesting, although normal, because they are usually not present on the lateral head film.

The lateral orthodontic cephalometric head film can disclose a variety of pathoses which are significant to the physician. The orthodontist should study the lateral head roentgenogram for nondental abnormalities.

1411 West Seventh Street
San Pedro, California 90732

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