The field of bone densitometry has grown rapidly, particularly in the past 15 years. Many techniques are now available from which the physician may choose. Although the clinical application of these technologies is relatively recent, the history of densitometry began over 60 years ago.

**PLAIN RADIOGRAPHY IN THE ASSESSMENT OF BONE DENSITY**

Some of the earliest attempts to quantify bone density utilized plain skeletal radiography. When viewed by the unaided eye, plain skeletal radiographs have never been useful for quantifying bone density. Demineralization becomes visually apparent only after 40% or more of the bone density has been lost (1). Beyond that general statement, no quantification of the bone density can be made. Plain radiographs have been used for
qualitative and quantitative skeletal morphometry, and were also used to assess bone density based on the optical densities of the skeleton when compared to simultaneously X-rayed standards of known density. With the advent of photon absorptiometric techniques, most of these early methods have fallen into disuse. Nevertheless, a brief review of these techniques should enhance the appreciation of the capabilities of modern testing, as well as provide a background for understanding modern technologies.

QUALITATIVE SPINAL MORPHOMETRY AND THE SINGH INDEX

Qualitative Spinal Morphometry

Qualitative morphometric techniques for the assessment of bone density have been in limited use for over 50 years. Grading systems for the spine relied on the appearance of the trabecular patterns within the vertebral body, and the appearance and thickness of the cortical shell (2). Vertebrae were graded from IV down to I, as the vertical trabecular pattern became more pronounced with the loss of the horizontal trabeculae and the cortical shell became progressively thinned. The spine shown in Fig. 1-1 demonstrates a pronounced vertical trabecular pattern. The cortical shell appears to be outlined in white around the more radiotranslucent vertebral body. These vertebrae would be classified as Grade II.

The Singh Index

The Singh Index is a qualitative morphometric technique that was similarly based on trabecular patterns, but based on those seen in the proximal femur (3). Singh and others had noted that there appeared to be a predictable pattern to the disappearance of the five groups of trabeculae in the proximal femur in osteoporosis. Based on this order of disappearance, radiographs of the proximal femur could be graded 1 through 6 with lower values indicating a greater loss of the trabecular patterns normally seen in the proximal femur. Studies evaluating prevalent fractures demonstrated a good association between Singh Index values of 3 or less and the presence of fractures of the hip, spine, or wrist. Figure 1-2 shows a proximal femur with a Singh Index of 2. Only the trabecular pattern known as the principle compressive group, which extends from the medial cortex of the shaft to the upper portion of the head of the femur, remains. This patient was known to have had osteoporotic spine fractures, as well as a contralateral proximal femur fracture. Subsequent attempts to demonstrate a strong correlation of Singh Index values and bone density of the proximal femur, measured by dual-photon absorptiometry, have not been successful (4). These qualitative morphometric techniques were highly subjective. In general, the best