Bone Scan in Dental Diseases

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Bone images of the jaws and related dental structures were obtained in 25 patients undergoing skeletal surveys. The upper and lower jaws were divided into eight quadrants to facilitate comparisons between scintigraphic image findings and the results of dental examination. Fourteen of these 25 patients had at least one jaw quadrant with a positive image. The areas of positive uptake correlated well with dental examination findings, which included healing extraction sites and common dental diseases, such as pulpal and periodontal infections and irritations from ill-fitting dentures. The potential usefulness of bone imaging as an adjunct in dental diagnosis is discussed.

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Although positive uptakes in the oral cavity are frequently observed in radiotracer bone surveys, their clinical significance is often overlooked or uncertain. The available reports in the literature have been concerned primarily with rare jaw lesions such as tumors, cysts, fibrous dysplasia, metabolic bone diseases, and osteomyelitis (*1–5*). It is unlikely that these uncommon lesions can account for the many positive observations made in skeletal imaging. In the present study we examined a hospital population undergoing diagnostic bone scanning for conditions unrelated to the oral cavity in order to determine: (a) an estimated frequency of positive jaw scintigrams; (b) the basis for uptake in terms of oral disease status; and (c) the potential applications of bone imaging in dental diagnoses.

METHODS

Patients. Patients undergoing skeletal imaging as part of diagnostic workups were asked to participate in the jaw survey. Twenty-five patients consented including 24 men and one woman, ranging in age from 21 to 72 yr.

Imaging. The radiopharmaceutical was either diphosphonate or methylene diphosphonate, labeled with 15 mCi of Tc-99m. Three views of the jaws were made with either a single-crystal scintillation camera with a low-energy high-resolution collimator or a multi-crystal scintillation camera with a parallel-hole collimator coupled to a copper filter. The three jaw views were right and left lateral, and anterior. The lateral view was made with the collimator face parallel to the sagittal plane of the skull. The anterior view was made with the head tilted backward to form a 75° angle between the canthomeatal line and the crystal surface. The subject was asked to maintain a relaxed jaw position. Any removable partial or full dentures were left in place during imaging. A minimum of 500,000 counts were obtained for each image view.

Dental examinations. Within two weeks of jaw imaging, each patient received a detailed dental and radiographic examination of the jaws. Positive findings were classified as:

1. Bone healing following tooth extractions or root-canal treatments within 18 mo before imaging.
2. Advanced active disease: radiographic evidence of bone destruction with marked clinical symptoms such as pain, swelling, sensitivity to palpation, etc.
3. Early active disease: moderate-to-severe clinical signs and/or symptoms of dental disease, but without radiographic evidence of bone destruction.
4. Inactive disease: radiographic signs of disease with negative or minimal clinical features suggestive of arrested disease.

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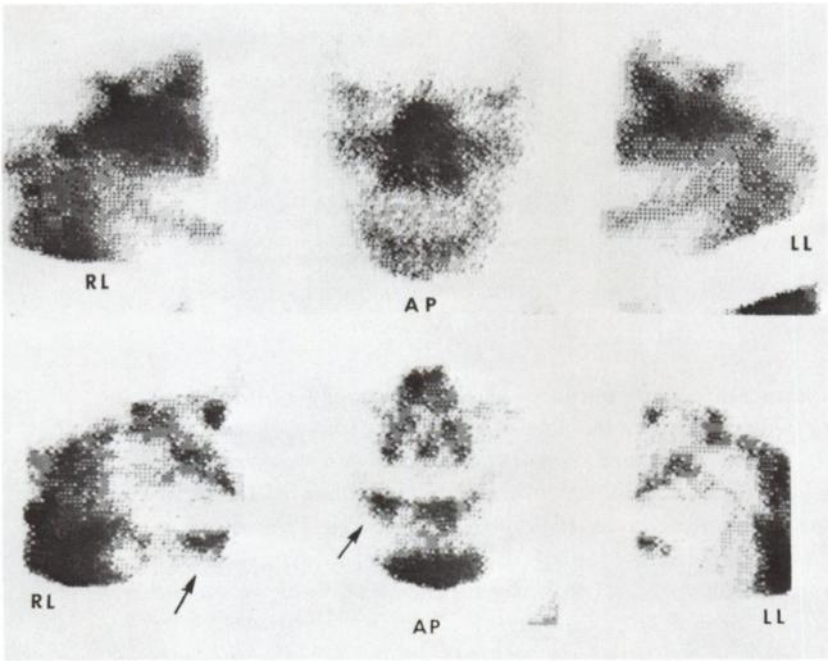

FIG. 1. Upper panel: normal jaw scan shown in anterior and right and left lateral projections. Lower panel: abnormal jaw scans. Arrows indicate positive areas as seen on right lateral and anterior projections. Intraoral radiographs of same patient (not shown) confirmed area of acute periodontal disease involving lower right premolar and molar teeth, corresponding to positive area on jaw scan.

Comparisons of findings. In order to relate dental disease to scintigraphic findings, the mandible and maxilla were each divided into right and left halves, with each half subdivided into anterior and posterior quadrants. Thus, there were eight quadrants or jaw regions of the mouth in which to locate positive findings from both types of examination.

RESULTS

Positive jaw scans were observed in 14 of the 25 patients, most of whom had more than one positive jaw quadrant. There were 56 positive quadrants among the 200 total imaged. Normal and abnormal jaw scans are shown in Fig. 1. Comparisons between dental and scintigraphic findings are summarized in Table 1.

Jaw images were positive, as expected, in all areas of healing bone. The advanced active diseases included numberous pulpal and periodontal abscesses, a cyst, and a residual osteitis. Twenty of 22 quadrants in this disease category were tracer-positive. The remaining two, unexpectedly unremarkable, were from one patient who had sustained a blow to the anterior mandible some 10 yr previously. Oral examination revealed a large draining cyst that subsequent biopsy proved to be aseptic and benign. Of the 14 early active disease quadrants, 11 were attributed to sores resulting from ill-fitting dentures, and five of these were tracer-positive. Positive uptake was also observed in quadrants with either inactive disease (14 of 44) or no disease (6 of 112).

TABLE 1.

Dental diagnosis	Total no. of quadrants	Results of jaw imaging: No. positive	Results of jaw imaging: No. normal
Healing bone	11	11	0
Advanced active disease	22	20	2
Early active disease	14	5	9
Inactive disease	41	14	27
No disease	112	6	106
Total	200	56	144

DISCUSSION

It is clear that abnormal uptake on skeletal images of the jaws is a fairly common occurrence (14 of 25 patients, or 56 of 200 mouth quadrants). The underlying tissue abnormalities in almost all instances were common dental diseases such as pulpitis and periodontitis, chronic irritations of the oral mucosa resulting from ill-fitting dentures, and healing bone following recent extractions or root-canal treatments. These findings are in accordance with those of reported animal studies (*6–8*). The common factor responsible for the positive finding appears to be an osteoblastic reaction to disease or trauma (*9,10*).

Positive jaw images were observed, as expected, in all quadrants but two classified in the first two dental categories: healing bone, and advanced active disease. The one exception was the negative finding for the traumatic cyst. Our findings are in disagreement with reports of similar lesions (*2,4*). We have tentatively concluded that intermittent, spontaneous

drainage of the sterile lesion might have accounted for the lack of a detectable osteoblastic response.

Although none of the quadrants with denture sores showed radiographic evidence of bone destruction, roughly half of them (5 of 11) were tracer-positive. It is probable that abnormal uptake represented a bony reaction to irritation that was chronic but insufficient to produce focal radiographic defects.

The common dental diseases are largely chronic, progressive conditions with episodic acute exacerbations of clinical symptoms. The 41 quadrants assigned to the inactive disease category were, by dental criteria, in arrested disease states, treatment for which could be postponed. Unexpectedly, one-third (14 of 41) showed positive uptake, indicating perhaps the initial phase of an acute episode preceding clinical signs of acute disease. This is a speculative interpretation, which is being tested by followup examinations for clinical signs of acute conversion. Likewise, the six positive quadrants among the 112 apparently normal ones may well represent early detection of incipient diseases escaping detection by current dental diagnostic methods. This matter is also being tested and, we hope, will be clarified by subsequent examinations.

From our results, the major application of jaw imaging in a hospital environment appears to be the detection of occult infectious dental lesions, specifically those that may be considered inactive by current dental diagnostic criteria. Such timely diagnosis may have a salutory effect on the outcome of cardiovascular reconstructive surgery, for which careful preoperative identification and eradication of potential sources of hematogenous contamination is of prime importance. The role of radionuclide imaging would be to complement routine dental examinations of these high-risk patients, in whom clinical diagnosis is equivocal. Jaw imaging may also prove to be useful in the workups of difficult cases of fever of unknown origin, in which incipient dental infection might have escaped clinical diagnosis in its early course.

In summary, positive uptakes in the jaws are often encountered during routine radionuclide skeletal surveys. The majority of these are accounted for by common dental diseases, some of which cannot be judged active by current dental diagnostic criteria.

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