A simple visual alignment device for use with the Leksell stereotactic co-ordinate frame

B. H. DAWSON¹, E. DERVIN², AND O. B. HEYWOOD²

From the Department of Neurological Surgery,
Salford Royal Hospital, Salford

Alignment of the co-ordinate reference frame and film cassette with the x-ray source and the control of image magnification and distortion due to divergence of the x-rays were resolved by Leksell (1949) in the following manner.

Three drills are used to fix the rectangular co-ordinate reference frame firmly to the patients skull. The x-ray source is coupled magnetically and aligned with the co-ordinate frame by a counter-

¹Consultant neurological surgeon, Salford Royal Hospital
²Lecturer in mechanical engineering, University of Salford.

balanced aluminium connector tube, which also supports the x-ray cassette for the lateral or anteroposterior projections (Figs. 1a and b).

Image magnification of the ventricular reference structures and co-ordinate scales is constant, because the distances between the cassettes, the co-ordinate frame, and the x-ray source are fixed.

Image distortion is also controlled because the film cassette and the co-ordinate frame are maintained in parallel planes by the coupling tube.

This rigid coupling system has certain disadvantages.

FIGS. 1a and b. Arrangements for lateral and anteroposterior projections using the standard Leksell technique.
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Advantages which, to some extent, limit its usefulness:

1. The attachment of the connector tube and the maintenance of the position of the x-ray film cassette sometimes proves difficult. Careless attachment of the connector tube or unpredictable movement of the patient may disconnect the magnetic lock between the Leksell co-ordinate frame and the connector tube, or may even dislodge the co-ordinate frame from the patient’s skull, with consequent loss of the fixed co-ordinate system.

2. A true edge-on view of the mid-sagittal plane will not be obtained in the anteroposterior projection if the co-ordinate frame has been misaligned relative to the patient’s ventricular system. The rigid coupling system of Leksell only gives a true edge-on view of the mid-sagittal plane when the operator has been fortunate in achieving alignment of the mid-sagittal plane of the brain coincident with the XX axis of the co-ordinate frame (Fig. 2a). Misalignment may be a lateral offset of the brain mid plane relative to the frame (Fig. 2b), or rotation of the brain about the vertical Y axis of the frame (Fig. 2c). A combination of both lateral offset and rotation about the vertical Y axis (Fig. 2d) is a

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**FIG. 2.** Leksell frame and x-ray source in position for AP projections. Viewed from above (plan view).

I = incorrect position of x-ray source. C = correct position of x-ray source.
frequent occurrence. With the standard Leksell method when frame misalignment occurs, the frame has to be refixed before the stereotactic procedure can continue with accuracy. This extra manoeuvre causes discomfort to the patient.

3. In patients with marked postural deformity, the engagement of the connector tube may prove difficult or even impossible.

In the Salford technique the rigid connecting tube has been replaced. A simple visual device is used to align the x-ray source. A detachable sub-frame carries the co-ordinate frame and supports the patient's head weight, and also the lateral and AP x-ray cassettes (Fig. 3). The alignment device consists of a pair of simple visual sighting boxes attached to a light magnesium alloy structure easily clipped on to the Leksell frame. The light beam from the optical delineator (now a standard accessory on most x-ray machines) is used to project an image of cross-wires at the open end of the box on to a plastic screen. Alignment of the x-ray source with respect to the co-ordinate frame is achieved when the shadow of the spot representing the source and shadows of the cross-wires are superimposed on the engraved cross of the screen (Fig. 4). The cross-wires

FIG. 3. Exploded view of modified co-ordinate frame, sub-frame, alignment device, and lateral x-ray cassette.

FIG. 4. Alignment device in use showing cross wires and rear screen. Small diagrams show (a) correct and (b) incorrect alignment of x-ray source.
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FIG. 5. Lateral radiograph showing lead images of cross wires (dashes) and engraved cross (dots) superimposed.

carry lead line markers at intervals, which appear as dashes on the radiograph. Lead dot markers inserted in the engraved cross of the plastic screen also appear on the radiograph and thereby record the beam alignment at the time the film is exposed (Fig. 5). A simple distance indicator between the x-ray tube and the alignment device maintains a fixed distance for magnification calculations.

The absence of the rigid coupling between the x-ray tube and the co-ordinate frame allows movement of the x-ray source into the correct position for a true anteroposterior projection. The usual procedure is to expose three AP films with varying degrees of tube movement and to select the film which displays the most symmetrical ventricular pattern. These new techniques have been used at the Salford Royal Hospital constantly over a period of two years with satisfactory results.

REFERENCE