RESEARCH ARTICLE   **OPEN ACCESS**

TOOTH.BASE: A MANAGEMENT SOFTWARE FOR HUMAN TEETH BANK

*1Gabriela Bohneberger, 2André Zuconelli, 3Fábio José Dallanora, 4Grasieli de Oliveira Ramos, 3Acir José Dirschnabel, 3Bruna Elisa De Dea, 4Claudia Elisa Grasel and 4Lea Maria Franceschi Dallanora

1Graduate Student of Dentistry – University of West Santa Catarina – Joaçaba, Brazil
2Information Technology Technician of Federal Institute Catarinense - Blumenau, Brazil
3Human Teeth Bank researcher - University of West Santa Catarina – Joaçaba, Brazil
4Researcher in Clinical Dentistry – University of West Santa Catarina – Joaçaba, Brazil

ARTICLE INFO

ABSTRACT

To identifying the origin, reduce contamination and using the Human teeth to didactic approaches, the Human Teeth Bank (HTB) was created. By actively acting in academic activities, assisting in research and pre-clinical practices, it is essential to organize the internal registry of the entrances and exits of the teeth. Thus, it was designed a computer system capable of managing automated reports such procedures and substituting the manual counting, that was done previously. It was developed in the web platform, the system allows the access of coordinators and trainees so that they can control the amount of teeth stored in bottles.To register a bottle is informed the input data, the number of teeth, group and the condition of the teeth. Once registered, the bottles may be withdrawal and outlet is registered for further consultation. The HTB has a collection around 17.000 teeth, which were managed manually, by notes in a log book. The software *Tooth.Base*organizes and considerably reduces the time spent by HTB trainees in daily activities, in addition to providing reports that generate more accurate information on the amount of information and quality of teeth found, as well as those that were excluded.

INTRODUCTION

With the Brazilian law of transplant (BRASIL, 1997) the teeth was consider as human organs, therefore should have your known origin for a Human Teeth Bank (HTB), so that they can be made available for research and educational uses (NASSIF *et al*., 2003), and to being human biological it provide the genetic identity of the donor, by the DNA, constituting a Biobank (GOMES *et al*., 2013). The assignments of HTB are related for strict control of the internal procedures of its processing, from the receipt of cessions terms, cleaning, separation and storage management by controlling the inputs and outputs of teeth (GOMES *et al*., 2013). The management of health-related structures, such as clinics and hospitals, created the need to develop programs for the management of these establishments.

*Corresponding author: **Gabriela Bohneberger,**
Graduate student of dentistry – University of West Santa Catarina – Joaçaba, Brazil

Likewise, HTB require operational management of teeth in and out, which have been granted and withdrawn by teachers, academics or researchers (PENTEADO; DE CARVALHO, 2010). This control, actuality, is performed the manual form, demanding time and make difficult the consult about data (GHIGGI; DALLANORA, 2011). A good control of the procedure involved in a HTB, facilitates the management and extraction of information about the entry and withdrawal of teeth, besides ensuring a better organization of the HTB. In this context, management software are an alternative, offering automated solutions, to be possible to coordinate processes and resources within the environment in which they are used. The knowledge management is defined as a process that assist in the identification, selection e dissemination of present information in an organization, but that are in a non-structured way (TURBAN *et al*., 2010). The aim of this article was to describe the steps involved in the development of a support and management tool for the control of storage processes in

Figure 1. Screen for registering groups of teeth and their condition

the HTB at the University of the West of Santa Catarina (UNOESC), and analyze and discuss the use of the software.

MATERIALS AND METHODS

In the beginning we defined the functional requirements that should be implemented in management software. By analyzing the information contained in the records of the bottles stored in the HTB, it was defined the functionalities that the new system should have and the way by which the information could be obtained quickly and intuitively. The information used to compose the software were the pre-existing data regarding the group, quantity and condition of the stored teeth, which until then were recorded in a control book. The management software was structured to guarantee the consistency and security of the information. Developed on the web platform, it is accessible from any device with internet access, thus ensuring data availability. PHP, an acronym for Hypertext Preprocessor, was used as a programming language. For greater agility in the development stage we adopted the use of the Laravel framework, widely distributed in the community of application developers due to the tools and facilities that it offers. For the persistence of the data, the database manager MySql was used. Access to the system is done through the login with the user and password. That way, you can register to keep the registrations and changes. At the end, tests were carried out to validating the functionalities developed and verifying the behavior and time response of the software before carrying out basic operations such as registration, alteration, deletion and data query. The software has also been evaluated by users for operational and functional performance in order to identify the pros and cons of executing HTB processes.

RESULTS AND DISCUSSIONS

The Unoesc Human Teeth Bank was created 7 years ago and is responsible for attending university students, professors and researchers of the dentistry course.

The collection has approximately 17,000 teeth stored in bottles with distilled and sterile water, divided according to the group and condition of the teeth. As important as storing the teeth, is the registry to control the data, essential for the HTB to organize its procedures and manage resources. Information management is essential in any type of organization, acting not only in the operational question, but also in the definition of strategies. Computational systems aimed at this area are developed with the objective of assisting managers in their making decision, from the inserted data precise information that, at first, is unclear or even not known (MARTINS, 2014). The developed system, called Tooth. Base, performs basic operations related to tooth bottles stored in the HTB. The first step is register the teeth groups that will compose the bottle (Figure 1). The teeth are divided into groups: incisors, canines, premolars and molars, and can also be separated by upper and lower teeth. Each tooth group is classified according to its condition, and can be: carious, healthy, restored or mixed. For the registration of a bottle, it is necessary to inform the amount of teeth that make up the bottle, the group to which the teeth belong and the date of sterilization of the flask (Figure 2).

Figure 2. Screen for the registration of the flask

Once registered, the bottles can be located by the date, amount or condition of the teeth. The system shows the registered flasks arranged according to Figure 3. Besides to registering the entrance, the Tooth.Base also allows to register the withdrawal of a certain flasks. To proceed with this operation you must locate the bottle in question and click the button represented by ">>", located at the bottom of each bottle. After the process has been carried out, the flasks that have been removed can be consulted (Figure 4).

Figure 3. Screen with the presentation of the flasks available in the collection
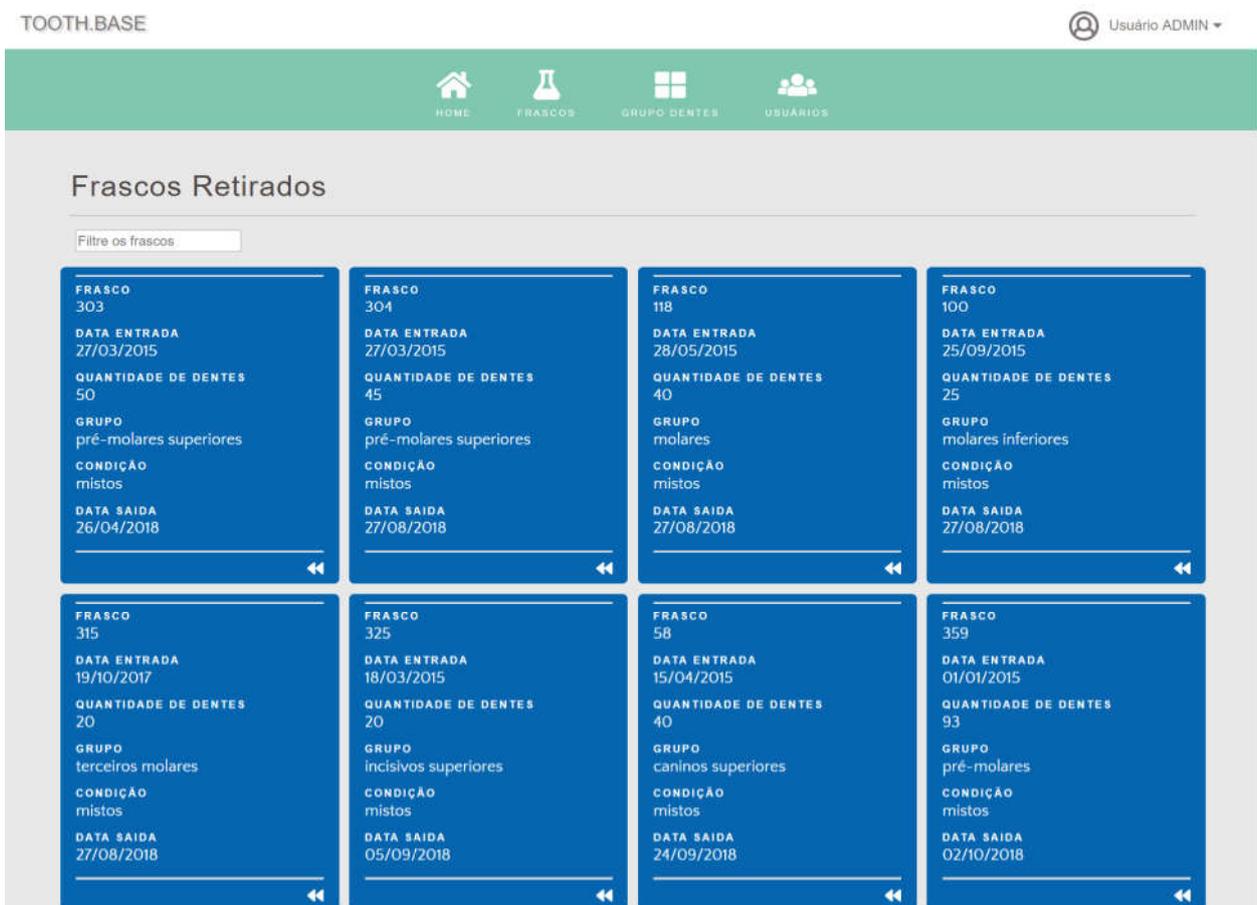
Figure 4. Screen with the presentation of the flasks removed of collection

Some additional information can be obtained by means of statistical data that the system provides(Figure 5), such as the number of teeth and jars present in the collection and also teeth and jars that have already been removed. By graphs it is possible to identify precisely which groups of teeth are available as well as those that have been most removed. It should be avoided that certain groups of teeth are over, the HTB establishes that for each group of teeth a "minimum stock" must be kept to be respected. The "minimum stock" political consists of keeping at least 100 teeth from each group stored and when it is reached, will serve as a "warning signal". Thereafter, that group of teeth can no longer be donated until its stock is restored. Thereafter, that group of teeth can no longer be donated until its stock is restored (NASSIF *et al*., 2003). The use of Tooth.Base system make it easily, because it is observed by graphics that inform the reports the amount of

Figure 5. Screen with statistical data and graphs available by system

teeth, by groups, that are in the collection.With the software was possible to identify and limit the output of these teeth. With the use of management software, the processes of registration and withdrawal of teeth bottles have become more practical, which facilitates understanding, thus making it easier to adapt the trainees who working in the HTB. This is an important factor, taking into account the turnover of the members, due to the contracts being semiannual. The Tooth.Base allows any trainee, even without specific knowledge about the routine of the BDH, to perform the registration and removal functions of the flasks, only with an understanding of the functioning of the system. In accordance with the internal regulations of the Unoesc HTB the registration and removal of bottles with teeth should be noted in specific sheets, which record the type and number of teeth thatinput or withdrawal and the date of movement. The software comply with this regulation perfectly. Thus, a previously manual process was automated and, consequently, the occurrence of human failures is reduced. Another important gain with the use of Tooth. Base concerns information security. In the context of computer systems security is related to the protection of information against numerous threats, minimizing the risks and ensuring the sequence of the business (SILVA, 2009). Information previously stored in a book, located within the BDH itself, is now centralized following the pillars of information security: integrity, confidentiality, and availability. The data entered into the system remains consistent and accurate while the information is available for access. Information from teeth stored in the HTB is now restricted to authorized persons, making the process more reliable. Regarding availability, data can be accessed at any time by any device with internet access (unless for some reason the access server is inaccessible).

Conclusion

Information is extremely important so that any organization can fulfill and execute the goals it proposes. Computational systems to support management are responsible for identifying, storing and processing information, facilitating the progress of daily activities, and also assists managers in defining strategies and decision making.

The inclusion of the Tooth. Base management system allowed the agility increase in the daily procedures, so that the trainees have more time to perform the other tasks such as, teeth collection, cleaning, sterilization and packaging in the bottles. In addition, for the coordinators of the BDH, the software made possible the control and interpretation of the results obtained after the execution of the processes. Although it is possible extract extra information through graphs, Tooth. Base offers a limited amount of statistical data. In the future, monthly reports can be explored to assist in monitoring the processes and flow of teeth in the HTB.

REFERENCES

BRASIL. Lei nº 9.434Brasil, 1997. Disponível em: <http://www.planalto.gov.br>. Acesso em: 11 mar. 2019.

GHIGGI, L. D.; DALLANORA, L. M. F. Implantação Do Banco De Dentes Humanos Do Curso De Odontologia Da Universidade Do Oeste De Santa Catarina. Ação Odonto, v. 2, n. 1, p. 61–72, 2011.

GOMES, G. M. *et al*. Utilização de dentes humanos: aspectos éticos e legais Human. Revista Gaúcha de Odontologia, v. 61, p. 477–483, 2013.

MARTINS, S. D. E. C. Gestão da informação: Estudo comparativo de modelos sob a ótica integrativa dos recursos de informação. Universidade Federal Fluminense, 2014.

NASSIF, A. C. *et al*. [Structuralization of a human teeth bank]. Pesquisa em Odontologia Brasileira, v. 17, n. 1, p. 70–74, 2003.

PENTEADO, R. F. S.; DE CARVALHO, H. G. Gestão Do Conhecimento E Aplicativos De Gerenciamento De Ideias Voltados À Inovação Organizacional: Uma Análise De Softwares. Revista Gestão Industrial, v. 5, n. ESPECIAL, p. 216–233, 2010.

SILVA, C. A. DA. Gestão da segurança da informação: um olhar a partir da Ciência da Informação. Pontífica Universidade Católica, 2009.

TURBAN, E. *et al*. Tecnologia da informação para gestão: Transformando os negócios da economia digital. 6. ed. Porto Alegre: Bookman, 2010.

****