

Tissue Banking and Periodontal Bone Allografts

Committee on Research, Science and Therapy



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PREFACE

This paper was prepared by the Committee on Research, Science and Therapy of The American Academy of Periodontology for the information of the dental profession. However, it may also be of interest to the lay public. It represents the position of The American Academy of Periodontology regarding tissue banking and the use of periodontal bone allografts in periodontal therapy.

This paper answers some of the most frequently asked questions regarding the selection of a tissue bank for the procurement of allogenic osseous tissue, the risk of disease transfer with bone allografts, and the best type of allograft to use.

1. What banks are recommended by The American Academy of Periodontology?

The AAP does not recommend any specific banks. The clinician should select a tissue bank that will provide tissue procured and processed according to currently accepted standards. Standards for tissue banking¹ have been developed by the American Association of Tissue Banks (AATB). The AATB offers accreditation on a voluntary basis to tissue banks that follow these standards. It should be stressed that some AATB member and non-member tissue banks may have internal quality assurance programs which are more stringent than the standards developed by the AATB.

2. What tissue banks offering allogenic bone are accredited by the AATB?

The AATB maintains a list of tissue banks that are currently accredited. AATB accreditation of tissue banks occurs on an ongoing basis. Clinicians interested in contacting the nearest AATB-accredited facility can call the AATB at 1-800-635-2282; the line is open from 9:00 a.m. to 4:00 p.m. (EST), Monday through Friday.

3. Are tissue banks regulated by the Food and Drug Administration?

On December 14, 1993, the FDA issued interim regulations, effective that day, which establish minimum standards for donor screening, donor testing, and record keeping for allografts and the tissue banking field. Prior to this date, tissue banking was largely a self-regulated field through its own trade association, the American Association of Tissue Banks. Although the AATB accredits tissue banks as having met their basic criteria, the AATB is a trade association that lacks any regulatory authority. Ultimately, every surgeon, hospital, dental and medical professional must consider the reputation and track record of the tissue bank that provides medical supplies to ensure the highest quality of services and products for their patients.

4. What is the risk of HIV transfer with bone allografts?

To date, four cases of HIV have been reported following fresh frozen bone allograft procedures.^{2,3} One resulted from a hospital case performed without the appropriate exclusionary procedures. Other cases reported in *The New England Journal of Medicine* resulted from the use of bone in 1985 from a bank where all the appropriate tests were performed.³ No direct antigen test was available at the time. The donor tested negative twice for HIV antibody but had not seroconverted. None of the recipients of ethanol-treated freeze-dried tissue from the same donor became infected. It has been recently demonstrated that HIV can be inactivated in a demineralized bone allograft which is treated with a virucidal agent.⁸

5. What exclusionary techniques must be used by responsible tissue banks?

The exclusionary techniques that should be used include:

- a. Exclusion/omission of donors from high-risk groups by medical and social screening. For example, information must be sought regarding previous hospitalizations, blood transfusions, serious illness, lifestyle, etc.
- b. Testing for HIV antibody with ELISA and/or Western blot tests.
- c. DNA probe for HIV virus.
- d. Autopsy to rule out occult disease.
- e. Tests for bacterial contamination.
- f. Tests for hepatitis B surface antigen (HBsAg), Hepatitis B core (HBcAB) and hepatitis C virus (HCV).
- g. Tests for syphilis.
- h. Special lymph node studies to detect changes characteristic of early HIV infection, and to exclude individuals with morphologic nodal changes typical of non-specific acute infection (bacterial, viral, parasitic, or fungal), chronic infection, drug abuse, etc.

6. Secondary sterilization - what is safe?

There is evidence that freeze-drying, washing with ethyl alcohol, and demineralization with an acid at low pH will all inactivate the HIV virus.^{4,7} These procedures are routinely used by most tissue banks in the processing of decalcified freeze-dried bone allograft. Freezing alone has been calculated to reduce the risk of disease transfer.⁸

While treatment of bone with ethanol may be adequate to prevent the transmission of HIV- 1, there may be other, more effective methods available. Studies have evaluated various methods of sterilization and the effects of these various sterilizing agents on the inductivity of bone. The conclusions suggest that irradiation sterilization is a good choice not only for sterilization but also to improve the inductive capacity of the material.^{9,10} This issue is controversial.

The 2.5 Mrad of gamma irradiation currently used by most bone banks was reported to completely inactivate the HIV-1 virus and did not reduce the inductive capacity.⁹ In fact, inductive capacity was enhanced up to the 5.0 Mrad¹⁰ when the procedure was performed in a frozen state.

However, preliminary reports¹¹ suggest that HIV-1 may be more radio-resistant than originally thought. The estimates suggest that the dose of gamma irradiation required to reliably kill HIV- 1 (one virus in 10⁶) is approximately 5.0 Mrad, assuming a bioburden of 10 TCID/ml. This does not exclude a partial effect of lower irradiation doses or other methods of sterilization which may be adequate, depending on the bioburden. However, if the work is not challenged, it would appear that the higher dose level must be considered by bone banks.

Other graft materials used in procurement such as dura mater have come under scrutiny because of the possibility of transmitting slow viral diseases. For this reason, several bone banks have discontinued storing those connective tissues which are in close proximity to the central nervous system. If a connective tissue graft is used, it would be wise to consider another source such as fascia lata.

7. Is cortical or cancellous freeze-dried allograft preferred for a periodontal bone graft?

Cortical freeze-dried bone allograft is the material of choice for several reasons:

- a. Cancellous bone may be more antigenic than cortical bone.¹²
- b. Freeze-drying a cortical bone allograft markedly reduces the antigenicity of the allograft.¹³⁻⁴
- c. The bone-inductive protein (bone morphogenetic protein) resides in a bone matrix, and there is more bone matrix in cortical bone.¹⁵⁻¹⁶

8. What is the recommended particle size for a periodontal bone allograft preparation?

Freeze-dried bone allograft with a particle size in the range of 125 to 1000 micron possesses a higher osteogenic potential than particles below 125 micron.¹⁷ Very small bone particles elicit a macrophage response and are rapidly resorbed with little or no new bone formation. Tissue banks providing decalcified freeze-dried bone allograft for dental use will usually have this graft preparation available in various particle sizes. A particle size with an appropriate range from 250 to 750 micron is the most frequently available.

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