Diagnosis of orbital lesions has traditionally been difficult when the orbital walls are not involved. Pathologic processes involving the orbit walls have been accurately analyzed by plain films and tomograms which can detail bone changes. Contrast angiography is useful when orbit tumors are large or have a significant blood supply. However, small avascular tumors in the orbit have been difficult to detect, define, and localize by these techniques (Trokel, 1976). Confusion also arises because swollen extraocular muscles may become large enough to mimic a neoplasm using these angiographic techniques.

This clinical problem has made the advent of computerized tomography particularly welcome since it directly visualizes the orbital soft tissue structures. In the four years that computerized tomography has been generally available it has become the preferred diagnostic technique for clinical investigation of orbital disease (Wright et al., 1975; Dallow et al., 1976; Hilal et al., 1976, 1977). This is because its tomographic image has unusual soft tissue discrimination and shows subtle differences among orbital structures. Fat is distinguished from water which in turn is distinguished from solid tissues. Soft tissue contours are imaged simultaneously with bony structures and their relationship determined. The sclera, vitreous, crystalline lens, optic nerve, extraocular muscles, and orbital fat are reliably seen in relationship to the adjacent bone. Intracranially it is routinely possible to demonstrate the cerebral ventricles, subarachnoid spaces, the cerebral sulci, and grey and white matter. Small amounts of calcium not visible on plain x-rays are shown. Similarly, a wide range of foreign material of low radiographic density is readily detected.

Many commercial machines have been developed but the first available and most widely distributed is the EMI scanner produced by the EMI corporation in England. This machine, designed for analysis of intracranial disease, is well suited for modification for orbital study. A newer machine, the AS&E-CT scanner has recently become available (Hilal et al., 1977, in press) and significantly increases the resolution of orbital detail. We are reporting the results of thin section CT scanning of 603 patients of whom 5 were studied with the AS&E scanner.
Fig. 1. Normal orbit prepared with AS&E CT scanner. The resolution of the bone detail approaches conventional pleridirectional tomography. Soft tissue structures are detailed into the orbit apex in this 2 mm section.

METHODS

Thin section tomography

High resolution in the EMI machine is achieved by decreasing the thickness of the slices from the standard (Hilal & Trokel, 1977) 10 mm to 3.5 mm. It is only with these thin sections that details of the orbit apex are resolved sufficiently to be used clinically. Briefly, necessary modifications for orbital CT scanning include proper skull positioning with rigid stabilization. Maximal extension of the head is required to include the entire orbital volume within the scanning area of the machine. The narrow x-ray beam width is necessary for scanning because of the small sizes of orbital structures. The wide scan beam does not resolve the extraocular muscles and the optic nerve at the apex of the orbit.

The AS&E machine is based on a 512 matrix and produces sections of two mm thickness. This capability is supplemented by a zoom magnification which provides exquisite details of orbital structures. Figure 1 is a CT scan of a normal orbit prepared with the AS&E scanner. The horizontal recti can be followed to their origins in the orbit apex and the normal variation in thickness and anatomic contour appreciated. The resolution of the bone detail approaches that which is obtained with conventional pleridirectional tomography. We show both oblique muscles in scans with the AS&E machine. The obliques have not been demonstrable in the EMI scanner even with collimation.