Evaluation of Biomatrix Hydroxyapatite Ocular Implants with Technetium-99m-MDP

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Hydroxyapatite ocular implants appear to offer excellent cosmetic reconstruction with lower rates of infection and extrusion compared to other integrated implants. However, vascularization of the implant needs to be established before the artificial eye is attached to the implant. Technetium-99m-methylene diphosphonate (MDP) scintigraphy can be utilized as a noninvasive method for determining the vascularity of the hydroxyapatite ocular implants. A case is presented in which ^{99m}Tc-MDP uptake in the implant was deemed sufficient for further surgical intervention.

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Technetium-99m-methylene diphosphonate (MDP) scintigraphy is used in the evaluation of hydroxyapatite as a bone replacement agent (*1*). A new application is its use as a noninvasive method for determining the vascularity of hydroxyapatite ocular implants. Ocular implants are used to replace the volume of the orbit following enucleation as well as to allow the artificial eye to move in conjunction with the normal eye when the artificial eye is coupled to the implant. Hence, these implants are also referred to as direct motility implants (*2*).

Hydroxyapatite ocular implants are made of calcium phosphate, a normal constituent of bone, with an interconnecting network of channels similar to cancellous bone (*3*). This porous configuration allows the ingrowth of fibrovascular tissue and integration of the implant into the normal orbital tissues. It is this integration that affords this particular implant its many advantages (*1,3,4*). First, it does not react like a foreign substance in the body. Second, the implant resists extrusion and migration. Third, the implant appears to be relatively resistant to infection. Last, it can be utilized as a direct motility implant after integration into the normal orbital tissues. Pathologic studies in humans and animals (*5,6*) indicate fibrovascular ingrowth in a period as little as four weeks. However, the recommended time for evaluation is 6 mo after placement of the implant (*2*).

The osteoinductive property of hydroxyapatite may explain this need for a delay of 6 mo before imaging, as well as its avidity for bone imaging agents. Osteoinductivity refers to the ability of the material to promote the growth of bone without being in contact with an osseous bed. Experimental work has shown that new bone formation may occur in extraskeletally implanted hydroxyapatite within 3 mo, but that it is most prominent 6–9 mo following implantation (*7,8*). Technetium-99m-MDP scintigraphy is a noninvasive method of evaluating the successful integration into the normal orbital tissues and therefore the optimal time for coupling with the artificial eye to afford motility.

CASE REPORT

A 47-yr-old male underwent enucleation of left eye for a predominantly spindle cell ocular melanoma followed by hydroxyapatite ocular implant placement on August 3, 1990 with suturing of extraocular muscles to the implant. The patient returned on September 10, 1991 for evaluation of the implant and possible preparation for motility coupling. Technetium-99m-MDP scintigraphy (Figs. 1 and 2) on September 10, 1991 demonstrates 4+ uptake (activity in the implant greater than activity in the midfacial bones) of radiotracer in the implant indicating ingrowth of fibrovascular tissue. SPECT imaging (Fig. 2) was also performed on this patient, confirming the intense uptake, but did not add further information regarding the viability of the implant. Following the scan, the hole was drilled and the artificial eye was attached. Viability was confirmed clinically. The implant has functioned normally without complication.

DISCUSSION

Perry (*2*) has defined a grading system for characterizing the uptake of radiotracer in implants. Uptake of 4+ is uptake in the implant greater than that in the midfacial bones, 3+ is equal to the midfacial bone, 2+ is midway between the midfacial bones and the normal orbit, while 1+ is greater than the normal orbit but not quite 2+. Uptake of 2+ or better in the implant demonstrates the successful ingrowth of fibrovascular tissue into the implant (*2*). This integration is necessary before exposure of the implant for coupling to the artificial eye. The coupling

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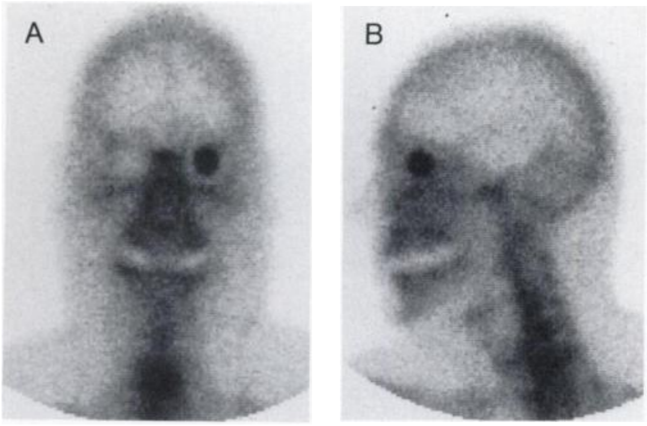

FIGURE 1. Anterior (A) and left lateral (B) images of the head 3 hr following the intravenous administration of ^{99m}Tc-MDP show prominent uptake in the hydroxyapatite ocular implant.

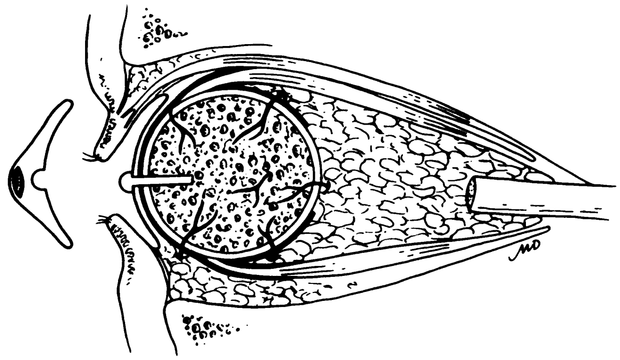

FIGURE 3. Motility implant showing vascular ingrowth and ball and socket coupling to the artificial eye (Reprinted with permission from Arthur C. Perry).

is achieved by means of a motility peg which is placed into a hole drilled into the implant and then coupled to the artificial eye by a ball-and socket type joint (Fig. 3). If uptake in the implant is not at least 2+, motility peg placement should be delayed until vascularization can be assured with a positive ^{99m}Tc-MDP scan. If the integration is incomplete, exposure of the implant during drilling can result in failure of the coupling procedure and extrusion of the implant (*2*).

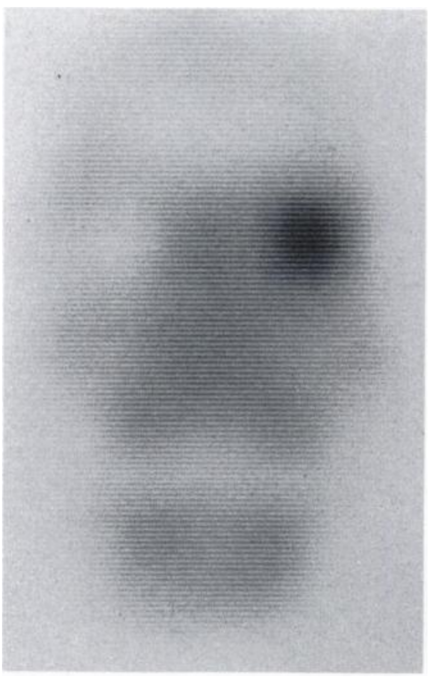

FIGURE 2. Coronal tomographic slice confirms uptake in the implant.

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