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Computed Tomography of the Optic Canals

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Radiographic delineation of the optic canals was first performed by Winckler [1] in 1901 and then by Rhese [2], who outlined the canal in the oblique position. Further refinements were made by Goalwin [3, 4], who examined 1,000 optic canals, and later by Pfeiffer [5], whose x-ray techniques are now commonly used in projecting the optic foramen in the inferolateral quadrant of the orbit.

The simultaneous demonstration of both optic canals in their axial plane by complex motion tomography [6, 7] further improved the detection of subtle abnormalities. However, a drawback of this technique is that it requires a skilled technician and a cooperative patient. The hyperextended head position required to obtain the satisfactory angle is often difficult for adult patients. Computed tomography (CT) has now enabled routine detailed visualization of the optic canals without subjecting the patient to any discomfort.

Method

With the patient supine, the head is placed in a slightly hyperextended position. A lateral view digital radiograph is obtained. The electronically generated line to indicate the angle of scan is placed so that the plane of scan extends from the tip of the anterior clinoids to a point slightly craniad to the inferior orbital rim. This corresponds to the axis of the optic canal and subtends to an angle of −40° to the orbitomeatal line (outer orbital canthus to the external auditory canal) or −30° to Reid baseline (inferior orbital rim to the external auditory canal) (fig. 1) [4, 5]. A few degrees of gantry tilt may be necessary to achieve precise alignment with the angle of the electronically generated line on the digital radiograph. A single 5 mm scan at this selected level is obtained, followed by one contiguous scan on either side. It is often necessary to obtain one more scan between the middle section and the one above or below, so as to precisely section through the axis of the canal without including the bony margins of the floor or the roof (fig. 2). As the vertical height of the central part of the canal is about 5 mm, thicker sections may be unsuitable.

The optic canal cannot be evaluated adequately unless the section is precisely through its axis. Therefore, a scan with an angle that is significantly less than the required −30° to Reid baseline, will section the canal obliquely and give it a spurious funneled configuration (fig. 3).

This method was used successfully in four adult skulls and five adult patients with normal and abnormal optic canals. The axis of the optic canal is less in children [3]. In infancy about 10° less angulation (i.e., 20° relative to Reid baseline) is required, with increasing angulation until the −30° of the adult configuration is reached in adolescence.

To complete the examination of the anterior optic pathways, both the intraorbital optic nerve and the optic chiasm should be imaged. No single plane is ideal for visualization of the intraorbital optic nerve [8]; however, we have found that it can be visualized adequately when viewed at soft tissue settings with the same three consecutive 5 mm slices obtained for the optic canal (fig. 4). The optic chiasm, however, is suboptimally delineated with sections in this plane and should be imaged with scans parallel to the orbitomeatal line [9].

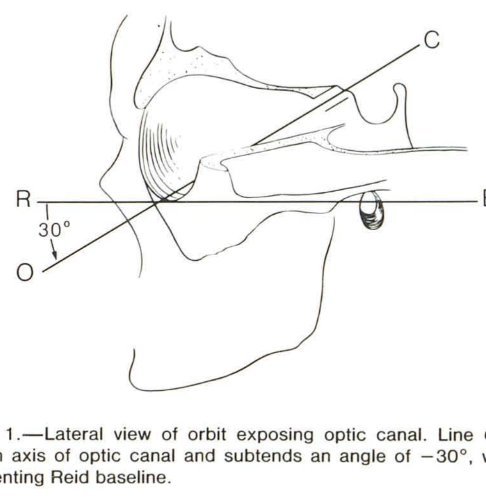

Fig. 1.—Lateral view of orbit exposing optic canal. Line *OC* extends through axis of optic canal and subtends an angle of −30°, with line *RB* representing Reid baseline.

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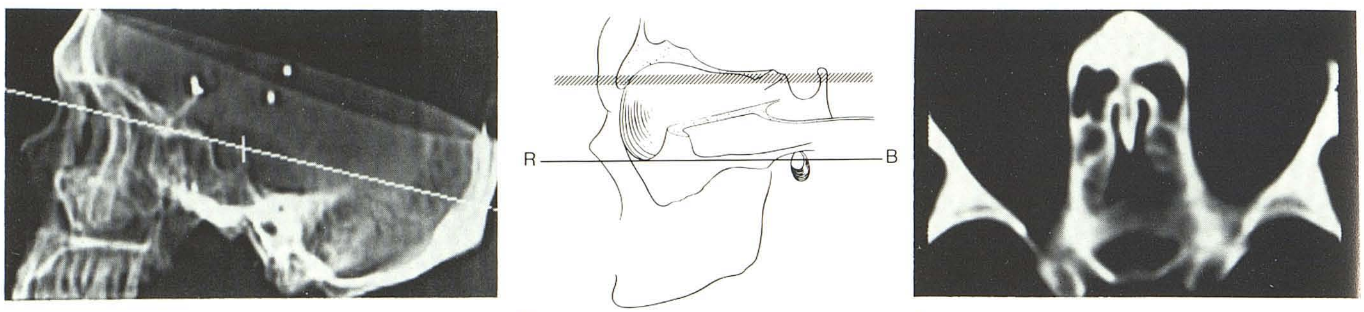
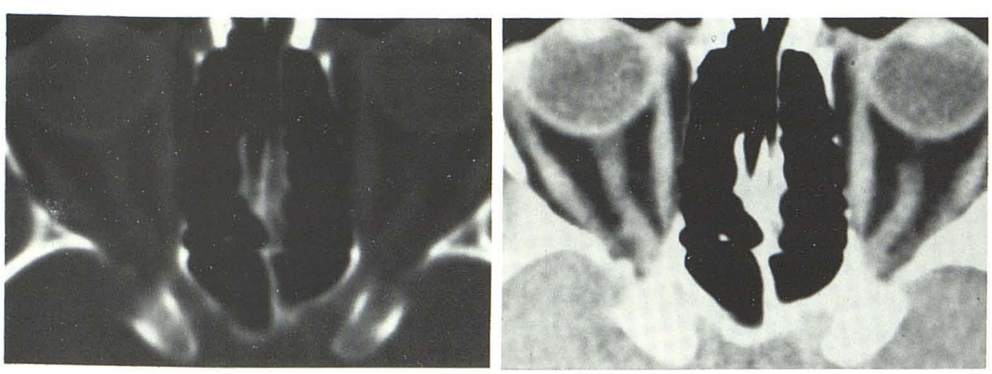
A B C

Fig. 2.—**A**, Lateral digital skull film. Electronically generated line *1* extends from anterior clinoids (or, if they cannot be visualized, the tuberculum sella) to the inferior orbital rim. Scans *2* and *3* are 5 mm craniad and caudad, respectively, to *1*. Scan *4* 1 mm caudad to scan *1*. **B**, Scan (line) *1*. Section is perfectly aligned with axis of left optic canal, but due to slight rotation, bone at orbital end of right optic canal (*arrow*) is included. **C**, Scan *4*. Section now perfectly aligned with axis of right optic canal. Bone at intracranial end of left optic canal (*arrow*) is included.



A B C

Fig. 3.—**A**, Lateral digital skull film. Electronically generated line indicating section through optic canals at plane parallel to Reid baseline. **B**, Same scan plane as in **A** (shaded area), parallel to Reid baseline, sections optic canals obliquely. **C**, Scan corresponding to **A**. Spurious funneling of optic canals due to oblique plane of section through cylindrically shaped optic canal.



A B

Fig. 4.—**A**, Scan through axis of optic canals at bone settings in normal patient. Symmetrical flaring of intracranial aspect of both optic canals is normal variant. **B**, Same image as in **A**, with soft tissue settings. Visualization of most intraorbital optic nerves is satisfactory.

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