

Comics for oral health education: construction, validation, and analysis of efficacy

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Abstract

Illustrated media has been a widely used device for oral health education, with comics being a format that is still under explored in terms of validation and analysis of their effectiveness towards the target audience. This study aimed to evaluate the effectiveness of a comic book in the process of oral health education to children between 6 and 12 years of age attended at the pediatric dentistry clinic of a dental polyclinic in the Brazilian Amazon. A playful-educational comic book was made, validated, and incorporated into a kit containing 01 toothbrush, 01 floss, and 01 toothpaste. Subsequently, a questionnaire was applied with the parents (N=50), before and after the delivery of the kits, which evaluated the child's oral hygiene care and the impressions on the impact of the comics on the oral hygiene of their children. The results were analyzed descriptively, through absolute frequencies and percentages using the McNemar test ($p < 0.05$). There was an increase of 55.32% of the children who started flossing after methodological implementation. It was also found that there was no statistical difference between the frequency of brushing after delivery of the kit ($p = 0.873$), but there was a significant increase in the frequency of flossing among the children evaluated ($p = 0.0401$). The comics were statistically effective in increasing the frequency of flossing, with comic books having a good acceptance of both children and parents.

Keywords: Health education. Child Health. Dentistry. Health promotion. Comic books.

INTRODUCTION

Dental caries continue to be one of the chronic diseases that most negatively impact people's quality of life, whether through pain, nutritional consequences caused by poor occlusions, or reduction of social activities due to non-aesthetic characteristics¹. And the impact of this disease, specifically in school

children, is also capable of resulting in psychosocial consequences and even low school achievement².

Preventive actions aimed at good oral hygiene practices have been shown to be a fundamental indicator of the critical perception of the individual's health. This benefit is ex-

DOI: 10.15343/0104-7809.2022465745861

tended to children and pre-adolescents who are establishing the initial foundation of a life built by good practices – especially in those aged between 6 and 12 years old, whose stage of cognitive evolution possesses firm traits to face the processes of self-knowledge and intellectual growth obtained through materials, people, and environments^{3,4}.

Health education, in its multiple forms, has still been one of the main instruments used in the prevention of dental caries, because in addition to promoting the adoption of healthy behaviors, it is also able to support the development of individuals in all dimensions. It is feasible to disseminate health education both at the professional and home level as well as in community-based institutions such as churches, schools, leisure spaces, etc.^{5,6}.

The plurality of methods used to improve conventional health education techniques has been the focus of several researchers. Use of pamphlets, media content, technological resources and the use of social networks are an example of this, acting as a means of propagating more concise and attractive information to the population that accesses it⁷.

One of the scientific consensuses about the effectiveness of such tools is the fact that these methodologies are paramount in the process of awareness in audiences of diffe-

rent age groups, and the visual stimulus is an attractive aspect, especially for children and adolescents. Electronic games, group games, puppet theater, and coloring books, among others, make up the playful foundation disseminated to schoolchildren as a dynamic and appropriate form of learning^{8,9,10}.

The informative illustrations for health purposes – pioneered in Brazil in the mid-1920s – has taken shape over the years and has now consolidated itself as one of the important pillars for visual communication of basic information on varied topics^{11,12}. Among the variety of options available to disseminate information, the use of comic books (comics) in pediatric dentistry has been underused as a means of health education, making it impossible to promote it as an creative practice on the subject; thus, reducing barriers that further distance children from a light and creative form of oral health education^{13,14}.

Due to the playful-integrative context attributed to the childhood learning process, considering the use of illustrated material in its multiple educational spheres, this study aims to apply these concepts to the pediatric dentistry scenario through a study that covers the creation, validation, and analysis of the effectiveness of comics as a resource of oral health education for children aged between 6 and 12 years living in Manaus, Amazonas.

METHODOLOGY

This was a cross-sectional analytical study, and the implementation of the methodology was carried out in the dental polyclinic located in Manaus - capital of the State of Amazonas - within the scope, specifically, of the pediatric dentistry clinic. The extensiveness of the methodological circumstance was di-

vided into the stages of creation, validation, and analysis of the effectiveness of a comic book (CB) created by the study team, which aimed to create material that was capable of providing entertainment and promoting oral health education.

This study was submitted and approved

by a Research Ethics Committee (CAAE: 89483818.9.0000.5016), ensuring the integrity of participants through the Informed Consent Form (ICF) signed by parents/guardians, as well as the Assent Form authorizing the participation of their children in the methodological process.

The target audience of the study was children within middle childhood (between 06 and 12 years old) who received dental care

in a specialized health unit. Data was collected by a convenience sampling of 50 children (N=50) – as well as parents or guardians who were present at the site and who agreed to participate in the research – and the answers of only 1 responsible one for each child were considered (N=50). The study was conducted in a segmented manner, covering the stages of creation, validation, and analysis of the comic book as a resource for health education.

RESULTS

The results of this work are presented in three distinct stages: the construction of the comic book, the validation of the elaborated material, and the analysis of the effectiveness of the comics.

Construction of the Comic Book

In the first stage, there was a bibliographical search on the difficulties and pathologies more recurrent to children in the targeted age group, aiming to obtain foundations that reflected in dialogs and knowledge capable of inserting technical-scientific content into the culture of the subjects who had access to the material elaborated¹⁵. This research was carried out in the PubMed - MEDLINE database using the uncontrolled descriptors "common pediatric oral diseases", and applying the following filters to the search: full text and with free access; systematic review articles; published in the last five years; in English, Portuguese and Spanish; published in dental journals; children aged between 6 and 12 years old. As a result, 80 articles were identified; of these, 76 were excluded because they are not compatible with the criteria described for the search or because they are

not consistent with the objective of the project. Therefore, 4 articles were considered for the choice of the themes addressed in the comic book – elaborating dental caries, malocclusions, and periodontal diseases as being chronic diseases of potential severity to children's oral health^{16,17,18,19}.

The preparation of the journal began with the creation of the scripts of the stories in the format of draft, initially using graphite and white A4 paper, prioritizing the construction of plots that covered the following criteria: short stories, easy to understand, with little (or no) written dialogue, evident illustrations, and a layout with pleasant appearance and vibrant colors. Moreover, specific techniques such as: breaking of the fourth wall, graphic contrast, depth perception, exaggerated expressions, etc.²⁰. There was a preference for the use of such conditions due to the target audience being children with different age groups (between 6 and 12 years of age), which, therefore, possess several intellectual and cognitive levels.

The creation of the scripts preempted a dialogical approach, with fun stories, seeking to introduce oral health concepts to the target

audience, without them realizing that, in the structure of the material, there were elements capable of promoting a critical reflection on this subject²¹. In addition to containing stories in different formats, another differential of the journal was the inclusion of interactive activities such as a memory game, find the errors, mazes, curiosities, and coloring pages – all interspersed in the book employed between the various narratives.

The title chosen for the comic book was "The Picturesque Adventures of Mamelinho", and in short, the stories depict several adventures of a family of small teeth who live in the Bocão (Big

Mouth) District, and who are constantly persecuted by a villain who is addicted to sugar and carbohydrates. In order to promote familiarity with anatomical structures of the oral cavity, several characters were created with peculiar names and personalities that allude to these characteristics, such as: Mamelinho (deciduous tooth protagonist of the stories), Dentiane (pre-molar tooth, and sister of Mamelinho), Molarzinho (molar tooth, and older brother of the family), Bicho-Podráo (villain of the stories, and direct allusion to dental carie), Canine (puppy of the family of teeth), Crystalline Fairy (tooth fairy that appears in several stories) (Figure 1).

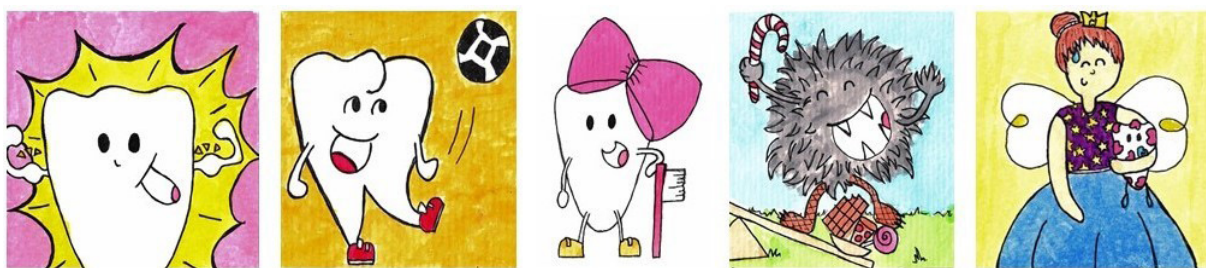


Figure 1 – Characters created for comic books.

After the conception of the work, preparation of the drafts, and the revision of the texts, the process of illustration and painting of the content was initiated. 0.5 mm Naquin pens, watercolor paper 300 g/m², watercolor ink, and a plastic palette were used. Watercolor techniques were performed in the painting, passing - later - by manual coating, aiming to accentuate the traces and minutiae of the

drawings. Next, the scanning, digital adjustment of images, text inclusion and diagramming was performed using software such as GIMP – GNU Image Manipulation Program®, Microsoft Paint® and Microsoft Word® to assist in this process. As soon as the comics were finished, 10 copies of the magazine were printed for the process of validation of the material that was performed by judges qualified for this purpose (Figure 2).

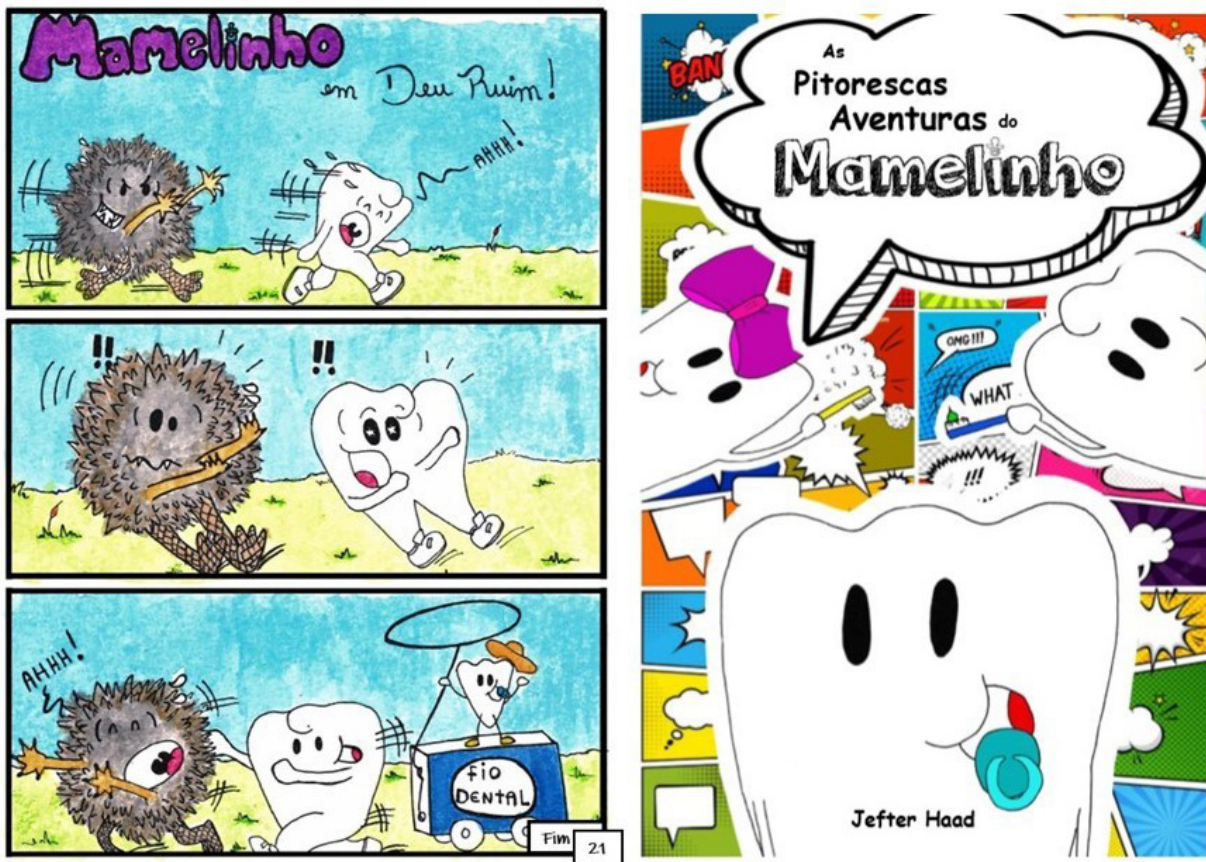


Figure 2 – Finished comic and magazine cover, respectively.

Validation of the material

In the second stage, the printed copies were submitted to different judges aiming to analyze the material regarding the relevance of the topics addressed, the satisfactory understanding of them, the editorial aspects of the drawings and texts, as well as the general view of the comic book. We consulted four professors from the Amazonas State University (UEA) with master's and PhD degrees in several health areas with significant relevance to the scope of the project, namely: pediatric dentistry, dentistry, and public health. The validation method of the comics was made through forms applied to professionals, who designated an opinion for each of the 18 stories and activities contained in the material, choosing one of the following

concepts: "bad", "regular", "good", "great", or "did not understand".

The parameters resulting from this method indicated the following results of the analysis of the appointed judges: PhD in pediatric dentistry - 5.5% bad, 5.5% regular, 16.7% good, and 72.3% excellent; Master's in public health - 5.5% bad, 5.5% good, and 89% excellent; PhD in dentistry - 11% good and 89% great; PhD in public health - 11% good and 89% great.

The levels of agreement to the approval of specific comics among the evaluating professionals reached averages in the "excellent" concept greater than 70%, suggesting only specific improvements to the excellence of the material that were therefore performed.

Among the adjustments requested by the judges were: exclusion of some comic strips, alteration of words or expressions, and inclusion/reformulation of illustrations pertinent to the material.

After the appropriate adjustments, the comic book was analyzed by a representative of the target audience, female, 8 years old at the time of the research. Through a form adapted to its intellectual stage, the child read the comic book and answered the questions asked, which were also arranged through different concepts assigned to each story and activity of the material. As a result, of the 18 items evaluated by the journal, 66.7% were considered excellent and 33.3% considered good, which led to the understanding of the expectations imposed by the target audience to editorial products of cartoon references, suggesting the preference for some specific characters of the stories – this was the only criterion considered for further correction in the content of the material.

The mother of this child also participated in the evaluation process in order to estimate acceptance, as well as that of the parents/guardians of the target audience, since the scope of this material can cover friends and family of children who, consequently, have a copy of the comic book. The opinion of the concepts provided by the mother, defined the material as being 11% good and 89% excellent.

From the consensus obtained among the researchers through the data collected in the validation process, the necessary adjustments were made in the book, which was finalized and forwarded to the procedures for ensuring copyright, registering the work in the National Library under item No. 809679. Then, 50 copies were printed (format: 16x23; number of pages: 5; finish: stapled) and included in 50 kits that contained one toothbrush, one pa-

cket of dental floss, and one tube of toothpaste, allowing for the estimated data collection to analyze the effectiveness of comics with the children designated for the study.

Analysis of the Efficacy of the Comics

In the third stage, two questionnaires were applied, at different times, to the parents/guardians of the children able to participate in the study. They answered the observation questions prior to the implementation of the comics, which addressed issues relevant to the perception of children's habits before using the kit – creating the necessary parameter for the comparison of subsequent results. Then the elaborated kit (containing one comic book, one packet of floss, one tube of toothpaste, and one toothbrush) was distributed to the children of the study for their use at home - environment in which the parents/guardians were observing. A period of 7 to 14 days was used as an observation period, by parents, as to the possible changes of habit of the children who received the kit.

During the follow-up consultation, which took place after the aforementioned interval period, a second questionnaire was applied to the same guardians, which consisted of the same questions as the previous questionnaire, adding, however, some questions about the particularities of the methodological implementation of the comics – this supplement was given as a proposal to expand the analysis about the educational approach employed.

The data obtained through the forms were recorded in the Microsoft Office Excel 2016® software, in order to perform a comparison between the frequency of brushing and the use of floss in the two moments observed by the study. Subsequently, the data were submitted to McNemar's statistical test to analyze the significance of the before and after data.

Of the 50 children assigned to the study, three (6%) did not participate in the second questionnaire because they did not attend the follow-up consultation, and 47 (94%) actively participated in the proposed objectives, thus characterizing the sample (n=47) for the data analysis.

There was the participation of children with all the ages recommended in the age group of the study, as shown in Table 1.

Of this total, 53.19% of the children were male and 46.81% female. Regarding the relationship of the guardians who participated in the questionnaire, 65.96% were mothers, 23.40% were fathers, and 10.64% fall into other categories (aunt, grandmother, etc.), most of them aged between 30 and 39 years old (42.55%).

In the first questionnaire applied to parents, questions about the children's oral hygiene habits were asked, obtaining a quantitative parameter on various questions in agreement with the study objective. The kits with oral hygiene utensils and the comic book were distributed, and between 7 and 14 days later, in the consultation of return to dental care, the same questions were asked to the participating parents, providing comparative data to the results before and after (Table 2).

In the application of the second questionnaire - from 7 to 14 days after the distribution of the kits with the journal - in addition to the same questions of the first questionnaire, other questions related to the acceptance process and individual profile of the children were asked in order to broaden the understanding about the reading habits and conduct of children with the kit at home. Table 3 lists most of the results obtained.

In the context of the referred to objectives of this study, the modification of hygiene habits after the implementation of the comic

book indicated some growth - although discrete - in the number of children who began brushing their teeth due to this approach, equivalent to a growth of 2.13% of the target audience. The frequency of toothbrushing specified by the item "more than 2 times a day" reflected an increase of 25.53%. As for the result that reflects the autonomy of children in the act of brushing, it was observed that 17.03% began to perform oral hygiene independently, without the help of parents or guardians. This indicates that the approach through comics was relatively effective in the self-care process.

However, the result of greater statistical significance was observed regarding flossing, which showed an increase of 55.32% of children who started flossing after the use of the comics. This result was confirmed by the McNemar statistical test ($p < 0.05$), which paired the data before and after, and indicated the result of $p = 0.0401$. There was also an increase of 29.78% in children who started flossing more than 2 times a day, as well as the decline in the number of times parents/guardians helped in flossing - reaffirming the autonomous tendency for healthy habits fostered by the material in question.

Given the evidence related to the interaction of the material created by the study, it is found that more than half of the children were already accustomed to reading (59.57%), and most of them (97.87%) effectively read the comics, allowing for the interpretation that 38.3% of the children interacted with the material despite not being accustomed to reading. Among the materials of the kit that most reflected interest in the children are the toothbrush (100%) and the comic book (95.74%), and the preference of the first item - according to descriptive data of the interviewees - should be due to the

fact that they are children's brushes, with dynamic shapes and varied colors.

Finally, regarding the acceptance of the material by the individuals involved in the study, the fact that 76.60% of the children showed the comics to other people in their social circle (friends or family) stands out, emphasizing the exponential dynamics of informative/interactive propagation that the comic books have.

Within this broad panorama of dissemination, the general perception of parents/guardians about a real difference in the number of times the child began brushing their teeth per day, reached positive responses in 89.36% of the cases. This demonstrated a direct correlation between the stimulus promoted by the material made available and the change of habit reflected in their children during the testing period.

Table 1 – Age of Participating Children, Manaus, 2019.

Age	N	%
06	9	19.15
07	14	29.79
08	11	23.40
09	4	8.51
10	7	14.89
11	1	2.13
12	1	2.13

Table 2 - Questions about the oral hygiene habits of participating children, Manaus, 2019.

Question	Reference response	Reading the comic book	%
Question 1: Does your child brush his/her teeth?	Yes	Before	95.74
		After	97.87
Question 2: How many times a day?	More than twice	Before	46.81
		After	72.34
Question 3: How many times do/did parents/guardians help/helped with brushing?	Never	Before	59.7
		After	76.60
Question 4: Do you use/did you use dental floss?	Yes	Before	23.40
		After	78.72
Question 5: How often do you use/did you floss?	More than twice	Before	02.13
		After	31.91
Question 6: How often do parents help/helped to use dental floss?	Not once	Before	65.96
		After	55.32

Table 3 - Questions about the profile of participating children and their behavior with the comic book and distributed oral hygiene material, Manaus, 2019.

Question	Reference Response	%
Question 1: Does the child know how to read?	Yes	59.57
	No	17.02
	More or less	23.40
Question 2: Has the child ever had access to comic books?	Yes	78.72
Question 3: Did the child interact, in any way, with the comic book at home?	Yes	97.87
Question 4: He/she showed interest in which of the tools in the kit?	Toothbrush	100
	Toothpaste	85.11
	Dental floss	72.34
	Comics	95.74
Question 5: Did the child ask for help to understand some text or image in the comic book?	Yes	53.19
Question 6: Did he/she show the magazine to friends or family?	Yes	76.60
Question 7: Did the child use the toothbrush or floss present in the kit?	Both	91.49
Question 8: Did you notice any difference in the number of times the child brushed their teeth per day?	Yes	89.36

DISCUSSION

It is crucial that the dentist, in their central role as a propagator of health actions, uses a motivating educational approach that offers inclusive, didactic, and acceptable methods of the individual as a unique being that needs specific care to the supply of all their needs²². In addition to the need to transpose scientific knowledge into the language of the population, it is also essential that professionals leave aside the exclusivity of the curative dimension to focus on the development of methods that, in fact, mobilize oral health practice in any social environment, thus, promoting the awareness and reflection of both the individual and the social context that surrounds them^{23,24,25}.

Childhood is recognized as a period conducive to new habits and learning that will reflect on the adult life of the individual, including new ideas about health and its particularities, and the partnership between education and health is of fundamental importance for the consoli-

dation of good health indicators, starting mainly from the action of multidisciplinary teams working in primary care. Furthermore, among the precepts that include the efficacy of oral hygiene for children, there is the incorporation of playful methods to improve behaviors related to oral hygiene practices⁹.

In this study, a comic book was used as an educational tool created by researchers to function as an instrument of oral health education, using a language that dialogues with children of a wide age group, involving stories and games with and without written dialogues. Moreover, throughout the execution of this study, it was observed that the use of play in favor of early childhood education is based on findings that go beyond the etymological concept of its term. Barbosa and Sobral²⁶ associate the various aspects of play with the pleasure that such methodology is capable of awakening in childhood, both through games, toys, and

entertainment, as well as in creative, dynamic, and colorful approaches to the target audience. This instrument allows a more real view of the world through creativity and can be arranged in various graphic media capable of fostering the critical perception of the student, even causing the improvement of their interpersonal relationships.

Brandão and Micheletti²⁷ recognize the act of reading as a process of information of the world around us, consolidating the individuality of man through his need for interaction with this media, leading him to explore different forms of literature in favor of his intellectual and social development, which characterizes this activity as an active means of learning. Moreover, the act of a playful and disjointed reading for pedagogical purposes, is capable of awakening, through lightness and spontaneity, the understanding of the various literary languages – framing in this figurative hall familiarity with illustrated and colorful stories, including comic books.²⁸

Using textual resources like onomatopoeias, symbols, and narrative content, as well as visuals like vignettes, figures, balloons, etc., comic books, also called comics, are defined as a language structure that uses a combination of texts and drawings to tell a story that is commonly attractive to children and adolescents²⁹. Among the subtleties of this illustrative material, there is the fact that the stories are structurally short and concise, which increases the probability of being reread, thus allowing for calm reading, where the reader can stop or go back in the text through an active rhythm and prone to the awakening from fantastic dynamism³⁰. The results of the present study corroborate the consolidation of comics as an efficient way of spreading knowledge, evidenced by the interest of the above-mentioned graphic ma-

terial, proving to be effective in 95.74% of children. Of the sample quantity, 78.72% reported having access to comic books before the study, indicating that most of the children already were familiar with the material elaborated by the study. Furthermore, 59.57% of the children analyzed were already able to read, which demonstrates the scope of the health education process, which is consistent with learning autonomy, since the data showed that about 17.02% of the children interacted with the comics even though they were not yet literate.

From the questionnaires applied before and after to the parents/guardians of the target audience, it was possible to visually observe the impact the distributed hygiene utensils had on the number of times when children began to perform oral hygiene in their homes, since toothbrushes had colors and shapes that are flashy to children. The stimulation of brushing through the distribution of the kits was directly reflected in the collected data, as indicated in the 25.53% increase in the number of children who brushed their teeth only 02 times a day before the comics (46.81%), compared to those who then began to brush more than 02 times a day (72.34%) in the period from 7 to 14 days.

Regarding the above-mentioned data, Silva *et al.*³¹ concluded in their study that the interest of children in toothbrushing is directly related to children's motifs printed or molded onto this object, and factors such as color and characters linked to the media are important indications to the tendency of their choosing this utensil. Thus, it is possible to interconnect the interest in the toothbrush, expressed by all the children involved, with the fun format and the varied colors present on this item that composed the kit. Another factor that may have contributed to the increased interest of children in the use

of toothbrush in this study was the experience they had with the stories and games contained in the comic book, since these arguments were created to illustrate, specifically, the characteristics that this utensil must have to achieve good results with this hygienic act.

In the case of flossing, the results were even more significant. Before the methodology, only 23.40% of the children flossed at least one time a day; then, 78.72% reported flossing daily. In this case, the item mentioned did not have children's characteristics, with colors or attractive shapes, which indicates that, unlike the visual stimulus provided by the brush, the dental floss had its increase of 55.32% related to the enthusiasm promoted by the content of the comics, which exhibited and stimulated, in various ways, the importance of using this utensil for a good prevention of possible dental problems.

Mattos-Silveira *et al.*³² and Karimi³³ attest to the obstacles that lead children and adolescents to neglect the use of floss, emphasizing the difficulties related to its proper use concerning motor aspects, laziness, and lack of education. In addition, the ignorance of parents/guardians about the importance of flossing in children is cited³⁴. However, the results obtained by analyzing the impact of the oral health comic book used in this study showed the propensity of children to take the initiative in flossing, indicating that, although there are physical barriers that hinder the use of this utensil, the potential for visual stimulation continues to be an important tool for the refinement of these habits.

Furthermore, Pimenta *et al.*³⁵ encompassed the visual praxis scenario as a potential means for critical reflection of subjects regarding the evolution of public health, stating that exploring educational materials that represent a social reality in parallel with heal-

th/disease processes, may produce results capable of overcoming physical, ideological and even transdisciplinary obstacles.

The possible limitations of this study are based on characteristics intrinsic to memory biases, since the application of the second questionnaire varied between 07 and 14 days, allowing for the potential forgetfulness of certain specific household observations. However, some attitudes were taken to minimize the occurrence of such bias, to mention the verbal reinforcement about the importance of accompanying the children laid out by the study, the training of the interviewer (through the pilot study with a representative of the target audience), as well as the use of standardized procedures in the conduct of the interviews. Another item to be considered would be the realization of a longitudinal study on the theme addressed, since the continuous analysis of the progression - or stagnation - of carious lesions in children can support healthy interventions aimed at the prevention of oral diseases. Furthermore, the carrying out of a study capable of assessing clinical indices resulting from awareness arising from the positive stimulus caused by this educational resource is suggested^{36,37}.

Thus, considering the aforementioned reflections, it is inferred that the educational material used in the present study proved to be an instrument conducive to learning by mixing written, illustrative, and recreational information capable of reinforcing the innumerable information and reflections on oral health described herein. This stimulates the care for children's oral hygiene, having as part of the methodological principle the use of graphic resources consolidated in popular culture that - despite the systematic advent of computerization - still prove to be an attractive aspect for children and adolescents¹¹.

CONCLUSION

The comic book magazine evaluated in this study, containing concepts about dental caries, malocclusion, and periodontal diseases, proved to be an efficient illustrative resource for oral health education for children in the age

group of 6 to 12 years, presenting significant results regarding the use of dental floss. Moreover, we demonstrated a wide acceptance from both parents and children who had access to the material prepared by the research team.

CRedit author's statement

Conceptualization: Silva JHS; Monteiro AX. Methodology: Silva JHS; Monteiro AX; Regalado DF. Validation: Silva JHS; Monteiro AX; Regalado DF; Honorato EJS. Statistical Analysis: Monteiro AX; Honorato EJS. Formal Analysis: Silva JHS; Monteiro AX; Silva IR; Carvalho ES. Research: Silva JHS; Junior FB. Resources: Silva JHS; Monteiro AX; Regalado DF; Silva IR. Elaboration of the original draft: Jaffer Haad; Angela Xavier; Iracema Ruiz. Writing-revision and editing: Silva JHS; Monteiro AX; Regalado DF; Honorato EJS; Oak ES; Silva IR; Junior FB. Visualization: Junior FB; Silva IR; Honorato EJS. Supervision: Silva JHS; Monteiro AX; Regalado DF. Project management: Silva JHS; Oak ES; Monteiro AX; Regalado DF.

All authors read and agreed with the published version of the manuscript.

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Received: february 22, 2022.
Accepted: november 08, 2022.
Published: 12 december 2022.