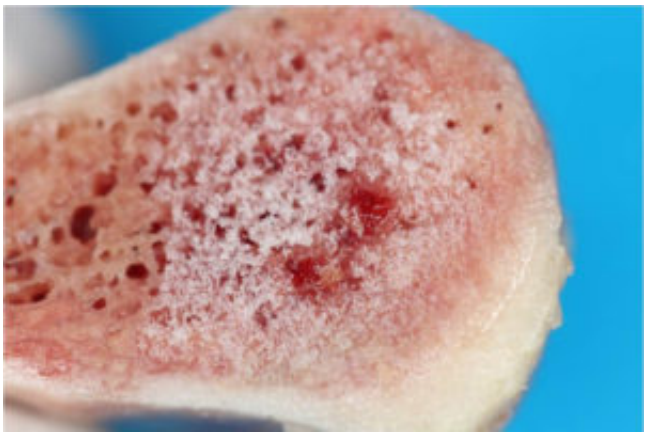
Bone from tissue banking to regenerate the lost bone jaws induce the production of antibodies

Dental implants have shown important role in dentistry, reaching success rates in osseointegration at the order of 97% of cases. The dental implant is a titanium device which is positioned in the alveolar bone, so as to simulate a tooth root, which will then later be restored through prosthesis. When a tooth is extracted, a remodeling process inducing to horizontal and vertical bone atrophy is immediately started in the region reaching the order of up to 25% in the first year turning the area impossible to install dental implants in some cases.



Frozen bone from tissue banking ready for transplant.

Numerous techniques have been developed in order to regenerate the lost bone through grafting procedures. The materials used can be of various origins, however, human bones from tissue bank has gained a lot of notoriety in the last decade. However bone is a vital tissue which can induce immune response from the host, thus to minimize it, freezing and lyophilization are processes with the purpose of reducing the immunogenicity of bones for transplantation. It should eliminate the cellular content and hinders the recognition process of the tissue by the host immune system. Freezing the bone makes most of the cells on the surface of bone graft not viable and therefore, drastically reducing the possibility of rejection.

All human cells have human leukocyte antigen (HLA) and one of its functions is to identify whether a cell belongs to the individual or not; in relation to organ transplantation such recognition eventually results in acceptance or rejection of the transplanted organs.

An individual produces antibodies against foreign HLA through three distinct mechanisms: organ or tissue (ex.: bone) transplant, blood transfusion, or pregnancy. The immune response against a bone graft can be triggered by many different components of the bone, such as collagen, fat, matrix

protein but mostly by human leukocyte antigen (HLA) molecule.

An important point demonstrated by studies carried out in femur head unprocessed block grafts and deep frozen at -80°C for at least 6 months, was the presence of viable cells inside the bone even after all the processing of the bone blocks. It is noteworthy, that the lack of standardization of processing techniques among different tissues banks favors the above described situations.

When a surgical procedure with the use of allograft bone is performed, the recipient immune T cells recognize the foreign HLA from the bone cells. Currently, surgical procedures using allogenic bone are made without taking into account the genetic matching of HLA between donor and the recipient individual, because the matching of bone tissue between donors and recipients is currently considered unnecessary. However, the presence of immune reactions to bone grafts has been demonstrated both in humans and in animal models.

In dentistry there are few studies about this awareness, on the other hand, there are numerous reports of successful clinical cases using bone banking with success rates above 90% in a 5 years follow-up after grafting and implant placement.

Given the absence of manuscripts in dentistry, our research group conducted a study in which two blocks from tissue banks were placed in the anterior region of the 6 patients jaw. Surprisingly, 33.3% had anti-HLA class II after bone grafting from tissue bank. This study on recipient allosensitization (who produce anti-HLA antibodies) suggests that processed human bone grafts are not innocuous and may cause potentially harmful effects on future solid organ transplantation. Faced with the fact that surgery for maxillary dental implants placement is an elective procedure and alternative biomaterials are available, one wonders whether the use of bone from tissue banking for this type of surgery is at all worth the risk.

Marcelo Henrique Napimoga, Christian Rado Jarry
São Leopoldo Mandic Institute and Research Center, Campinas/SP, Brazil

Publication

Homologous transplantation with fresh frozen bone for dental implant placement can induce HLA sensitization: a preliminary study.
de Lacerda PE, Pelegrine AA, Teixeira ML, Montalli VA, Rodrigues H, Napimoga MH
Cell Tissue Bank. 2016 Sep