

# Human Tooth Bank: a bioethical analysis

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## Abstract

A human teeth bank (HTB) is a non-profit institution linked to a teaching institution with the purpose of supplying the academic needs, supplying human teeth for research, laboratorial training, and biological restorations. The present work resulted from bibliographic assessment related to HTB implantation, objectives, operations, ethical aspects, trends, and connection with contemporary bioethics. Bioethics helps dentistry to undertake a reflection on the topic, reconciling the technological progresses with ethical principles, drawing paths for the use of the dental organs without offense to the human dignity. It can be concluded that the HTB turns into the most appropriate model to supply the need for teeth, and at the same time fulfilling the legal, ethics and biosafety requirements, avoiding the illegal trade.

**Key words:** Tissue and organ harvesting. Dentistry. Bioethics.

## Resumo

### Banco de dentes humanos: uma análise bioética

Banco de dentes humanos (BDH) é uma instituição sem fins lucrativos, vinculada a uma instituição de ensino com o propósito de suprir as necessidades acadêmicas, fornecendo dentes humanos para pesquisa, treinamento laboratorial e restaurações biológicas. O presente trabalho resultou de levantamento bibliográfico relativo à implantação, objetivos, funcionamento, aspectos éticos, tendências e elo do BDH com a bioética contemporânea. A bioética ajuda a odontologia a fazer uma reflexão sobre o tema, conciliando os avanços tecnológicos com os princípios éticos, traçando caminhos para o uso dos órgãos dentais sem ofensa à dignidade humana. Pode-se concluir que o BDH mostra-se como o modelo mais adequado para suprir a necessidade por dentes, ao mesmo tempo em que cumpre as exigências legais, éticas e de biossegurança, evitando o comércio ilegal.

**Palavras-chave:** Coleta de tecidos e Órgãos. Odontologia. Bioética.

## Resumen

### Banco de dientes humanos: un análisis bioético

Un banco de dientes humanos (BDH) es una institución sin fines lucrativos, vinculada a una institución de enseñanza con el propósito de suprir las necesidades académicas, suministrando dientes humanos para investigación, entrenamiento en laboratorio y restauraciones biológicas. El presente trabajo ha resultado de investigación bibliográfica relativa a la implantación, objetivos, funcionamiento, aspectos éticos, tendencias y la vinculación del BDH con la bioética contemporánea. La bioética ayuda la odontología a realizar una reflexión acerca del tema, conciliando los avances tecnológicos con los principios éticos, creando caminos para el uso de los Órganos dentales sin ofensa a la dignidad humana. Se puede concluir que el BDH se presenta como el modelo más adecuado para suprir la necesidad por dientes, al mismo tiempo en que cumple las exigencias legales, éticas y de bioseguridad, evitando el comercio ilegal.

**Palabras-clave:** Recolección de tejidos y Órganos. Odontología. Bioética.

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A human tooth bank is defined as a non-profit organization, connected with a college, university, or other entity / organization whose objective is to meet the academic needs by providing human teeth for research or pre-clinical laboratorial training of the students. In this context, the BDH institution (Human tooth Bank – HTB) takes on an important ethical role, scuttling the illegal trade of teeth which still exists at the dental colleges<sup>1-4</sup>. Another HTB relevant role is providing teeth for scientific research. The production of knowledge, by means of research, depends directly on the existence of natural teeth, donated officially. In-vitro studies have contributed to the ability of guiding the teaching in the different areas of dentistry, so as to assess techniques and test, and develop new methods and products, seeking to improve the quality of dental services delivered to the public<sup>5</sup>.

An HTB also promotes the awareness on the part of the individuals, of the importance of the teeth as organs, and their relation with the overall health condition, by putting together the information alluded to its use in scientific research and treatments<sup>6</sup>. Besides providing with teeth for research, an HTB will be able to undertake research targeted at its own development. And especially, there are few studies related to the HTBs, and this shall be the next important step to establish its functionality<sup>3</sup>. Still, the social role of tooth banks is particularly material, by passing on information to the public and promoting awareness efforts/campaigns so as to prod teeth donations, thus scuttling the illegal trade of teeth<sup>7</sup>. In the case of deciduous teeth, the relevance of donations is not limited only to the availability of teeth for laboratorial practices and research, but also characterizes the children's true awareness of respectfulness of organ donations, shaping a better prepared generation, so that, in the future, they are able to donate blood to blood banks, for example<sup>8</sup>. Nassif<sup>3</sup> summarizes all the roles cited in the objectives of the HTB: greater valuing of the teeth as an organ and its ubiquity building, acquisition and preparation of the teeth; management of the data and registries; and the deployment of research and didactic activities.

The article at hand aims to assess the human tooth bank under the eyes of bioethics, as it discusses topics such as the origin of the teeth, the patient's autonomy in donating, the reasoning of the use, the information distribution to make people aware of the importance of donations and use of an HTB as genetic banks. This is a new topic and it entails factors connected with health. Thus, bioethics, as an inter-disciplinary field, brings up a reflection so that technical issues pertaining to teeth

use in research do not override the humanistic values implied in the issue.

### Deployment and Implementation of an HTB (BDH)

The human tooth banks are relatively new institutions. In Brazil, the first one was the tooth bank of the Odonto-pediatrics field at the University of Sao Paulo Dental School (FO-USP), in 1992. Despite the fact that the aspects related to the banks' implementation and organization are already set, the interchange between the university faculties is richly rewarding in terms of the issues of its actual functioning<sup>9</sup>.

The normalization of an HTB goes under the following definition proposed by the direction or by the directorship of the institution, who appoint a coordinator in charge, preferably, a qualified professor, who will be the HTB representative at meetings or councils, with attribution to suggesting staff for managing the HTB, and responsible for its management<sup>3</sup>. It is, therefore, important to point out that this person in charge must be a dental surgeon<sup>8</sup>.

The HTB must not be connected to any department of the university's colleges, which will demonstrate its autonomous feature, providing for all departments of the university's college, according to their needs and without any privileges or preferences<sup>9</sup>.

The creation of a tooth bank demands the existence of adequate infrastructure, acquisition of its own equipment, hiring specialized technical personnel and aids, besides establishing specific routines which guide all the stages pertaining to the acquisition, processing, classification, quality control, distribution, conservation, and records.

All the requirements imply in presenting a project to the institution's management for approval. After this stage, a statute must be created, which will be approved through a general meeting to be registered at a registry office of legal entities and approved by the official sanitary surveillance agency<sup>5</sup>. In terms of infrastructure for the installation of an HTB, there is the need for a laboratory and a support room (physical-functional area)<sup>3</sup>.

### Norms for the HTB's operation

There is no definitive format to be followed for all the existing HTBs. An attempt at standardization of organization protocols and functionality is still to be debated and to come to

future reality<sup>2</sup>. The intake and the exit of teeth must be registered; in addition, informational and clarifying circulars must be elaborated for the lay public (community) and for the professional class, and there must be the establishment of routines targeted at standardizing teeth disinfection, sterilization, and storage processes of<sup>2</sup>.

Upon the removal a teeth from the HTB, the student/researcher must always fill out a registry form so that there is effective control of the organ's destination; in relation to research, the project must bring along a favorable approval in annexed form, granted by the research ethics committee (CEP) for the execution of the work<sup>3</sup>. It is important to clarify that the HTBs are not just mere storage rooms that are mostly found in health services or in the educational institutions themselves. Tooth banks imply the existence of adequate infrastructure and norms in conformity with the rulings from the official sanitary surveillance and competent agencies<sup>8</sup>.

The way of storage is capable of interfering, mainly, in the dentine of the removed teeth, causing changes in their physical and optical features. As compared to other methods, the freezing of the teeth is the one that best preserves the dentinal characteristics<sup>3</sup>. With the intent of controlling stocks, and consequently, the total available teeth, as well as preventing errors in the documentation of intakes and withdrawals, the HTB must, as a mandatory routine, deploy audits targeted at preventing the occasional accumulation of mistakes pertaining to the documentation technique adopted<sup>10</sup>. Tooth banks' internal norms are not protocols that create red tape work, but instead, they create procedures of security that, based on technical, scientific and ethical standards, seek to set forth the minimal safety actions so that the HTB is able to work in conformity with its primary goals<sup>9</sup>.

### Bio-safety at a HTB

For a sound working condition of an HTB, it is fundamental that there is strict control of its internal procedures, which entail the separation and the storage of teeth, as well as the filing of the donators' forms, besides cross-infection control<sup>3</sup>. The preparation of the teeth comprises the stages of manipulation, cleaning, selection, storage and sterilization. The teeth are distributed in specific recipients that are also labeled by groups (incisors, canine teeth, molar teeth, anomalous teeth and the

sectional teeth)<sup>4</sup>. It is known that teeth, as all human body organs, are a source of pathogens for humans. Some pathogens may survive for a long period of time on removed teeth, allowing for possible cross-contaminations and several infections to take place. It is relevant to point out that still there is not one method of sterilization or disinfection that does not interfere, in some way, in the physio-chemical properties of the teeth, which may result in compromising the results of the in-vitro tests deployed with the teeth, which had received some sort of treatment. However, the importance of keeping the teeth sterilized must held relevant<sup>3</sup>.

Individual protection equipment is indispensable to the personnel that handles teeth, mainly in the cases of aerosol formation, and drips. Universal precautions must the adopted at times when the removed teeth are handled, for pre-clinical educational exercises simulating clinical experiences<sup>10</sup>.

The approach targeted at bio-safety and bioethics does not expressly indicate a reductive position, but a focus directed to biotechnology, which brings along great and new ethical questions, thus demanding an interdisciplinary articulation in order to meet a broad scope of humanitarian concerns, ethical concerns, scientific and cultural concerns. The impact caused by bio-technology on society, together with the rise of new technologies, has opened space for great discussions, in which it ends up overriding the need for discussing bio-safety and bioethics in an articulate fashion. It is needed that both are taken up, although it is recognized that each of them has its own purpose and relevance. The complexity of each discipline provokes a deeper reflection when the goal is to get the individual to obtain information and apply them as a set<sup>11</sup>.

Both bio-safety and bioethics perform on the probability of the risks, of the degradation of life quality of the individuals and populations, and perform also, on the acceptability of new practices. Nonetheless, bio-safety quantifies and ponders about the risks and benefits, whereas bioethics assesses the rational arguments which justify, or do not justify such risks. In this context, bioethics presents itself as a new moral-ethical field of study and reflection, encompassing different movements and individuals, aiming at the professional action, as in respect for citizenship and human rights, in timely and special contexts wherein people are vulnerable, either in having access to or in searching for health<sup>12</sup>.

## Bioethical Aspects of the HTB

Bioethics leads us to a reflection on HTBs in several points. Firstly, on the origin of teeth, whether they are being acquired in an ethical fashion, or whether this follows current legislation (by means of donations); secondly, on its rational use, because it is not acceptable to make the population toothless so that the future dentists learn dentistry, especially because it is known that every semester, thousands of teeth are utilized at the Brazilian university dental schools, thirdly, a reflection on the fact that bioethics brings up humanistic values to dentistry, so that students and professionals can keep going with technical concepts, for instance, by raising awareness, on the part of the donors, or by discussing the potential genetic bank of the HTBs.

It has become necessary to discuss and rethink the practices of teaching, as human-driven practices and human focused, intending to harmonize the academic interest with the needs of the patient, and not prioritizing one in detriment of the other, taking on dignity as a primary and ultimate value of human life.

## About the origin of the teeth

The main issue pertains to teeth acquisition in order to provide for an HTB in ethical and legal manner, which is often left behind by professors and students<sup>13</sup>. Therefore, a priority must be set to the legality as to the origin of the teeth.

The teeth may be obtained from patients, in cases of formalized extraction/removal, when the professional inquires whether one accepts to donate the teeth, letting him know about their destination and what end use will be given to them. It is foremost important to point out that teeth, as any other human body organs, may only be donated with the patient or responsible adult prior knowledge— which is expressed, for the HTB, by means of a signed spontaneous and clarified term of acknowledgment /consent and approval (TCLE).

As any body part bank, the human tooth banks depend on donations, wherein it is necessary to invest in awareness campaigns for the population, in order to provide incentives and by making them a continuous program, regardless of the period of time that the referred tooth has been outside of the mouth or the environment in which it has been kept<sup>6</sup>. Currently, several campaigns are undertaken with this goal. In them, several instruments may be utilized, such as videos, movies, theatrical plays and children's plays, which must be elaborated while seeking to reach the

focused age group<sup>10</sup>.

The best way to acquire human teeth is by partnerships with hospitals, city halls (health units), clinics and schools, or by the incentive through print and spoken media<sup>14</sup>. The increase in the number of body part donors in Brazil depends mainly on the quality of information offered to the population. The proper communication in health may be considered as a fundamental point to be extensively worked out for the efficiency of a family approach, and for an increasing number of donors<sup>15</sup>. Currently, there is a government bill at the state of Sao Paulo Legislative Chamber, which sets forth the Statewide Week of Awareness on Human Teeth Donations, aiming at taking up the sanitary conscience concerning the importance of donating teeth, and also aiming at prodding health professionals to make donations, at meeting the academic and research needs, and at alerting on the need to denounce practices of illegal trade of teeth, which goes against ethical and bio-safety principles<sup>16</sup>.

When met with the possibility of establishing human teeth banks in the universities' dental schools as an attempt to solve the problem of tooth trade, it turns out to be necessary to begin bioethical reflections concerning the donations and the destinations of the organs so donated<sup>17</sup>.

## Legal Matters

A tooth is a human body organ and, as such, is subject to the Brazilian law of transplants<sup>18</sup>, which prohibits the trade of organs and foresees under the Article 52<sup>nd</sup>, a punishment of three to eight years of detention and a fine for those who remove, at *post mortem* moment, organs, tissues and human body parts from non-identified people. Also liable to the same punishment is anyone who promotes, mediates, facilitates or makes any profits from the referred transaction.

According to Article 28<sup>th</sup> of the Dentistry Code of Ethics, launched in 2006, one who does not abide by the legislation which regulate transplants of organs and corpse use for studies and/or the practice of surgical techniques is considered under ethical infringement, wherein the Article may determine punishment which may go from mere confidential warning up to the cancellation of one's professional activities.

The governmental decree GM 904/00, by the Ministry of Health, creates, in the scope of the Single Health System (SUS), the bone-facial-chondral-ligament tissue bank, from human origin, for therapeutic and scientific purposes. The decree defines as a bank, the service that, in physical installations of equipment, of techniques and

professionals, be destined for acquiring, removing, classifying, processing, preparing, controlling quality, distributing and preserving bone-facial-chondral-ligament tissues – however, it brings up information which best apply to the creation of tooth banks.

The illegal teeth trade is an unquestionable fact, especially in university environments. In a study performed by Paula<sup>2</sup>, 70.6% of students in Rio de Janeiro, and 46.9% in Sao Paulo, could be observed to have commercialized teeth. To the author, this trade strengthens the necessity of organizing tooth banks at universities, in that such measure will end illegal trade and will aid students not only in clinical, pre-clinical and research activities, but also in the guarantee of bio-safety in handling these teeth.

Some students contribute for the illegal trade of dental organs, wherein they try to obtain them in cemeteries or dental clinics, or buy them by means of university employees and former students<sup>13</sup>. Thus, university professors, as role models, who solicit or in some subjects, haphazardly demand the use of human teeth, are in fact collaborating to the illegal trade of organs<sup>1</sup>. Nevertheless, as they demand human material without due origins, they may be liable to current legislation, as in the enticement to crime offense<sup>9</sup>. Besides this being illegal, this act also represents an ethical offense, because very likely these teeth will not be accompanied by the respective term of consent<sup>20</sup>.

Either with or without the presence of a statute that regulates HTB, compliance to the sanitary surveillance standards is crucially important, heeding the fact that tooth banks must be considered organ banks<sup>6</sup>. The creation of tooth banks at the Brazilian institutions for dental education, in our view, seem to be the best way to meet the current legislation in respect to research involving human beings and the removal of organs, tissues and human body parts, destined for the purposes of transplants and treatments<sup>5,8</sup>.

### The rational use of the teeth

Based on the recognition of the relevance of organs and tissue donations, for health promotion and recovery, which otherwise cannot be perfectly provided, it is suitable to discuss its condition of supply and scarcity, considering that donations are much lesser than the actual demand. The best alternative to be followed is, therefore, to go after improving the mechanisms for bettering the donations system, organs and tissue transplantations, thus strengthening its due relevance and reliability, in order to promote the

acceptable and ethical broadening of offers of resources and so, that it makes the widely known naturally tragic process of search for the just allocation of these resources, which are scarce in the health front<sup>21</sup>, less arduous and less pungent. The HTB entity seeks, therefore, to optimize the consumption of teeth, decreasing the need for donations and performing its ethical role of rationality in a scarcity system.

A dental school spends three to four thousand teeth per semester. In this case, there are about 150 colleges in Brazil, and it is suitable to state that 450 thousand teeth are needed to meet the demand of each semester, which are indeed provided without any type of control. Out of all teeth donated, only 10% are destined for fragment gluing; the other remaining 90% is targeted to academic research.

In the university dental courses in the state of Pernambuco, over the first semester of 2001, 5,524 teeth had been requested – a shocking amount, taking heed of the lack of evidence of the origins of those, its deliberate utilizations, and the issue of not having been utilized in other course subjects. This way, the implementation of HTBs by the dental courses is highly relevant, as long as they are in conformity with the legal norm, as a way to ethically and rationally addressing the issue<sup>22</sup>. As it has been proven, the tooth banks represent an ethical form of usage and abuse control of academic practices widely scattered<sup>1</sup> now-a-days.

A study on teeth usage in research works presented at the 17<sup>th</sup> and 18<sup>th</sup> annual meetings of the Brazilian Society of Dental Research demonstrates that out of 2,569 works, 834 (32.5%) used natural teeth, which tallies up to, on average, 34 teeth per research work. There is a huge incidence of human teeth in the research works, which highlights the need to standardize its acquisition process<sup>23</sup>.

When they are targeted to research, the tooth bank must request their return after study is complete; for the teaching purposes; the utilization of the teeth must be based on the need for the organs to be a part of what each subject presents, so as to rationalize the deployment in cascade mode<sup>5</sup>. The teeth, as discussed, are required at the HTB for use in a given discipline/subject, for a specified period of time. In this case, students must return them at the end of the agreed period of time, so they may be re-utilized<sup>4</sup>.

At the FO-USP tooth bank, teeth are lent to students, and, at the end of the semester, they must be given back in the condition in which they are then, being useful later, for training in the subjects of Dentistry and Partial Fixed Prosthesis –

an ideal methodology for rational use of teeth<sup>13</sup>. As for the disparity between supply and demand of transplant organs, it is considered that information and society's awareness of would be, in fact, the best way to increase the supply of organs, not only *post mortem*, but also from living individuals<sup>24</sup>.

### Ethical Issues

An HTB must have as its philosophy, grounded in its intentions and purposes, to aid, facilitate and promote the broadening of the dental profession, based in a three-fold basis of supporting structure, the ethical practice, bio-safety and Science. In order to achieve that, one must wish, feel and visualize the structural and paradigm changes which inherit and will be inherited from their institution. Human teeth banks will have a meaning of more than new laboratories for dental schools, because besides being suitable for regulating dental organs, ethically and biologically, they will also incite scientific research, opening new and a huge realm of possibilities, bringing up current ways to concede and deal with the profession's masterpiece. Additionally, they must be strongly linked and participative with the respective committees of ethics at the colleges where they will be created, so that there is not an alternative of misconduct, which will ensure their ethical character<sup>10</sup>.

Currently, the CEP bodies do not approve research works which utilize human teeth whose origin is not proven or legal. This is the main reason that each school must have a structured and regulated HTB, thus eliminating the collections of teeth<sup>10</sup>. Researchers themselves acknowledge that the development of research works with teeth of known origins is important, because it gives stronger rigor to the experiments<sup>9</sup>. In spite of HTB operational norms, an HTB must fit itself into the requirements of the CEP institution where it is installed/based, which will make its full development possible<sup>10</sup>.

A research work on scientific articles in dentistry managed to verify that the majority of publications does not cite the source of acquisition of removed teeth, nor the submission of the research work to an ethics committee, which goes against the quality and ethics binomial of the national scientific works<sup>25</sup>. The true recognition of the origins of the dental organs makes it possible to add social values to donated organs, yielding a greater commitment and compromise to processes, resulting in all the lines/strands of

dental research<sup>26</sup>.

The receipt of the TCLE from the donator of organs is the only way to guarantee respectful treatment to it, to the dental organ donated and its receiver. Only by this, will the Brazilian schools be able to keep human tooth banks that can meet the institutions' needs to bioethical standards<sup>17</sup>. This action is agreed upon with the patient under full autonomy, that is, an adult person with the ability to evaluate, understand and think out on the best for himself. But, wherein there is a patient with limited autonomy, the term of consent will be held by his/her legal responsible adult, guardian, or tutor<sup>27</sup>.

So, two relevant documents to be established are the free and clarified consent term, and the donation term. These mandatory documents must be explanatory and issued in two copies – one goes with the donated organ and must be filed; the other must be handed over to the donator<sup>5</sup>. The HTB operational functioning must be similar to that of an organs bank. There, one needs to have the donator's authorization for using his teeth<sup>23</sup>.

The National Research Ethics Commission (Conep) understands the consent term as a free one because there is not a chance of any type of limitation to influence the refereed donator's will and the decision by the individual in the research, The commission understands also that the consent term is clarified for not taking heed that the commitment with the individual in the research not only to inform, but that of clarifying. On elaboration of the TCLE, one must ensure the effective information to the individual so as ascertain that he maintains his right of choice. For such, the TCLE must be worded in accessible language terms and it must encompass all the information pertaining to the donation which is taking place, as well as the purpose of the use of the tooth. A trained person must present the consent term confidentially and explain it to the patient before or after teeth removal.

If necessary, the TCLE may be modified, the information may be renewed or, as a whole, reconsidered at any given time. All this, must be done in order to provide integral autonomy to the individual in the research. The people in charge must avoid, above all, ambiguity, and avoid also hiding the risks alluded to the research or address the pairs that will evaluate the proposal. Its wording must not be done in seeking to protect the researcher, institution or sponsor. Still, possible discomforts must be clearly specified, as well as risks and benefits; also the way that the patient will be able to obtain continuity in case he benefits

from the treatment, and how he will be indemnified or treated because of problems arising from the research. The individual will necessarily have to be certain of the privacy of all the information. The researcher must make it clear how he will proceed with the information in cases of mental disabilities (children or adults with mental disorder), clinical cases (unconscious patients) or cultural cases (for instance, indigenous individuals)<sup>26, 28</sup>.

The discussion here is not about the decision on removing, considering that the tooth may have been evaluated by a professional and he/she has agreed on its removal by scientifically proven reasons. The patient is already aware that the loss of the tooth is inevitable, and from this understanding, he agrees on donating or not it to an HTB. This decision has as its main elements, the autonomy, the self-capabilities, willingness, the adequate information and clear understanding.

A study with tooth donators has pointed out that the most frequent reason for dental losses had been tooth decays (36%), followed by periodontal diseases (34%), orthodontic treatments (14%) and others (16%)<sup>26</sup>. A given patient under treatment at a public, or private institution with an indication of tooth removal, by the professional, will be clarified that the referred tooth will be used in research and teaching, whereas the patient might be authorizing or not, the use of that tooth for this purpose.

This way, the bioethical principle of autonomy is respected and the origin of the tooth is duly proven. Respectfulness is a fundamental principle for steering the conduct of human beings. By the way, we need to take into consideration its two essential aspects – the individual's autonomy and the altruistic feeling which exists (or should exist) on organ and tissue donations. The free and expressed consent of any individual must always be autonomous and grounded in his/her own convictions<sup>24</sup>. It is important to point out that, particularly in cases of organs and tissue donations, respect to human beings is a fundamental human ethical principle which must always be taken into consideration. Society has expressed a great concern regarding the risk of reduction of human beings or his/her body parts, to mere merchandize or things, against the reality of the evident imbalance between the demand of organs and materials available. A human being is not a thing (res) and, therefore, may not be simply used as a mere object, which elicits spontaneous donations and free-of-charge donations. Such gratuitousness is directly associated with the satisfaction of doing well to someone: that the body itself, or a relative's body can still be useful

to some else<sup>24</sup>. The tooth banks make it possible that adequate conditions for re-discussions be created, at the academy, on the importance of the dental element as an organ and its relation with the overall health of the individual, as well as its rational use in scientific research works, in therapeutic use, in teaching and in bio-safe stocks<sup>4,5</sup>.

The creation of tooth banks in universities and in all the educational institutions is fundamental to guide towards the ethical and legal utilization, meeting the bio-safety standards, giving room for less risk of cross contamination<sup>23</sup>.

Nonetheless, a study developed at the Brazilian universities has pointed toward little implementation of this type of organ bank, hence there is the need for broader information campaigns targeted to university schools, aiming at the establishment of more tooth banks. Additionally, awareness-driven campaigns must be implemented/broadened by schools' extension programs, so that teeth donations become continuous<sup>6</sup>. Professors' due awareness would be the first step towards the end of the problem of teeth trade<sup>1</sup>.

A national educational policy, also non-sectorial, will reach a greater number of individuals and will contribute more substantially to meet the increasingly urgent needs of building up scientifically educated citizens and not just technically educated ones, seeking to have, in the medium and long-terms, individuals capable of dealing with the issues proposed by biotechnology<sup>11</sup>. Besides the latter, what is left to ensure the success of tooth banks is the effective awareness modeling of everyone connected in some way with dental education.

HTBs have been showing an ethical way of controlling uses and abuses of academic practices widely known today<sup>13</sup>. A given study with dental students has revealed that 85% of students at the tenth academic period know of an HTB, whereas 100% of the students at the first period reveal complete unawareness about these entities<sup>7</sup>.

Thus, the ethics debate which lies beyond the identity of the mouth actually brings up to the dental arena, challenges, not constrained to a dentist's office, in a paternalistic relation between the professional and the patient. The ethical aspect at hand must be able to insert society and to promote a science of reflection, aimed at the production of behavior and norms of services of mankind, applying intangible principles, such as respect for autonomy, justice, tolerance and freedom<sup>29</sup>.

Professionals will only be well prepared if,

side by side with competent technical educational empowerment, they might also have been trained for the recognition of ethical conflicts, critical analyses of its implications and the use of responsibility, and the moral obligation at making decisions related to human life<sup>30</sup>. Several authors denote the importance of bioethics in dentistry work, and that it must be inserted in the academic field of the future professionals<sup>30, 31</sup>. Nonetheless, few Brazilian universities have Bioethics Courses in their curricula<sup>32-34</sup>. In face of the contemporary needs, bioethics should become an essential topic for the development of Brazilian researchers<sup>33</sup>.

Bioethics has come to aid dentistry at remaining linked to the role of understanding the challenges, and to ensure the benefits of overall health, as well as, through diagnoses, to act in the prevention and in the treatment of oral diseases, contributing significantly to human quality of life<sup>27</sup>. Bioethics as based on principles is complemented by the day-to-day bioethics in the constant search for explaining the emerging conflicts in health professionals' relations, in their patients' relations and in society. This trinomial sets out the focus of contemporary bioethics<sup>20</sup> discussion.

Ethics dedicates itself to the study of behavior in the search for the best way to act. Besides past experiences, customs and traditions, ethics proposes that our actions be guided by principles and, mainly, by unending reflection. To reflect is to re-think on our way of acting in the world. Bioethics, therefore, places itself in the endless search for wisdom, criticism, use of information and knowledge, for enhancing the conditions and preservation of life, combining humbleness, responsibility and rationality, targeted to the well-being of the individual as well as of the collectivity.

In this sense, bioethics has a broad range for reflection, by way of theoretical models which help in re-thinking life or conflict situations, be them the day-to-day ones, limits-prone or frontier-type ones – as well as those classified as emerging and persistent problems<sup>35</sup>. As for discussions about conjure up: autonomy, DDH, it is feasible to notice that the principled classical bioethical principles of beneficence, non-maleficence, and justice.

The patient's autonomy is respected in terms of the conscious donation, also free and clarified; beneficence is implicit, because the donated tooth may be used in research works, which may benefit the donator himself and society; non-maleficence aspect present in tooth removal, under duly appointed removal indication will not bring any damage to anyone, but rather, it will

improve the patient's health; in the end, justice takes place, because donation is universal, taking heed of the fact that regardless of where the patient is being treated, he can still donate his tooth. Thus, we notice that the application of the bioethical principles is in accordance with the implantation and operation of HTBs.

Bioethics sets forth a new paradigm to truly work out the dilemmas and moral contradictions which have come to take place in a more and more pluralistic world – in constant and fierce transformations. Although it has progressed greatly, specifically on the dentistry front, the bioethical discussion still is scarce. Bioethics does not have any prescription and it may not be quantified; based on the grounds of applied ethics opens discussions, analyses of diverse cases, interprets techniques and programs, confronts ideas, takes on argumentations grounded in reasons.

The ascertained extraordinary technical-scientific progress in the dentistry field, over the last years was not accompanied by any ethical grounds that would support the new techniques and use of materials, as well as the situations created. It is certainly relevant to take heed of, in this context, that bioethics has not originated with the intention of limiting the development of science and technology, provided they are working within human limits. One must evaluate and point out, though, when science and technology begin to interfere negatively in human life, going to the extremes of the border of humanistic values and practices<sup>36</sup>.

The upscale prestige given to technology and the experimental sciences has been outdoing human sciences and the outcome of this value imbalance is the dehumanization of health professionals. The presence of bioethics favors the reflection on dilemmas of ethical nature concerning human life<sup>37</sup>. The latter, belonging to a referential point which makes reflection possible, a referential point which is a contributor for building up a critical view of the world, heeding the social, cultural and economic problems which is visible in each people's reality; bioethics adds up to the humanistic growth of the odontology's professional and stimulates the social commitment to intervene so as to improve people's life quality, especially in his/her realm of professional activity. By assessing health problems under multi and interdisciplinary outlooks, his/her epistemology may contribute to the analysis of the problem-situations, of the moral dilemmas and conflicts of interest in the field of odontology focus<sup>30</sup>.

Dental surgeons, in the same way that other health professionals will only be prepared for professional activity, when they get to know – and

get to be able to reflect on – the bioethical principles and its implications onto the clinical routine<sup>33</sup>. When bioethics brings up the reflection on humanistic values, the dental surgeon begins to see the patient in an integral fashion. Hence, he/she has a viewpoint that the teeth utilized in research and in teaching are not a means or object of study, but an end-product that will draw a benefit for human health and for collectivity.

### Bioethics and Genetics at the HTBs

Perhaps, the greatest revolution in dentistry is starting out its first steps: the use of tooth banks as genetic archives. Teeth have the genetic information of each individual. Hence, as the donation of two teeth from the same individual takes place, one of them could be utilized in research and the other, archived, being useful as a reservoir of the patient's genetic information, also allowing for an easy process of recognition, if necessary<sup>8</sup>. Several studies show that teeth are an excellent source of DNA. The pulp's cells are protected by hard tissues such as enamels, dentine and cement, which allows for the extraction of DNA even in adverse conditions, such as in the advanced state of decomposition of the body, carbonization, aerial accidents, among other circumstances<sup>38</sup>.

Biotechnology, because of its intervention-driven nature – whose example is the manipulation of human genetic patrimony – is an originator of genetically manipulated products which cause great impacts on society and, consequently, yielding ethical worries. Nowadays, DNA extraction from teeth donated to HTBs is an usual practice. But theoretically, this is possible to be done before the teeth undergo the process of cleaning and sterilization. The commitment that every researcher should have with ethics must not be only conceptual, but surely a commitment that constantly influences his/her thoughts and that are always present in his/her actions<sup>11</sup>.

And again, bioethics takes on an important role, bringing along the reflection about this genetic material stored in the teeth; therefore, recommending that it be not utilized deliberately. It shows, still, a moral viewpoint (for what to use) on decisions (when), conduct (how) and policies of the life sciences, employing a variety of ethical methodologies in an interdisciplinary context. If necessary, such as in a possible forensic identification, the genetic material must be used according to ethical and beneficial standards for the donators or for their relatives (akins), a fact

**Human Tooth Bank: a biological analysis** that must also be clear at the moment of donation.

Carvalho<sup>1</sup>, in his article, points out a case of a dentist who inquired a girl whether she would want to donate her tooth for an HTB. The child, then, asked if the dentist would clone the tooth. This case exemplifies the doubts which involve the capture (process of collecting), storage and utilization of human teeth. In this specific circumstance, one might consider that the child has the right of keeping his/her own tooth, because she feels it is a part of her body. However, many adult people do not make organ donations, either, because they do not know the usual/routine procedures or because they are afraid of the ongoing technological changes.

### Final considerations

The creation of HTBs in dental schools is the model which best meets the growing need for teeth targeted to scientific and teaching purposes, while following and fostering adoption of bioethical principles. Besides complying with current legislation related to research involving human beings, and the removal of organs for transplantations and treatments purposes, the HTB takes on an important ethical role, aiding to scuttle the occasional illegal teeth trade. It has, also, the role of protecting students and professionals against unlawfulness in the form of teeth acquisitions, for execution of academic and research activities, working on the awareness building of the fact that human teeth are organs.

HTBs must promote awareness campaigns, also passing on information to the population, giving a prod to organs donations, thus undertaking also a social role. Yet, it is attributed to caring for the elimination of cross infections that take place as of the deliberate handling of removed teeth (extracted teeth).

Bioethics engages in a guiding role in tooth banks, by making sure the patient's autonomy when the person in charge of the HTB fulfills the phase of the free and clarified consent term, jointly with the donors, thus ensuring the legal and ethical origins of the dental organs. As already discussed, bioethics brings up the reflection on current issues, such as the rational use of teeth, the building-up of people's awareness of becoming potential donors and the HTBs acting as genetic banks. Bioethics helps dentistry, as a traditionally mechanical science, to get health professionals aware to the humanistic spirit which must go along with the technological advances, based on the primary goals of improving people's quality of life.

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