



Original article

Development of differentiated pharmaceutical packaging for greater autonomy and quality of life for physically and visually impaired patients

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ABSTRACT

20–45% of the world population present special needs, permanent or provisional. This index is higher than that presented by the WHO, which determines that 10% of a country's population has some kind of disabled, in times of peace. This work proposes, focused on Assistive Technology, to seek solutions to daily problems encountered during the distribution of toothpaste for the toothbrushing of persons with visual impairment or with reduced mobility, through the development of a device that assists in the autonomy and independence of the individual, allowing their well-being and social inclusion. For this, an innovative packaging for toothpaste with important characteristics for the support was proposed, such as the presence of a pump valve and an adapter that guides the user to locate the exit of a predefined quantity of the toothpaste, without the need to handle the bristles of the brush, avoiding contaminations. The developed packaging material allows the user independence in day-to-day activities, which strengthens their self-esteem and quality of life, leading, consequently, to family well-being.

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1. Introduction

At least 25% of any population presents some special needs, from permanent to temporary, which includes people with disabled, elderly, pregnant women and those with reduced mobility. When added the relatives and companions responsible for the care of these patients, it surpasses 70% of the world population (Brazil, 2009; WHO, 2011).

The term Assistive Technology (AT) is a broad concept that defines a new area of knowledge that aims to promote the human rights of people with disabled through their social inclusion, providing autonomy and independence in their daily activities and accessibility. It is a set of adaptive measures or equipment designed to facilitate the functional independence of persons with disabled.

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The full inclusion of this portion of the population within society requires that their needs be identified and solutions be designed to minimize existing differences. The development of products and processes of Assistive Technology has allowed the valorization, integration and inclusion of such people with special needs, promoting a better expectation of life and human rights (Brazil, 2009).

In this context, an innovative packaging for toothpaste was proposed. It aims at the independence of temporary or permanent disabled and better quality of life of these people and all that surround them.

2. State of art

This proposal seeks to improve the daily routine and the practical life of people with visual impairments or with reduced mobility, through the development of devices that help in the autonomy and independence of daily activities, including the execution of personal hygiene activities. These new products and the optimization of existing ones are extremely important for the inclusion of this significant portion of the Brazilian population in their routine activities, helping to improve their self-esteem.

Several devices are available to facilitate routine activities (Brazil, 2012). Among the categories of Assistive Technology, Aids

for daily life and practical life products and materials that facilitate the autonomous and independent handling of the disabled during their daily activities.

The quality of life of the population has always been a concern of the WHO, because the guarantee of products within the quality standards allows the best performance of the activities (WHO, 2007). Aiming at the quality of life of the population with some disability, social inclusion has been the object of concern and research around the world, through the development of products and processes that optimize the performance of people with permanent disabilities or not.

The Universities play a fundamental role for health improvements and quality of life of society and scientific enrichment, since they are research centers for the development and optimization of products and processes (IFPMA, 1997). The elaboration of these products and processes that allow improvements in the quality of life of the population with special needs, allowing routine activities to be performed independently and autonomously.

It is important to emphasize that scientific advances are due to observation and necessity, since they are ideas that corroborate with the development and improvement of products that can solve the needs imposed by adverse circumstances.

So, a new product is proposed, based on the experiences and needs of a significant portion of the Brazilian population, through new techniques, fast, simple and low-cost, allowing the proposal of a new product to reach the population, enabling an improvement in quality of life of the visually impaired and disabled of the upper limbs, permanent and temporary.

3. History of packaging

The packaging exists to meet the needs of society and it has evolved through the ages (Cavalcanti and Chagas, 2006). This makes us think about the importance of packaging in the development of a society.

Since man began to hunt, collect and market his products, the use of packaging is present, with the purpose of transporting and protecting this merchandise. The first packages were made of sheets, skins and leather. Over time, these packages began to be made with grass and other natural fibers, because they were more resistant and could store heavier products (Twede, 2016). Nature can be considered the first inventor of the packaging, due to the natural protections that some foods have, such as: pod to protect the beans and peas, straw to wrap the corn cob, eggshell and walnut shell (Cavalcanti and Chagas, 2006).

Until 1800, packaging was used only to store, protect and transport large quantities of merchandise. They were not intended to store product for just one individual consumer. It was only currently that one of the objectives of the packaging became to satisfy the great individual demand of the modern marketing and the logistics of the commerce. At the beginning of the period 1800–1890, the use of sheet metal in the production of individual packages was reduced due to its high cost and manual production, so the use of glass, paper and cans were more used because they cost less and were more affordable (Twede, 2016).

It was only in the period between 1920 and 1940 that the packaging began to be used as a way of advertising the product and to sell the product directly to the consumer. In 1928, people came to know the brands of the products they bought, and therefore they began to buy from the brands (Franken and Larrabee, 1928). In addition, the packaging became individualized and intended for the consumer, since the population stopped buying product in bulk (Twede, 2016).

The democratization of consumption and the fall in consumption in bulk made the presence of packaging recurrent in our daily

life, since people hardly buy any product without the presence of at least one packaging. Some products have two or even three packages between the external medium and the product itself. Packaging is the most manufactured item in the world, since food, perfume, pharmaceutical, hygiene and cleaning industries use at least one type of packaging in their products (Cavalcanti and Chagas, 2006).

Polyethylene was already used in the insulation of telephone cables and submarine cables, but it was only after the War that plastic became used in the production of food packaging. One of the first successes in the use of plastics in packaging was the development of containers with precise covers, the Tupperwares®, widely used until today (Finnen, 1966; Cavalcanti and Chagas, 2006).

Consumers are increasingly concerned about environmental issues, global warming and climate change. They are inclined to consume environmentally correct products. Thus, packaging is also part of the marketing strategies related to ecologically correct products, and therefore they undergo changes in order to reduce the average daily production of solid waste, because packaging is the main responsible for this volume (Silva, 2013).

3.1. History of the packaging of toothpaste

The first use of toothpaste is dated 3000–5000 years BC by the Egyptians, who made their toothpaste with a mixture of powdered ash, burned eggshells, pumice and water. The Egyptians applied the toothpaste using sticks, because toothbrushes did not exist (Adjei et al., 2014).

The first toothpaste as we know it today was created by an American dentist called Washington Wentworth Sheffield in the year 1850 through the development of a powder to clean the teeth. With the help of his son, who was also a dentist, Sheffield modified the original formula giving rise to the Dr. Sheffield Dentifrice Cream, the first toothpaste to be registered (Silva, 2015). In 1841, the American painter John Goffe Rand patented in England and United States the packaging that he developed, the metal tubes (Anastasia, 2017). However, the popularization of this product only occurred with the emergence of toothpaste, which was developed by Sheffield, and stored in metal tubes (Silva, 2015). These metal tubes were produced through the impact extrusion process, and the tube, after filling, had several folds and a final recavation. This process had the purpose of closing the tube properly, avoiding any leakage (Tolentino, 2009). The toothpaste, if exposed to the environment, can suffer contamination by microorganisms, in addition to losing water, therefore, humectants are added in its formulation (Silva, 2015). The quality required in the emergence of packaging, such as resistance to transport and humidity, still remain one of the main objectives (Cavalcanti and Chagas, 2006; Seibel and Lima, 2011).

In 1873, the company Colgate® launched its first toothpaste in a bottle made of porcelain with handmade painting on the outside (Colgate-Palmolive® 2017). The use of this first toothpaste was different in each social level. In the society elite, the toothpaste was placed on toothbrushes, while at the lower levels of society they applied the product directly on the fingers to perform the friction (Tolentino, 2009). In 1896, the American company Colgate-Palmolive® launched its first tube of toothpaste, made of tin and metal cover, and had two-color printing on its tube (Silva, 2015).

In the 1950s, Gessy Industrial Company, now known as Unilever®, began to market its dentifrice creams, a more sophisticated way to call toothpaste, in aluminum tubes with plastic covers.

It was in the 1990s that toothpaste tubes began to be produced with the association of aluminum and plastic, that is, with an outer layer of *low density polyethylene* and an inner layer of *aluminum*, through a process called lamination. In 1990, the first packaging

with pump system, that is, it had a valve that when triggered it releases the content. For toothpaste it was placed on the market by the Kolynos® brand, which was later purchased by Colgate-Palmolive® (Silva, 2015). However, the market share for this type of packaging is small and the demand limited due to high complexity and cost of production, because of this, these packages with the Pump system did not remain in the market for toothpaste packaging for a long time (Anastasia, 2017).

In 1996, the Close-up LiquiFresh® was launched with its most liquid formulation, allowing its use as a dental gel and mouthwash. Its packaging is made of transparent polypropylene with dosing tip (Unilever® 2017).

After the change to the tubes produced with low density polyethylene and an inner layer of aluminum, the packaging of toothpaste did not suffer major changes in its production, only aesthetic changes, such as the production of new formats and with new colors, and changes aimed at improving the closure of the packaging, allowing a reduction in the time and cost of production (Silva, 2015).

One of the major aesthetic changes observed in toothpaste packaging in recent years has been the production of stand-up tube, which has a larger diameter than conventional base with shorter tubes. In addition to these characteristics, these packages have flip-flop with the same diameter of the tube, allowing it to remain in the vertical position. This facilitates the use of the product, as well as offering greater safety to small children, in order not to put them in their mouths and accidentally swallow the cover (Tolentino, 2009).

4. Assistive technology

The term Assistive Technology was officially established in the United States in 1988 as a legal element under Public Law 100–

407, which, along with other laws, participates in the American with Disabilities Act (ADA) (Galvão Filho, 2009). The ADA became a law in 1990 and is considered one of the most important civil rights laws against discrimination, ensuring that people with disabilities have the same job opportunities, can use services and products in the same way as people who do not (ADA, 2017).

The creation of the term Assistive Technology came from the need to regulate this type of technology, so that the population with some disability could have their rights and guaranteed access to these specialized services. However, Assistive Technology resources have been present in our daily life since before 1988. Canes, used by the elderly, provide greater safety when walking. Amplification devices used by people with different levels of deafness. Cars adapted for people with disabilities can be considered as Assistive Technology (Galvão Filho, 2009).

In Europe, the term Assistive Technology is often translated by the terms Technical Help or Support Technology. The Empowering Users Through Assistive Technology (EUSTAT) encompasses all products and services that can compensate for functional limitations, facilitating independence, and enhancing the quality of life for people with disabilities and the elderly (EUSTAT, 1999).

Between 2004 and 2005, EASTIN, European Assistive Technology Information Network, was created in Europe and aims to create an international information network on Technical Aids, and has already been able to verify the existence of 20,000 Assistive Technology products in Europe, generating costs around 30 billion euros (Galvão Filho, 2009).

5. Results and discussion

The World Health Organization defines that 10% of a country's population has some type of disability, even in times of peace. However some countries presents higher special needs, whether

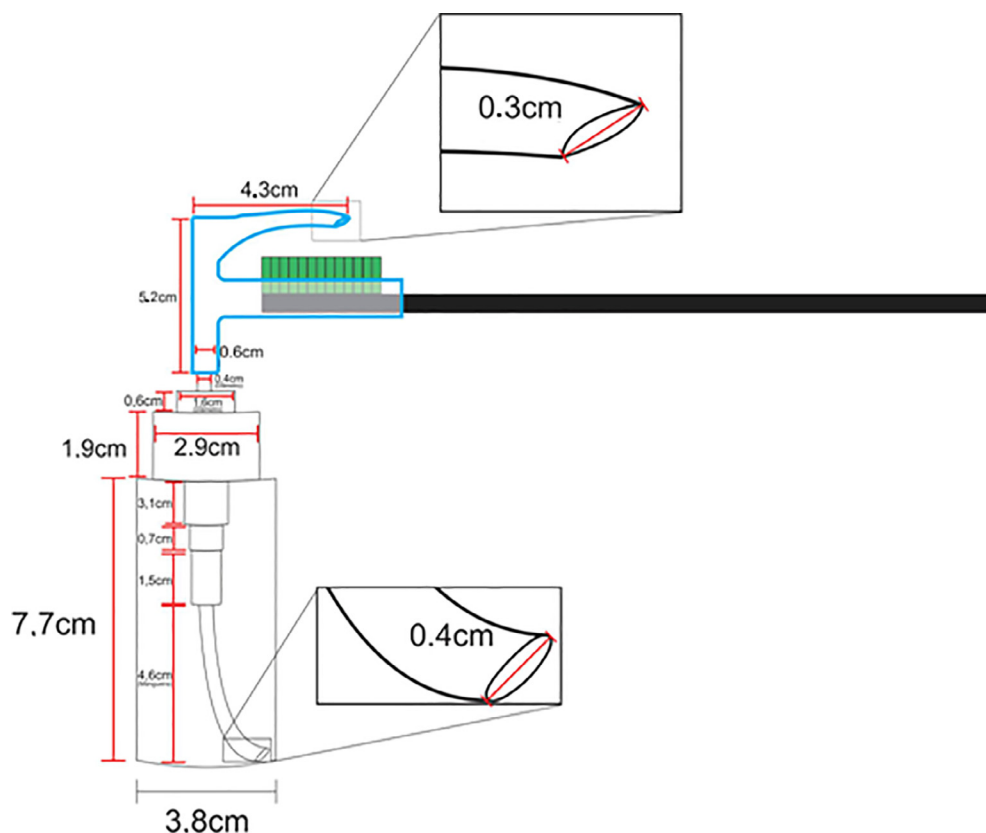


Fig. 1. Design of the packaging with the device coupled to the upper part responsible by actuation of the Pump valve.

permanent or temporary. At a recent Brazilian document on products design to disable people, we could not find any indicate for toothpaste control amount release.

5.1. Experimental

So, it is important to generate new ideas designing new concepts to reach goals and improving old designs. Necessity is the mother of invention and always catches up and solves a problem. Product development tools can focus in observation and improvement. In this scenario a new product may be done to optimize an already established product. The new product is optimized to best serve the needs of public target. This work proposes develop a new vial to attend disable people to do an easy activity as brush their teeth. This product is addressed to disable people such as blind or visual ability reduced or people with temporary or permanent only one arm.

In summary, the work searches, based in Assistive Technology, to find solutions to daily problems encountered during the distribution of toothpaste for the tooth brushing of visually impaired people or persons with reduced arm mobility, through the development of an instrument that assists in the autonomy and independence of the individual, allowing their well-being and their social inclusion.

In this context, an innovative packaging for toothpaste was proposed with important characteristics for the support, such as the presence of pump valve and adapter that guides the user to locate the exit of a predefined amount of the toothpaste, without having to handle the bristles, avoiding contaminations and the dependence of temporary or permanent disable people. The system is simple and based on liquid soap dispenser. To better understanding, take a look at Fig. 1.

Its development was inspired by all the history presented previously, as well as the materials used for its manufacture, forms of packaging and solution to the problems encountered. It can be manufactured with environmentally friendly and recyclable packaging and have specifications written in Braille. This was adequate and rethought for the target audience of the work.

This package not only makes the toothpaste easier to release but also prevents accidental use. It is an environment-friendly concept that guides your dental brush to the correct amount since the vial comes with an extension to the top through which the user can throw the product for the brush. Based on the survey made in the Assistive Technology product catalogs of the Ministry of Science and Technology for products for the visually impaired, which indicated the absence of a product that would lead to the autonomy of the individual during the tooth brushing process, this significant portion of the Brazilian population presents, and in the history of assistive technology in the world, that this study was conducted. Finally, the developed packaging material allows the independence of the user in this daily activity, which strengthens their self-esteem and quality of life, leading, consequently, to the family well-being. The packaging developed can provide an improved quality of life of patients and, mainly, independence in a constant activity present in the day to day of everyone, patient and familiars.

6. Conclusion

Based on the survey made in the catalogs of Assistive Technology Products for people with visual impairments was indicated the absence of a product that would lead to the autonomy of the individual during the toothbrushing process. The need that this significant part of the Brazilian population presents together the history

of Assistive Technology in the world promoted the construction of this work.

The packaging developed provides a better quality of life for the patient and all around her/him for independence in a constant activity, besides the microbiological contamination of the bristles to be avoided by hand aid in toothpaste arrangement and in relation to obtaining adequate quantities of product by actuation of the dispenser, avoiding waste.

Conflict of interest

The authors report no declarations of interest.

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References

- ADA, 2017. United States Department of Justice Civil Rights Division. Available in <https://www.ada.gov/ada_intro.htm> (accessed on September 16 2017).
- Adjei, L.N., Mensah, J.P., Adu-Boahen, E., 2014. The role of branding and packaging in creating customer loyalty in the toothpaste market: the case of Ghana, *Europa. Eur. J. Bus. Manage.* 6, 155–166.
- Anastasia, M., 2017. Innovative packaging design: toothpaste packaging case study. School of economics, business administration & legal studies. Thessalon, Greece, pp.117.
- Brazil, 2009. Subsecretaria Nacional de Promoção dos Direitos da Pessoa com Deficiência. Comitê de Ajudas Técnicas. Tecnologia Assistiva. Brasília, CORDE, pp. 138.
- Brazil, 2012. Ministério da Saúde. Portaria Interministerial nº 362, de 24 de outubro de 2012. Diário Oficial da União, Brasília, nº 207 – DOU de 25 de outubro de 2012, seção 1, p. 44 (accessed on January 5, 2017).
- Cavalcanti, P.; Chagas, C., 2006. História da embalagem no Brasil. São Paulo ABRE, pp. 253.
- Colgate-Palmolive, 2017. Uma História de Sucesso. Available in <<http://www.colgate.com.br/app/Colgate/BR/Corp/History/1806.cvsp>> (accessed on September 16, 2017).
- EUSTAT, 1999. Empowering Users Through Assistive Technology. Available in <<http://www.siva.it/research/eustat/portugue.html>> (accessed on September 16, 2017).
- Finnen, A.M., 1966. History and development of flexible packaging. *Proc. Inst. Mech. Eng.* 181, 52–60.
- Franken, R.B., Larrabee, C.B., 1928. *Packages that Sell*. Harper & Brothers, Nova York.
- Galvão Filho, T.A., 2009. A Tecnologia Assistiva: de que se trata? In: Machado, G.J.C.; Sobral, M.N. Conexões: educação, comunicação, inclusão e interculturalidade. Porto Alegre, Redes Editora, pp. 207–235.
- IFPMA, 1997. IFPA issue paper. Quality assurance of medicines. Switzerland, International Federation of Pharmaceutical Manufacturers Associations
- Seibel, F., Lima, L.O., 2011. A revolução das embalagens. Available in <<http://exame.abril.com.br/revista-exame/a-revolucao-das-embalagens-m0055159/>> (accessed on September 16, 2017).
- Silva, R.B., 2013. A ecoeficiência em relação aos atributos socioambientais comunicados nas embalagens de produtos. *Universitas, Arquitetura e Comunicação Social* 10, pp. 59–72.
- Silva, E.L., 2015. História da embalagem, Levantamento sobre design, materiais e processos de fabricação do creme dentel. São Caetano do Sul, Escola de Engenharia, Centro Universitário Mauá de Tecnologia, pp. 60.
- Tolentino, S.R., 2009. Embalagem em constante evolução. *Revista C&T temática*, June 21–24.
- Twede, D., 2016. History of packaging. In: Jones, D.G.B., Tadjewsky, M. (Eds.), *The Routledge Companion to Marketing History*. Routledge, pp. 115–130.
- UNILEVER 2017. História Unilever. Available in <<http://www.historyunilever.com.br/unilever/timeline/produto/closeup>> (accessed on September 16, 2017).
- WHO, 2007. Global Public Health Security in the 21st Century, A safer future. Available in <http://www.who.int/whr/2007/whr07_en.pdf> (accessed on September 16, 2017).
- WHO, 2011. World Health Organization, World report on disability, Geneva, 2011. Available in <http://www.who.int/disabilities/world_report/2011/report.pdf> (accessed on April 1, 2018).