

Development, validation and assessment of effectiveness of an educational folder about mouthguards in a child and adolescent population - a strategy for preventing dental trauma in sports

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Received: 12/01/2022. Approved: 12/06/2022.

ABSTRACT

The aim of this study was to develop, verify the content validity and evaluate the effectiveness of an educational folder about mouthguard (MG) for children and adolescents (C/A) between the ages of eight and fifteen. The steps of development and content validity were carried out after a bibliographic search for an evidence-based literature on the subject, and the evaluation of MSc or PhD dentistry students and/or professors, education experts, as well as C/A (target group). The content validity index (CVI) for each item (I-CVI) and the total folder content validity index (F-CVI) after the PhD professors (judges) analysis was calculated. A questionnaire with assertions related to the content of the folder (indication, types and storage of MG, myths and truths about the device) was created, and the effectiveness of knowledge acquisition was evaluated by applying tests for paired data, considering C/A responses before and after reading the folder. Generalized and mixed linear model were used to evaluate unadjusted and adjusted associations, respectively. The sample power was also calculated. The I-CVI and F-CVI were 1.0, showing that the items were considered relevant, representative, showed good operability and were valid. Forty-four C/A of 10.9 ± 2.24 years were included and, after reading the folder, the mean of correct answers had a significant increase ($p < 0.001$). In the adjusted model, “reading the folder” influenced positively on the knowledge about MG ($p < 0.001$). Sample power of 100% was obtained. The folder presented satisfactory content validity and should be considered as an instrument capable of increasing the knowledge of C/A about MG.

Descriptors: Mouth Protectors. Tooth Injuries. Validation Study. Athletic Injuries. Child.

1 INTRODUCTION

Children and adolescents (C/A) are often affected by traumatic dental injuries (TDIs), and a high incidence of these injuries occurs during the period of mixed dentition¹⁻³. Sports activities are an important etiologic factor of TDIs in permanent anterior teeth. Considering that C/A are spending even more time participating in these activities, they are more exposed to the risk factor of those injuries^{1,3,4}. It should be noted that TDIs can cause sequelae beyond the clinical aspect, influencing negatively on oral health related to quality of life and on social relationships^{5,6}.

The prevention of sports-related injuries is necessary since the high frequency, cost and long period of treatment could keep the athlete away from training and competitions^{4,7}. Mouthguards are effective protective devices that absorb and dissipate the impact force of objects or players in the orofacial region during the practice of sports, mainly during the contact ones^{8,9}. The American Academy of Pediatric Dentistry and the Academy for Sports Dentistry have recommended the use of mouthguards in all activities with a risk of TDIs, although the frequency of use is still low^{2,10-13}.

The production and provision of information on preventive measures through educational materials constitutes an important strategy to promote the health of the population. Both education and health are areas intended for the development and well-being of individuals¹⁴. Education is one of the most important points in the process of change in a society, being considered an instrument of social transformation, mainly for the reformulation of habits^{14,15}. Furthermore, literature stimulates health education to prevent TDIs^{10,12,16}.

A folder is a small print consisted of

only one sheet of paper, with one or more folds, which presents informative content¹⁷. Assessing the validity of educational materials, such as those included in folders, is important to evaluate how well the material can transmit the desired information. This can be checked by applying the instrument and comparing if the target group was able to understand and absorb the information^{18,19}. The purpose of this study was to develop, verify the content validity and assess the effectiveness of an educational folder about mouthguards for children and adolescents, as a future preventive strategy for TDIs during sports practice.

2 METHODS

The present study was approved by the Committee for Ethics in Research at the Clementino Fraga Filho Hospital, with the opinion number 4.886.805/2021. To better understand the methodology, it was divided into three steps: (1) development, (2) content validity and (3) assessment of knowledge transmission effectiveness. The development and validation process (creation and testing) followed the model proposed by Marques *et al.* (2016)²⁰.

Development process

The material titled “Protetores bucais: O que você precisa saber!” (“Mouthguards: what you need to know!”) was developed in Brazilian Portuguese, based on the updated scientific evidence about the theme obtained after a bibliographic search. The folder was created based on the importance of the use and function of mouthguards during sports practice, presenting ways of obtaining them, types of mouthguards and care in the use and storage of these devices. In addition, a topic regarding myths and truths about the use of

mouthguards was added to inform about the athlete's performance during its use and the possibility of use along with fixed orthodontic appliances.

After the elaboration of the theoretical content of the folder, design and illustrations were included and/or created through the Canva® program (Canva Pty Ltd, Sydney, Australia). The illustrations added are part of the collection made available by the Centro de Vigilância e Monitoramento de Traumatismos Dentoalveolares® at the Universidade Federal do Rio de Janeiro (CVMT/UFRJ) - *Instagram: @cvmt.ufrj*- and are free of charge on the online platform.

Finally, different professionals and groups evaluated the preview of the educational material, as follows.

MSc or PhD dentistry students and professors

Six researchers from the Department of Pediatric Dentistry of the Universidade Federal do Rio de Janeiro (UFRJ), with expertise in TDIs' research, analyzed the technical content and design of the folder. The folder was distributed individually via e-mail for evaluation. The researchers had to make their remarks, suggestions and point out any possible doubts. After the reply via e-mail with the comments, the authors discussed and accepted modifications considered pertinent to be included in the folder.

Educational experts

The folder was sent to two educational professionals via e-mail with the description of the study objective and the directions to judge the material. Both professionals evaluated the material regarding concept of suitability of communication and language. The authors discussed and accepted modifications considered pertinent.

Children and adolescents who practice sports or not

The folder was printed and given individually to C/A between the ages of eight and fifteen presented at the Pediatric Dentistry Clinic of UFRJ, with the exception of CVMT/UFRJ, which is a dental trauma care center. The authors read the content with each participant, who made their remarks, suggestions or pointed out any possible doubts. Additionally, C/A were encouraged to evaluate the folder design. After the comments, the authors discussed and accepted modifications considered pertinent to be included in the folder.

This step was done in two separate moments: first, with fourteen children or adolescents, either regular sports players or not, and second, with six children or adolescents, amongst who regular sports players were included.

Content validity verification process

Six professors (judges) with experience in TDIs from different states and regions of Brazil evaluated the technical content. They were considered eligible as long as they met pre-established criteria related to the topic of dental trauma: the published studies in dental trauma should have a doctoral degree and university professors of undergraduate courses in dentistry. The folder was distributed individually via e-mail, elucidating the objective of this study. In the e-mail, the technical content that should be analyzed was explained, based on a document also sent with instructions on how this assessment would be carried out.

In the document, each topic in the folder was described separately to allow an independent, objective and clear evaluation on their content. The topics of the folder were

divided and totaled five items: 1) “Myths and Truths about custom mouthguards”; 2) “What are mouthguards and why use them”; 3) “In which sports should we use them”; 4) “Types of mouthguards”; 5) “When the mouthguard is used, some care is needed”.

To verify the content validity, each item (n=5) was evaluated by “A” and “B” questions (n=2), as follows:

Question A: the judges had to assess the relevance and representativeness of each item. A 4-point Likert scale was used as follows: 1 = Item not relevant or not representative; 2 = Item needs major revision to be representative; 3 = Item needs minor revision to be representative; 4 = Item relevant or representative. The judges had to mark the table with an “X” in the column that corresponds to the scale value selected for each item to assess the representativeness and relevance of the item.

Question B: the judges had to fill out descriptive suggestions, if they had any, about how each item or content should be rewritten, modified, added or removed from the folder.

After the reply via e-mail with the comments, the authors discussed to determine whether to accept or not the suggestions and/or recommendations in the folder.

Content validity index statistical analysis

The content validity index (CVI) was calculated for each item (I-CVI) of the elaborated folder (n=5), as well as for the entire folder (F-CVI). In total, six PhD professors made assessments, and according to the Likert scale, the score of each item can range between 1-4 points, and the total score of the folder between 5-20 points for each judge.

The items that received a score of “1” or “2” should be revised or eliminated, and items with a score of “3” or “4” were considered

satisfactory. The I-CVI measures the proportion of experts who agree on the items and is calculated by adding the number of answers marked “3” or “4” for each judge divided by the total number of answers for that item, according to the following formula:

$$\text{I-CVI: } \frac{\text{Number of answers “3” or “4”}}{\text{Number of total answers}}$$

It is important to clarify that, before calculating the F-CVI, the relevance rating was recorded as 1 (relevance scale of “3” or “4”) or 0 (relevance scale of “1” or “2”).

There are two methods for calculating the F-CVI that can be used. In the F-CVI/AVE (AVE = average variance extracted), the average of the scores of each I-CVI is calculated for all items in the folder – average between items in the folder, that is, the sum of all I-CVI divided by the total number of items in the folder (n=5). In the F-CVI/UA (universal agreement), the content validity index of the entire folder is calculated based on the universal agreement method through the proportion of folder items (n=5) that reached a relevance scale of “3” or “4” by all experts (n=6).

To calculate the F-IVC through the F-CVI/UA, it is necessary to highlight that the universal agreement score (UA) is 1 when the item reaches 100% of agreement among experts, otherwise, the UA score is 0. The F-CVI/AVE and F-CVI/UA formulas are described below:

$$\text{F-CVI/AVE: } \frac{\text{Sum of all I-CVI}}{\text{Number of items}}$$

$$\text{F-CVI/UA: } \frac{\text{Sum of UAs}}{\text{Number of items}}$$

For the CVI to be considered acceptable, it must be at least 0.78 for each item (I-CVI) and 0.80 for the entire folder (F-CVI), being preferably greater than 0.90²¹.

The final version of the folder can be seen in figure 1.



Figure 1. Developed folder

Assessment of effectiveness

After the end of the validation process, the evaluation effectiveness stage was carried out. A questionnaire (Figure 2) was elaborated with 11 questions and divided in four parts related to personal data, perception of TDIs during sports practice, knowledge about mouthguards and personal experiences with sports, as follows: 1st: two questions about personal data (1,2); 2nd: one question related to the perception of traumatic dental injuries during sports practice (3); 3rd: six

questions related to the use and knowledge about mouthguards (4, 7-11); 4th: two questions about personal experiences with sports (5,6). In the questionnaire, an image of a child using a custom-made mouthguard was exhibited in a tablet and it was used to illustrate an example of the device for some of the questions (7-11). It is worth remembering that the questionnaire was elaborated and applied in Brazilian Portuguese. The version in figure 2 was translated, but not validated.


<p>1. Are you a boy or a girl? () Girl () Boy</p> <p>2. How old are you? A: _____</p> <p>3. Do you think somebody can hurt their mouth or teeth while playing sports? () Yes () No () I don't know</p> <p>4. Do you know any way to protect your teeth and mouth while playing sports? Which one? () Yes () No () I don't know A: _____</p> <p>5. Do you play any sport? Which one?/ () Yes () No () I don't know A: _____</p> <p>6. Do you participate in championships or competitions in this sport? () Yes () No () Don't practice sports</p> <p>Now, look at the image below and answer the following questions:</p>  <p>Do you know what is in the child's mouth in the picture? If so, what is? () Yes () No () I don't know A: _____</p>	<p>8. Do you know what this device is used for? If so, what is it for? () Yes () No () I don't know A: _____</p> <p>9. Have you ever used this device? () Yes () No () I don't know</p> <p>10. Do you think the use of this device is important? Why? () Yes () No () I don't know A: _____</p> <p>11. Answer the following questions: "This device is made by a dentist." Does it:</p> <p>a) ... protect the teeth and gums during sports? () I agree () I disagree</p> <p>b) ... protect the lips and cheeks during sports? () I agree () I disagree</p> <p>c) ... can it be used when playing sports with balls, such as soccer, basketball and volleyball? () I agree () I disagree</p> <p>d) ... can it be borrowed by your friends? () I agree () I disagree</p> <p>e) ... can it be washed and placed in the sun to dry? () I agree () I disagree</p> <p>f) ... decrease the athlete's performance (hinders the athlete) during any training or competition? () I agree () I disagree</p> <p>g) ... can it be used with a fixed orthodontic appliance? () I agree () I disagree</p> <p>h) ... can it be used by children and adults who practice sports? () I agree () I disagree</p>
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Figure 2. Elaborated four-part questionnaire

There were C/A considered eligible between the ages of eight and fifteen presented at the Pediatric Dentistry Clinic of UFRJ, from November 2021 to February 2022. First, the questionnaire was applied individually in the form of a single interview, and the participants answered the entire questionnaire. After this, the same researcher showed them the printed folder and read it in full with the C/A. Subsequently, the questions relating to the perception of LDTs during sports practice and knowledge about mouthguards were answered again by the participants.

Assessment of effectiveness statistical analysis

The sample characteristics were presented through the frequencies (N and %), the mean (\bar{x}) and standard deviation (SD) were used for dependent variables (mean of correct answers) and independent variables. The parametric distribution was evaluated using the Shapiro-Wilk test and the difference between the means, and the frequencies of correct answers before (T1) and after (T2) reading the informative folder were evaluated using the Wilcoxon and McNemar tests, respectively.

For before and after data analysis, generalized and mixed linear model were used to evaluate unadjusted and adjusted associations, respectively, between individual factors (previous history of TDIs, sports practice and use of mouthguard) and correct answers (dependent variable). Variables with statistical significance in the unadjusted model were inserted into the adjusted model.

Data analysis was performed using the JAMOVI 2.2.5²² program and an alpha of 5% was considered for all analyzes performed.

Sample Power

The test of power analysis was calculated in GPower 3.1.9.4²³ considering the Wilcoxon

test for paired data (before and after the folder reading) through the “post hoc: compute achieved power”.

The effect size was calculated from the difference between the means of the groups before and after reading the folder, divided between the mean of their SD and applying a correlation factor of 0.5 between the groups.

3 RESULTS

Content validity verification process

The I-CVI was 1.0 for all items, as well as for the F-CVI/AVE and F-CVI/UA, indicating that the items were considered relevant, representative and with good operability, as well as valid.

Assessment of effectiveness

Forty-four children and adolescents presented in the Pediatric Dentistry Clinic in the period of enrolment were included in the sample, with a mean age of 10.9 ± 2.2 years, 23 girls (47.7%) and 21 boys (52.3%). Table 1 shows the distribution of the sample in relation to age, perception of TDIs during sports practice, personal experiences with sports and knowledge and use of mouthguard.

Before reading the folder, the mean of correct answers was 5.16 ± 1.80 . After reading the folder, the mean of correct answers increased (mean difference 2.5 [confidence interval ranging from 2.0 to 3.0], $p < 0.001$), as well as the frequency of the correct answers about lips and cheek protection (question 11(B), $p < 0.001$); possibility of washing and placing the mouthguards in the sun to dry (question 11(E), $p < 0.001$); reducing the athlete's performance ($p < 0.001$); being able to be used with fixed orthodontic appliances (question 11(G), $p < 0.001$); and being indicated for children and adolescents who practice sports ($p = 0.034$).

Table 2 shows the mean of correct answers of the participants before (T1) and after (T2) reading the folder, in relation to the perception of TDIs during sports practice, personal experiences with sports and knowledge and use of mouthguard considering the answers at baseline (T1 – before the folder).

Comparing the characteristics of the sample before and after reading the folder in relation to the correct answers, a difference was found in the children and adolescents' age ($p=0.013$), in the “know some way to protect their teeth and recognize the mouthguard”

($p<0.001$) and “know what this device is for” items ($p<0.001$), in the “who plays sports” ($p=0.003$) and “thought its use was important” items ($p<0.001$). It is believed that the variable “know some way to protect their teeth” is related to two other variables, “recognizing the mouthguard” and “know what this device is for”. Thus, only “recognize the mouthguard” and “know what this device is for” were included in the analysis. Table 3 shows the adjusted model for these parameters and, after the inclusion of all parameters, only the folder remained as an influence on the knowledge factor ($p<0.001$).

Table 1. Sample distribution regarding age, perception of TDIs during sports practice, personal experiences with sports and knowledge and use of mouthguard before reading the folder (T1)

Age (years)	N (%)		
8-10	20 (45.5%)		
11-15	24 (54.5%)		
	Yes	No	Don't know
Do you think someone can injure their mouth or teeth while playing sports? (N=44)	32 (72.7%)	12 (27.3%)	-
Do you know any way to protect your teeth and/or mouth while playing sports? (N=44)	27 (61.4%)	17 (38.6%)	-
Do you play any sports? (N=44)	32 (72.7%)	12 (27.3%)	-
Do you participate in sports competitions? (N=32) #	7 (21.9%)	25 (78.1%)	-
Do you know what is in the athlete's mouth? * (N=44)	26 (59.1%)	18 (40.9%)	-
Do you know what it is for? * (N=23)	29 (65.9%)	1 (2.3%)	14 (31.8%)
Have you ever used this device? * (N=44)	2 (4.5%)	42 (95.5%)	-
Do you think the use of this device is important? * (N=44)	30 (68.2%)	-	14 (31.8%)

Only participants who played sports answered (N=32).

*Questions asked showing the image of a child using a custom-made mouthguard.

Table 2. Correct answers (mean \pm standard deviation) considering the perception of TDIs during sports practice, personal experiences with sports and use and knowledge of mouthguard before and after reading the folder

Age (years)	Before	After	p value
8-10	4.5 \pm 2.12	7.1 \pm 1.21	0.013
11-15	5.71 \pm 1.3	7.79 \pm 0.42	
Do you think somebody can hurt their mouth pr teeth while playing sports? (N=44)			
No	2.0 \pm 0.0	6.0 \pm 0.0	0.992
Yes	5.2 \pm 1.9	7.45 \pm 1.15	
Do you know any way to protect your teeth and/or mouth while playing sports? (N=44)			
No	4.14 \pm 1.46	7.14 \pm 0.77	<0.001
Yes	5.63 \pm 1.77	7.63 \pm 0.96	
Do you play any sports? (N=44)			
No	4.0 \pm 2.22	6.83 \pm 1.34	0.003
Yes	5.59 \pm 1.43	7.72 \pm 0.6	
Do you participate in sports competitions? (N=32) #			
No	5.76 \pm 1.27	7.84 \pm 0.5	0.151
Yes	5.0 \pm 1.91	7.3 \pm 0.76	
Do you know what is in the athlete's mouth? * (N=44)			
No	4.11 \pm 1.81	7.06 \pm 1.11	<0.001
Yes	5.88 \pm 1.42	7.77 \pm 0.65	
Do you know what is it for? * (N=44)			
No	3.73 \pm 1.71	6.87 \pm 1.13	<0.001
Yes	5.09 \pm 1.37	7.79 \pm 0.62	
Have you ever used this device? * (N=44)			
No	5.07 \pm 1.8	7.45 \pm 0.9	0.187
Yes	7.0 \pm 1.4	8.0 \pm 0.0	
Do you think the use of this device is important? * (N=44)			
I don't know	3.36 \pm 1.55	6.64 \pm 1.22	<0.001
Yes	6.0 \pm 1.2	7.87 \pm 0.35	

Only participants who played sports answered (N=32). * Questions asked showing the image of a child using a custom-made mouthguard.

Table 3. Correct answers before and after reading the folder, adjusted for possible factors.

	Beta	Confidence interval	p value
Before and after reading the folder	7.06	3.93 to 12.69	<0.001
Age	0.637	0.38 to 1.05	0.076
Sports practice	1.20	0.65 to 2.23	0.558
Recognizes mouthguard	0.81	0.29 to 2.26	0.771
Mouthguards function	1.17	0.58 to 2.39	0.661
Importance of mouthguards	1.82	0.80 to 4.13	0.154

Sample power

Considering the parameters found in the main study were $\bar{x} \pm SD = 5.16 \pm 1.80$ before the folder and $\bar{x} \pm SD = 7.48 \pm 0.93$ after the folder, and a correlation of 0.5 between groups, the effect size

of 1.48 was calculated. Considering the means and standard deviation of the groups before and after the found effect size of 1.48, adopting a two-tails test, $\alpha = 0.05$, and a total sample size = 44, a power of 100% was obtained ($1 - \beta$ err prob = 1.00).

4 DISCUSSION

Sports-related TDIs are common worldwide and can have important physical, social, psychological and economic impacts in the life of affected sports practitioners^{1,12}. However, most of these kinds of injuries could be prevented with the use of personal protective equipment, such as mouthguards. The use of mouthguards to effectively reduce the incidence and minimize the severity of injuries in both soft and hard oral tissues has already been proven in previous studies, while the non-use of these devices increases the risk of TDIs in sports practice between 1.6 to 1.9 times^{2,8,9,12}.

Lack of knowledge and the belief in the ineffectiveness of mouthguards are reasons for the athletes' inability to use these devices^{2,3,12}. In literature, some studies encourage health educators and health care providers to inform sports players about the possible ways of preventing injuries^{2,3,10,16}. In addition to that, a study suggests that stimulating awareness regarding the use of mouthguards from an early age could be important to improve mouthguard wearing rates in later years²⁴.

This type of education aimed at children and adolescents can be provided using printed educational materials. This form of material is an accessible alternative and it allows for the sharing of information and knowledge, promoting health based on the participation of the population and on the receptivity to the folder's easy dissemination of content when distributed to and read by their target audience¹⁴. The present study developed and validated the content of a folder about mouthguards to be used as an educative instrument for children and adolescents. It aims to offer a simple and low-cost resource to facilitate children's comprehension about the importance of using a mouthguard during sports activities and to clarify common doubts about this device.

In the health area, producing educational

material with healthcare instructions and making sure that the lay public will understand the scientific information is not an easy task to overcome^{18,20}. To allow the target audience to use the folder and benefit from this tool, it is important to translate knowledge through an accessible and understandable language to said target audience. Therefore, content validity and effectiveness evaluation processes are important and essential steps for the adequacy of the material and its responsible disclosure¹⁸⁻²⁰.

Well-written materials must contain precise and relevant information through a coherent and well-understood vocabulary, with simple language and short sentences to make the tool attractive to the target audience. In the present study, both health professionals and members of the target audience were consulted for developing and content validity of the folder to ensure differences in opinion and approaches to the same subject, as recommended in literature^{20,25}. This experience was essential for enhancing the folder, mainly due to the important suggested words and terms modification during the evaluation process.

Well-crafted materials with easy-to-understand information improve knowledge, and the presence of images and ludic designs help fix the written content, reducing communication barriers during the process of learning²⁶. In the present study, the folder developed included illustrations and designs that were previously evaluated by the experts, children and adolescents during the development process. During the content validity process, they were considered coherent, relevant and easy to understand by the judges. These facts and stages corroborated to the positive results found in terms of the gain of knowledge after the use of the folders.

In relation to the results, children and adolescents are a difficult group to convey evidence-based information to, and there are several factors that can influence short-term

working memory. One of the most accepted factors for that today is the attentional focus, which refers to the efficiency with which attention captures relevant stimulus and how attention can be used to suppress or inhibit the activation of irrelevant stimulus. According to this perspective, older children are more efficient at focusing their attention on relevant information and at inhibiting irrelevant aspects that are often activated automatically²⁷. This factor may explain the difference between the age groups included in the unadjusted statistical model.

Playing sports, knowing the function and importance of mouthguards also influenced the transmission of knowledge of the folder developed. All of these parameters are directly or indirectly related to sports practice. It has been reported that humans are more likely to remember consecutive data when it is contextualized. In other words, when data is inserted in a spatial environment, it can be remembered faster and easier²⁸. Both the sports practice by children and adolescents and the application of the folder in a dental environment are related to the information contained in the folder and may have influenced the results. Future studies with the application of this educational material, outside of the dental environment, are encouraged.

The fact that this type of educational material is in the form of a folder could also be related to its positive results in the present study. A folder is a simple and objective alternative in which the content is written in a summarized way, highlighting the most important information. Small amounts of information reduce the time spent during the folder “study” and could reduce the chances of attention being diverted, contributing to its effectiveness.

However, a folder generates only one type of stimulus during the learning process - visual. If the reader reads aloud, a second stimulus - vocal - can be created. Some research groups from different countries demonstrated that multisensory stimuli

had a positive effect during the learning process^{29,30}. Future studies about mouthguards comparing different educational tools with different stimuli, such as audio with podcast, audiovisual with videos, and audio-visual-tactile with videos and models could confirm this hypothesis.

As previously mentioned, the fact that this target population is from a dental environment of a single public health care unit implies in a homogeneous socio-economic and educational population, which can be considered a limitation. Thus, more studies with more heterogeneous children and adolescents are important. Another limitation of the study is that a difference in knowledge acquisition immediately after the folder application was verified, but it is positive because it shows the material is capable of changing the knowledge of the target audience right away. However, it is not possible to say that the folder is capable of definitely increasing this knowledge over time. Further studies with the same population and questionnaire could be a viable proposal to see a definitive increase in knowledge and perception changes.

It is common that those who have not suffered TDIs tend to consider mouthguards unnecessary^{2,4,13}. Studies have shown that, for athletes, having suffered some previous trauma experience is a decisive factor in choosing to use this device^{2,32,4}. However, some studies with children and adolescents found that acquired knowledge was considered the main reason to wear a mouthguard^{3,31}. The educational interventions that increase knowledge may consequently influence this behavior¹⁵. This should serve as a warning to learn early on about the importance of the use of mouthguards during sports practice, to prevent the occurrence, and not just the recurrence, of TDIs, especially in children and adolescents.

An increase in mouthguards use has already been reported following an intervention^{32,33}. In

addition, previous training on prevention of TDIs was associated with the reduced history of these injuries³. The educational material developed showed excellent content validity and effectiveness in transmitting knowledge about mouthguards for children and adolescents, therefore, it could be used as a tool in health education for future studies as a strategy for the prevention of TDIs for children and adolescents.

5 CONCLUSION

The folder developed presented satisfactory content validity and should be considered as an instrument capable of transmitting and increasing the knowledge of children and adolescents about mouthguards, and it should be used in future studies to evaluate this tool for the prevention of TDIs.

ACKNOWLEDGMENTS

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brazil (CAPES) – Finance code 001, Fundação Carlos Chagas de Amparo à Pesquisa no Estado do Rio de Janeiro (FAPERJ) - Finance code E-26/202.766/2019 and E-26/200.534/2021, and Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPQ) – Finance code 310225/2020-5. This study is part of the master's thesis of the primary author.

RESUMO

Desenvolvimento, validação e avaliação da eficácia de um folheto educativo sobre protetores bucais para crianças e adolescentes – uma estratégia de prevenção aos traumatismos dentários durante a prática de esportes

O objetivo deste estudo foi desenvolver, verificar a validação do conteúdo e avaliar a eficácia de um folheto educativo sobre protetores bucais (PBs) para crianças e adolescentes (C/A) com idade entre oito e quinze anos. As etapas de

desenvolvimento e validação do conteúdo foram realizadas após pesquisa bibliográfica na literatura baseada em evidências sobre o assunto, e avaliação de estudantes de pós-graduação e/ou professores de odontologia, especialistas em educação, bem como por C/A (público-alvo). Foram calculados o índice de validade do conteúdo (IVC) para cada item (I-IVC) e o índice de validade total do conteúdo do folheto (F-IVC). Um questionário foi elaborado com questões relacionadas ao conteúdo do folheto e a eficácia da aquisição de conhecimentos foi avaliada por meio de testes para dados pareados, considerando as respostas das C/A antes e depois da leitura do folheto. Modelos lineares generalizados e mistos foram utilizados para avaliar associações não ajustadas e ajustadas, respectivamente ($p < 0,05$). O poder da amostra também foi calculado. Os itens foram considerados relevantes, representativos e com boa operacionalidade, e válidos com I-IVC e F-IVC de 1.0. Quarenta e quatro C/A com $10,9 \pm 2,2$ anos foram incluídos e, após a leitura do folheto, a média de respostas corretas teve um aumento significativo ($p < 0,001$). No modelo ajustado, a "leitura do folheto" influenciou positivamente no conhecimento sobre PB ($p < 0,001$). Um poder de amostragem de 100% foi obtido. O folheto apresentou um conteúdo de validade satisfatória e deve ser considerado um instrumento capaz de aumentar o conhecimento de C/A sobre PB.

Descritores: Protetores Bucais. Traumatismos Dentários. Estudo de Validação. Traumatismos em Atletas. Criança.

REFERENCES

1. Farcaşiu C, Farcaşiu AT, Munteanu A, Stanciu I, Luca R. Sports related dental trauma in mixed dentition in Bucharest. Rom J Oral Rehabil. 2012; 4(1):59-63.
2. Galic T, Kuncic D, Poklepovic Pericic T, Galic I, Mihanovic F, Bozic J, Herceg, M. Knowledge and attitudes about sports-related dental injuries and mouthguard use in young athletes in four different contact sports-water polo, karate, taekwondo and handball.

- Dent Traumatol. 2018; 34(3), 175-81.
3. Esmaeilpoor A, Mohebbi SZ, Moghadam N, Ahmandian M, Razeghi S, Khami MR. Self-reported experience of orofacial injury, preventive practice and knowledge of Iranian adolescent martial art athletes towards sports-related orofacial injuries. *BMC Sports Sci Med Rehabil.* 2021; 13(1):134.
 4. Vucic S, Drost RW, Ongkosuwito EM, Wolvius EB. Dentofacial trauma and players attitude towards mouthguard use in field hockey: a systematic review and meta-analysis. *Br J Sports Med.* 2016; 50(5):298-304.
 5. Silva-Oliveira F, Goursand D, Ferreira RC, Paiva PCP, Paiva HN, Ferreira EF, et al. Traumatic dental injuries in Brazilian children and oral health-related quality of life. *Dent Traumatol.* 2018; 34(1):28-35.
 6. Da Silva RLC, Dias Ribeiro AP, Almeida JCF, Sousa SJL, Garcia FCP. Impact of dental treatment and the severity of traumatic dental injuries on the quality of life of Brazilian schoolchildren. *Dent Traumatol.* 2021; 37(4):562-67.
 7. Rishiraj N, Taunton JE, Niven B. Injury profile of elite under-21 age female field hockey players. *J Sports Med Phys Fitness.* 2009; 49(1):71-7.
 8. Knapik JJ, Hoedebecke BL, Rogers GG, Sharp MA, Marshall SW. Effectiveness of mouthguards for the prevention of orofacial injuries and concussions in sports: systematic review and meta-analysis. *Sports Med.* 2019; 49(8):1217-32.
 9. Magno MB, Nadelman P, Leite KLF, Ferreira DM, Pithon MM, Maia LC. Associations and risk factors for dental trauma: a systematic review of systematic reviews. *Community Dent Oral Epidemiol.* 2020; 48(6): 447-63.
 10. American Academy of Pediatric Dentistry. Policy on prevention of sports-related orofacial injuries. *The Reference Manual of Pediatric Dentistry.* Chicago, Ill.: AAPD 2021; 110-5.
 11. Academy for Sports Dentistry. Definition of sports dentistry. [Cited Dec. 6, 2022]. Available from: <http://www.acadportsdent.org>.
 12. O'Malley M, Evans DS, Hewson A, Owens J. Mouthguard use and dental injury in sport: a questionnaire study of national school children in the west of Ireland. *J Ir Dent Assoc.* 2012; 58(4):205-11.
 13. Persic R, Pohl Y, Filippi A. Dental squash injuries - a survey among players and coaches in Switzerland, Germany and France. *Dent Traumatol.* 2006; 22(5):231-6.
 14. Santos EC. Educação ambiental e ensino de ciências: a transversalidade e a mudança de paradigma. Encontro Nacional de Pesquisa em Educação em Ciências, VII –Enpec, 2009.
 15. Shah A, Blackhall K, Ker K, Patel D. Educational interventions for the prevention of eye injuries. *Cochrane Database Syst Rev.* 2009; (4):CD006527.
 16. Levin L, Zadik Y. Education on and prevention of dental trauma: it's time to act! *Dent Traumatol.* 2012; 28(1): 49-54.
 17. Paula MANR, Carvalho AP. O gênero textual folder a serviço da educação ambiental. *REGET.* 2014; 18(2):982-9.
 18. Leite SS, Áfio ACE, Carvalho LV, Silva JM, Almeida PC, Pagliuca LMF. Construction and validation of an educational content validation instrument in health. *Rev Bras Enferm.* 2018; 71(4):1635-41.
 19. Monteiro MLRBP, Ferraz AI, Rodrigues FMP. Assessment of knowledge and self-efficacy before and after teaching basic life support to schoolchildren. *Rev Paul Pediatr.*

- 2021; 39:e2019143.
20. Marques AL, Andrade MRT, Primo LG. Validation of an oral health pamphlet for children and adolescents with chronic kidney disease. *Creat Educ*. 2016; (7): 838-44.
21. Yusoff MSB. ABC of content validation and content validity index calculation. *Educ Med J*. 2019; 11(2):49-54.
22. The jamovi project (2021). jamovi (Version 1.6) [Computer Software]. Retrieved from: <https://www.jamovi.org>.
23. Faul F, Erdfelder E, Buchner A, Lang A-G. Statistical power analyses using G*Power 264 3.1: Tests for correlation and regression analyses. *Behav Res Methods*. 2009; 41(4):1149-60.
24. Hayashi K, Churei H, Tanabe G, Togawa K, Chowdhury RU, Ueno T. Improving the wearing rate of mouthguards in the youth rugby category affects the total future mouthguard wearing rate. *Dent J*. 2020; 8(3):77.
25. Vasques MCMZ, Silva BB, Avila MAG. Construction and validation of a Brazilian educational comic book for pediatric perioperative care. *J Spec Pediatr Nurs*. 2020; 26(3):e12320.
26. Nietzsche EA, Teixeira E, Medeiros HP. Assistive-educational technologies: a possibility for the empowerment of the nurse Porto Alegre: Moriá. *Rev Rene*. 2014; 15:185-6.
27. Cowan, N. The development of working memory. In N. Cowan (Ed.), *The development of memory in childhood*. Psychology Press/Erlbaum (UK). Taylor & Francis. 1997; p. 163-99.
28. Miller JF, Neufang M, Solway A, Brandt A, Trippel M, Mader I, et al. Neural activity in human hippocampal formation reveals the spatial context of retrieved memories. *Sci*. 2013; 342(6162):1111-4.
29. Heikkilä J, Alho K, Hyvönen H, Tiippana K. Audiovisual semantic congruency during encoding enhances memory performance. *Exp Psychol*. 2014; 10:1-8.
30. Thelen A, Murray MM. The efficacy of single-trial multisensory memories. *Multisens Res*. 2013; 26(5):483-502.
31. Cornwell H, Messer LB, Speed H. Use of mouthguards by basketball players in Victoria, Australia. *Dent Traumatol*. 2003; 19(4):193-203.
32. Jalleh G, Donovan RJ, Clarkson J, March K, Foster M, Giles-Corti B. Increasing mouthguards usage among junior rugby and basketball players. *Aust N Z J Public Health*. 2001; 25(3):250-52.
33. Spinass E, Aresu M, Giannetti L. Use of mouth guard in basketball: observational study of a group of teenagers with and without motivational reinforcement. *Eur J Paediatr Dent*. 2014; 15(4):392-6.

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