

# Maintenance and physical conditions of toothbrushes used by children with or without special needs: a cross-sectional study

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## Abstract

Dental hygiene is a preventive measure to prevent and control diseases, and tooth brushing is the most efficient mechanical method for removing bio-film. The aim of the present study was to analyze the care of children with or without special needs in relation to the maintenance and physical condition of the brushes in relation to stiffness, deformities and the presence of residues. The cross-sectional study, using a questionnaire and visual inspection of the brushes, assessed the knowledge of 60 children without special needs and 60 children with special needs in relation to care after using a toothbrush and visual analysis of toothbrushes. The results showed no statistically significant difference in relation to previous knowledge about toothbrush care if they have already received instructions on toothbrush care, replacement periodicity, storage, brush head size, bristle deformities and presence of residues. There was a statistical difference in relation to the bristle stiffness in which the group of children with special needs used more hard bristles than the children without special needs. The present study concludes that children with special needs use harder bristles than children without special needs and that there is no difference between prior knowledge of the maintenance of toothbrushes with the periodicity of exchange, storage, brush head size, deformities of the toothbrushes, bristles and the presence of waste from children with and without special needs.

**KEYWORDS:** Tooth brushing; Health Promotion; Dental Plaque.



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Received: 02/06/20  
Accepted: 19/01/21  
Published: 22/03/21

DOI: 10.36065/robrac.v30i89.1418

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## Introduction

Each age group of patients uses a differentiated instruction for correct dental treatment. The dentist should be prepared to pass on information to his patients according to their need and cognitive ability. Proper management of oral health conditions to prevent and control oral diseases such as caries and periodontitis should be promoted<sup>1-5</sup>.

Toothbrushing is the main method of removal of dental biofilm which reduces one of the etiological factors of caries and periodontal diseases<sup>6,7</sup>. However, toothbrushes can be contaminated by microorganisms after use, which use the brush as a solid structure where they grow. Instructions for cleaning after use, proper storage, and physical maintenance of brushes are important to improve oral health<sup>5,8,9</sup>. Immediately after brushing, the brush should be washed under running water, removing any excess and leaving it very dry. The storage mode should include a clean and dry region that is free of moisture. The brush should be stored vertically, avoiding contact with other objects or brushes<sup>8</sup>.

It has already been found in the literature that different types of brushes do not directly interfere with the ability to eliminate the dental biofilm. According to the individual's need, a particular type of brush is recommended<sup>10</sup>. Therefore, the AAPD recommends that dental intervention should take place in childhood so that a professional can properly provide instruction according to the patient's need<sup>1,11-13</sup>. However, factors that may influence the effectiveness of toothbrushing are brushing technique, periodicity of exchange, stiffness and deformities of the bristles, as well as presence of residues and previous knowledge of those responsible for brushing<sup>9</sup>.

Brushing instruction is initiated by the caregiver from the birth of the baby using gauze and, as soon as the eruption of the first tooth occurs, a toothbrush should be used. Because toddlers are discovering the sensations<sup>6</sup>, the earlier the habit of hygiene

is introduced, the better chances the child will grow with good oral health. The number of brushing times in the literature is controversial. The AAPD and ADA recommends brushing at least 2 times a day<sup>5,14</sup>, while Barros<sup>10</sup> recommends oral hygiene three times a day, in the morning, after lunch, and in the evening after dinner or before bed.

Physical conditions of the brushes influence the brushing process due to material wear, therefore, decreasing its efficacy<sup>8-10,15,16</sup>. Thus, patients continue to live with plaque amounts adhered to the dental surface even when brushing two or three times a day as recommended<sup>7</sup>.

Although the oral conditions of the population have improved in the last years, there is a great concern with the oral health of the young population due to the process of contamination of the brushes in day cares, schools, or even at home. This can be caused due to not knowing a correct way of handling the brush after its use<sup>8,17</sup>. The need for prior knowledge of toothbrush storage and maintenance to reduce the microorganisms present in the bristles increases the toothbrush replacement periodicity and prevents oral diseases<sup>9</sup>. Therefore, the objective of the present study was to analyze the knowledge of caregivers of children with and without special needs regarding the care of toothbrushes soon after their use, and to evaluate the physical conditions of toothbrushes of children with and without special needs in the rigidity, deformities and presence of residues.

## Materials and methods

The cross-sectional study was approved by the Ethics and Research Committee of the Ribeirão Preto School of Dentistry, University of São Paulo (process number 2005.1.411.58.5). After explaining the research objectives, parents and / or guardians (from now on referred to as caregivers) authorized the evaluation of their children's brushes and signed a free and informed consent form.

The sample size was determined based on a pilot study<sup>18</sup>. A convenience sample of 120 children accompanied by their caregivers answered the questionnaire about knowledge regarding brush maintenance and hygiene; being children without special needs (n = 60) and children with special needs (n = 60). To be included in the research, the child should be undergoing dental treatment at the Ribeirão Preto School of Dentistry (FORP – USP), aged 6 to 12 years old, presenting at least one permanent tooth in the mouth (mixed dentition) and brushing must be carried out by the children. Children with impaired motor skills or an inability to brush their teeth were excluded. Patients with special needs included children with genetic disorders (Down syndrome, West syndrome, Williams syndrome and cleidocranial dysostosis), behavioral (autism spectrum), paroxysmal (epilepsy and seizure) and hemodynamic disorders (sickle cell anemia and hemophilia). Data were collected through a simplified questionnaire, validated in the pilot study<sup>18</sup>, which evaluates the interviewee's knowledge of instructions on brush care, storage conditions, time of use, factors that influence the choice of brush, characteristics of brushes: brand, size of head and stiffness of bristles, deformity of bristles, cleaning of brushes (Table 1).

In the visual evaluation, the inspection of the brushes was performed only by a single trained examiner who monitored the degree of deformation of the bristles using a modified criteria based on Raws et al.<sup>15</sup> (1989). For instance, scores 0 (uncertainty regarding use) and 1 (some divergent bristles indicating low use) were grouped as “no deformation” and scores 2 (majority of the bristles divergent) and 3 (bristles very divergent and improper for use) were grouped as “presence of deformation.” The toothbrush was also evaluated regarding the presence of residues (toothpaste, food, dust, mold or other) according to Massoni et al.<sup>8</sup> (2015). Based on visual inspection, the evaluator classified the toothbrush as in conditions for use or not. Statistical analyses were performed in the R software (R CORE TEAM, 2019) using the chi-square test and adopting a significance level of 5%.

After data collection, lectures were given to children and caregivers regarding oral health care, brushing techniques and brush care.

**TABLE 1** · Simplified questionnaire used in the interview regarding the storage of toothbrushes

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a) Have you ever received instructions on how to care for your toothbrush after use?  
 Yes  No

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b) Do you think this toothbrush is in proper condition for use?  
 Yes  No

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c) How often do you change the toothbrush?  
 1-2 months  3-4 months  + 5 months  don't know

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d) Where do you keep the toothbrush at home?  
 Wardrobe  Sink  Door Brush  Other

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e) Where do you keep the toothbrush that you bring to the clinic?  
 HandBag  Door Brush  Other

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**Visual examination of the toothbrush**

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a) Presence of residues (toothpaste, food, mold, other):  
 Yes  No

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b) Deformities of dental brushes:  
 Yes (Scores 0 and 1 from Rawls et al.<sup>15</sup>)  No (Scores 2 and 3 from Rawls et al.<sup>15</sup> (1989))

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c) Head size of toothbrushes:  
 small  medium  large

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d) Stiffness of toothbrush bristles:  
 soft  medium  hard

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e) Appropriate conditions for use:  
 Yes  N

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## Results

The two evaluated groups of children with and without special needs had a mean age of 9.51 ( $\sigma = 1.88$ ) and 9.31 ( $\sigma = 2.06$ ), respectively. Regarding gender, children without special needs were 52% female and 48% male, while children with special needs were 49% female and 51% male. There was no statistical difference between the groups ( $p = 0.7773$ ).

Table 2 presents the results on the prior knowledge of the care with toothbrushes of children with and without special needs. When comparing whether dental care instructions were received for use and whether the brushes were considered suitable for use, there was no statistical difference between the groups ( $p > 0.05$ ). It also shows the frequency of toothbrush replacement. No statistical difference was found between children with and without special needs ( $p > 0.05$ ).

**TABLE 2** - Information regarding toothbrush care instructions after use with their conditions of use, periodicity of toothbrush replacement, storage forms at home and for transportation, presence of residues and adequate conditions of use

<b>Prior knowledge and suitable brushes for use</b>	Did you receive dental brush care instructions after use?		Are toothbrushes suitable for use?	
	Children without special needs	Children with special needs	Children without special needs	Children with special needs
Yes	32	12	48	47
No	28	48	12	13
Total	60	60	60	60

<b>Frequency of toothbrush replacement</b>	Children without special needs		Children with special needs	
	1-2 months	33		27
3-4 months	23		20	
+ 5 months	4		13	
Do not know	0		0	
Total	60		60	

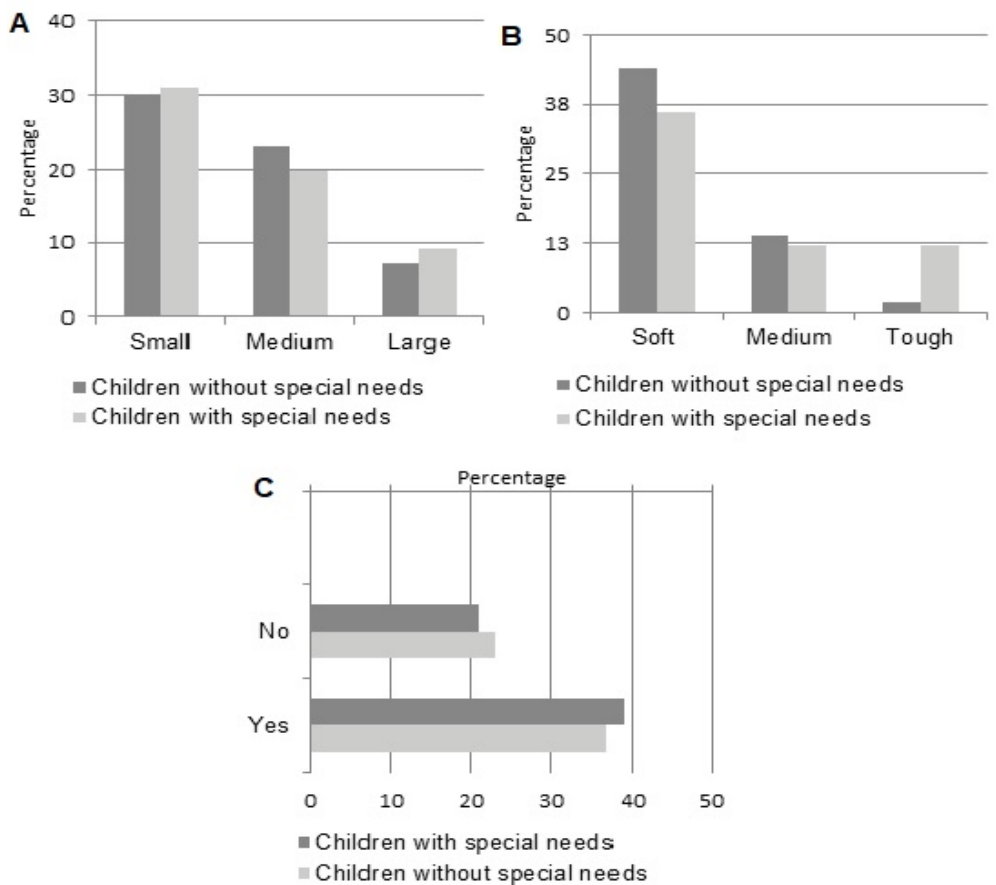
  

<b>Storage</b>	At Home		Transport of toothbrushes	Transport	
	Children without special needs	Children with special needs		Children without special needs	Children with special needs
Wardrobe	36	35	Handbag	42	40
Over the sink	18	15	Toothbrush holder	18	20
Toothbrush holder	6	10	Other	0	0
Other	0	0		-	-
Total	60	100	Total	60	60

<b>Presence of residues on the brushes and whether they are suitable for use</b>	Presence of residues on brushes		Appropriate conditions for use	
	Children without special needs	Children with special needs	Children without special needs	Children with special needs
Yes	38	35	18	20
No	22	25	42	40
Total	60	60	60	60

Regarding toothbrush storage at home or when used for transport to the dental clinic, there were no statistical differences between the results when compared to the storage form in children with and without special needs ( $p > 0.05$ ; Table 2). Figure 1 shows the size of the brush heads of children with and without special needs without any statistical differences when comparing the groups ( $p > 0.05$ ). Regarding the stiffness of dental brush bristles, the group of special needs children had more brushes with hard bristles compared to the group of children without special needs ( $p = 0.0174$ ; Figure 1). When analyzing the presence of deformities and visual inspection of toothbrushes of children with and without special needs, there were no statistical differences between the groups ( $p > 0.05$ ; Figure 1, Table 2).



**FIGURE 1** - Head size (A), stiffness of bristles (B), and presence of deformities (C) of tooth brushes used by children with or without special needs

## Discussion

Dental hygiene is an essential factor for removing dental bio-film and reducing the risks of diseases such as caries and periodontal diseases<sup>6,7</sup>. The device that participates in mechanical removal is the toothbrush, which has effectiveness in the process of cleaning the teeth<sup>7,10</sup>. Therefore, we believe that receiving information regarding the use of toothbrushes after their use is necessary to maintain the effectiveness of oral hygiene and consequently improved oral health. The present study evaluated the condition of the dental brush of children with and without special needs. In the visual assessment of the toothbrush for both groups, we found that they were largely suitable for use, although almost half of the children without special needs and triple the children with special needs did not receive any care instructions with the toothbrush.

During the brush replacement period, it was observed that the short-term replacement (1-2 months) for almost half of children with and without special needs shows that although the brush was being changed frequently, it was suitable for use. Other authors cite the change period of 2 to 3 months and find in the literature that most Brazilians change the brush once a year<sup>19-21</sup>. The reason for changing the brushes is the need that, with the use of bristles, they become divergent and more flexible, losing their effectiveness in cleaning teeth<sup>20</sup>. After use, toothbrushes are usually stored incorrectly and the situation is aggravated in relation to transport. We observed that the bathroom cabinet is the most used place for this purpose at home and in the transport bag. The installation of residential transport or storage facilitates the proliferation of microorganisms in the bristles<sup>22,23</sup>.

The purchase of the correct toothbrush is influenced by several factors, that is, the display on the shelves of markets and pharmacies, bristle shape, color, brush layout and professional recommendation. We found that the size of the toothbrush head was adequate for the child's mouth size, and a small minority



reported the use of brushes with the head size larger than recommended. There was a big difference in the stiffness of the bristles since more than 50% of children with and without special needs used soft bristle brushes, less than 10% of children used hard bristle brushes, while those with special needs represented more than 30%, which may suggest that they believe that hard bristles perform a more adequate cleaning<sup>24</sup>. The durability of the hard bristles is greater than the soft and extra soft bristles, but the abrasiveness of the gum tissues is greater, causing damage to periodontal health<sup>25</sup>. The toothbrush recommended by dentists and published articles are mostly soft or extra-soft bristles, with a good grip and a head compatible with the child's size<sup>5,7,8</sup>. However, there is no ideal brush, since it depends on each patient, but it is known that interconnected factors, such as: force exerted on brushing, bristle hardness, periodicity of change and physical condition of the brush, interfere with brush maintenance and mouth cleaning hygiene<sup>9</sup>.

In a systematic review of oral hygiene assessment performed in patients with intellectual disability, Waldron et al.<sup>26</sup> (2019) emphasizes that there is no difference in the mechanical removal of dental biofilm performed by hand brushes compared to electric brushes. Guidelines for caregivers regarding brush choice and brushing technique should always be based on the need of the special patient and the caregiver's skill.

The extreme wear of the brush bristles causes a reduction in the effectiveness of the mechanical removal of the biofilm<sup>27</sup>. Wear is influenced more by the time of use and the individual skills of those who use the toothbrush than by their design<sup>15</sup>. Although the exchange of brushes is frequent, more than 50% of the evaluated brushes showed significant deformities. We believe that, based on this, shorter brush change periods should be recommended.

The presence of residues was found on toothbrushes of both groups and they were considered as unsuitable for use in more

than 60% of both. These findings indicate that the cleaning of toothbrushes or the use of any method of disinfecting the brush were inadequate. Several methods have been proposed in the literature including immersion in white vinegar<sup>28</sup> or 0.12% chlorhexidine spray<sup>29</sup>. Orientation from the dentist on oral hygiene regarding the choice of toothbrush, storage and brushing technique is important to prevent patients from adopting inappropriate habits due to lack of orientation<sup>30,31</sup>.

## Conclusion

We found no difference between prior knowledge of the maintenance of toothbrushes with the frequency of replacement, storage, brush head size, bristle deformities and the presence of residues in the toothbrush of children with and without special needs. A significant percentage of children with special needs use hard bristle brushes compared to children without special needs.

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## Manutenção e condições físicas das escovas de dentes usadas por crianças com ou sem necessidades especiais: um estudo transversal

### Resumo

A higiene bucal é uma medida preventiva para prevenir e controlar doenças e a escovação dental é o método mecânico mais eficiente para remover o biofilme. O objetivo deste estudo foi analisar o cuidado das crianças com ou sem necessidades especiais em relação a manutenção e condições físicas das escovas em relação a rigidez, deformidades e presença de resíduos. O estudo transversal, por meio de um questionário e inspeção visual das escovas, avaliou o conhecimento de 60 crianças sem necessidades especiais e 60 crianças com necessidades especiais em relação aos cuidados após o uso de escova dental e análise visual de escovas de dente. Os resultados não mostraram diferença estatisticamente significativa em relação ao conhecimento prévio sobre o cuidado com escovas de dentes, se já receberam instruções de cuidados com escovas dentais, periodicidade de substituição, armazenamento, tamanho da cabeça da escova, deformidades das cerdas e presença de resíduos. Houve diferença estatística em relação à rigidez das cerdas, na qual o grupo de crianças com necessidades especiais utilizou mais cerdas duras do que as crianças. Este estudo conclui que crianças com necessidades especiais usam cerdas mais duras em relação às crianças sem necessidades especiais e que não há diferença entre o conhecimento prévio da manutenção das escovas de dentes com a periodicidade de troca, armazenamento, tamanho da cabeça da escova, deformidades das cerdas e presença de resíduos de crianças com e sem necessidades especiais.

**PALAVRA-CHAVE:** Escovação Dentária; Promoção da Saúde; Placa Dentária.

### Como citar este artigo

Almeida-Junior LA, Mellara TS, Inácio GC, Silva RAB, Nelson-Filho P, Queiroz AM, Paula-Silva FWG. Maintenance and physical conditions of toothbrushes used by children with or without special needs: a cross-sectional study. Rev Odontol Bras Central 2021; 30(89): 128-140. DOI: 10.36065/robrac.v30i89.1418