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Some Dental Materials Cause Hot Spots in the Oral Region When Whole Body ^{131}I Scans Are Done after Thyroidectomy

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Savas H, Wong KK, Saglik B, Hubers D, Ackermann RJ, Avram AM. SPECT/CT characterization of oral activity on radioiodine scintigraphy. J Clin Endocrinol Metab. September 3, 2013 [E-published ahead of print]. doi:10.1210/jc.2013-2467.

SUMMARY

Background

When an ^{131}I total-body scan is performed after thyroidectomy to look for metastases, radioactivity is often detected in the mouth. This has previously been attributed to saliva or dental/periodontal disease. The authors noted many such foci of uptake in the oral region on planar scans, and they felt these foci were too common to be attributed to pooled saliva or to dental or periodontal inflammation.

Methods

The authors utilized single-photon-emission computed tomography (SPECT) combined with computed tomographic (CT) radiography to obtain a more precise three-dimensional localization of these radioactive foci than is possible on planar ^{131}I scanning. Between April 2007 and April 2011, a total of 216 consecutive patients with differentiated thyroid cancer had undergone both a preablation diagnostic ^{131}I planar scan and SPECT/CT imaging. None had had reported symptoms of tooth pain or oral swelling. All had eaten a low-iodine diet for 2 weeks and then had either been deprived of L-T_4 for 4 to 6 weeks or had been deprived of L-T_3 for 2 weeks after having received it for 4 weeks. The investigators determined the location of any focal or diffuse oral uptake on SPECT/CT fusion images and classified it as being maxillary, mandibular, or within the oral cavity. The relationship to any region of high-density dental materials was noted. Dental phantoms containing amalgam or composite filling materials, gold partial dentures, titanium abutments, porcelain fused to metal and all-ceramic crowns were soaked in 100 ml of distilled water containing 250 µCi ^{131}I for 24 hours, to simulate the amount of ^{131}I in the saliva of patients receiving a 1-mCi diagnostic scan. After air-drying for 2 hours and rinsing in water, the dental models underwent the same imaging procedures.

Results

Planar scans from 123 of 216 patients were judged to be positive or equivocal for oral cavity uptake: bilateral foci were present in 85%. Twelve patients were excluded because the scans did not include the complete oral cavity; in the remaining 111 patients, uptake that co-localized with high-density dental material was found in 86%. A total of 323 foci were observed (up to 12 foci in a single patient). Some regions with high-density dental material were not associated with ^{131}I uptake, possibly indicating that they were resin or amalgam fillings or ceramic crowns containing no metal. Scans from 16 patients showed uptake within the oral cavity: in 4 it appeared to be associated with dental material, while in 12 it was localized in the floor of the mouth, in the soft palate, or in teeth that did not contain dental materials. In all cases with focal uptake on the diagnostic scan, uptake was also observed on the therapeutic scans. The phantom tooth studies showed intense uptake in the porcelain fused-to-metal crown and the gold partial denture, less uptake in the titanium abutment, and no focal uptake in the all-ceramic crown or in the resin or amalgam fillings.

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Conclusions

The authors postulate that the negatively the charged ^{131}I ion can form a permanent or semipermanent bond with positively charged ions on dental materials containing gold, silver, palladium, or mercury. The bond formed with titanium seems weaker. Most of the uptake detected in the mouth on postthyroidectomy scans appears to be due to this benign cause.

ANALYSIS AND COMMENTARY

The authors had no information about the actual dental materials that they found to be correlated with the SPECT/CT foci, and the patients did not undergo dental examination to look for evidence of subclinical gingivitis or dental abscess associated with the dental materials. The phantom model study showed clear-cut interactions of a tracer dose of ^{131}I with several virgin dental metals, but the results might have been somewhat different if saliva had been used to soak the dental phantoms instead of distilled water. (Saliva contains substantial amounts of nonradioactive iodide, and the iodine level does not differ between euthyroid and hypothyroid subjects [1]). Interestingly, no uptake was found on the dental phantom containing a mercury/silver amalgam filling, although iodides of mercury and silver have been well characterized. A prospective study is now needed to correlate such oral foci of ^{131}I with the specific dental materials present in each patient, the length of time those materials have been in place, plus other clinical (and metallurgical) parameters. Nonetheless, previous clinical studies concerning the kinetics of radioiodine in the salivary glands, and on salivary-gland function in patients treated with ^{131}I may need to be reinterpreted.

REFERENCES

1. Harden RM, Mason DK, Buchanan WW. Quantitative studies of iodide excretion in saliva in euthyroid, hypothyroid and thyrotoxic patients. J Clin Endocrinol Metab 1965;25:957-61.