

Effects of oral hygiene motivation strategies in paediatric patients with autism



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Abstract

Aims This study assessed the effectiveness of technological aids (video modelling) versus verbal and demonstrative motivation for improving oral hygiene in paediatric patients with autism spectrum disorder (ASD).

Material and Methods Consecutive patients with ASD were enrolled. Data on brushing frequency, snack intake frequency, plaque index, gum index, and Frankl scale were collected at baseline. After a tooth scaling session, patients were randomly assigned to two groups: Group 1 (G1) received live brushing instructions, while Group 2 (G2) received an oral hygiene motivation video via email, created using the video modelling strategy. A follow-up evaluation was conducted after three months, with all parameters measured again for comparison.

Results Fifty-eight patients (29 per group) were enrolled. No differences at baseline were present between treatment groups. G2 showed significant improvement in brushing frequency ($p < 0.05$), snack intake frequency ($p < 0.05$), and gum index ($p < 0.001$).

Conclusions Video modelling is an effective tool for motivating oral hygiene in patients with ASD, demonstrated by significant improvements in most measured parameters for the video modelling group.

Introduction

Maintaining oral hygiene is a crucial aspect of overall health, especially in paediatric patients [Drummond et al., 2013]. However, it becomes particularly challenging in children affected by autism spectrum disorder (ASD) [Friedlander et al., 2006]. Autism is a neurodevelopmental condition characterised by difficulties in social interaction, communication, and repetitive behaviours [American Psychiatric Association, 2013]. These characteristics can significantly impact the ability of children with autism to engage in regular oral hygiene practices, thus necessitating tailored motivational strategies [Deli et al., 2013]. Oral hygiene is vital for preventing dental caries, periodontal diseases, and other oral health issues that can have systemic implications [Atif et al., 2024]. Good oral health practices, such as regular brushing and flossing, and routine dental visits, help in maintaining healthy teeth and gums, which are essential for proper nutrition and overall well-being [Petersen, 2003]. For

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paediatric patients, establishing these habits early is crucial as they are formative years that lay the foundation for lifelong health practices. Children with ASD often face unique challenges when it comes to maintaining oral hygiene [Bartolomé-Villar et al., 2016]. Sensory sensitivities, communication barriers, and behavioural difficulties can hinder their ability to follow routine oral care practices [Stein et al., 2012]. For instance, sensory issues can make the physical sensations associated with brushing teeth uncomfortable or even painful, leading to resistance [Cermak et al., 2015]. Communication challenges can make it difficult for these children to understand and follow oral hygiene instructions. Furthermore, the repetitive behaviours and insistence on sameness, common in ASD subjects, can interfere with the flexibility required to adopt new hygiene routines [Klintwall et al., 2015]. Given these challenges, the role of caregivers and dental professionals becomes crucial in motivating and assisting children with autism to maintain good oral hygiene [Tang et al., 2023]. Caregivers, often parents, are typically the primary source of support and guidance for children with ASD [Tang et al., 2023]. Their involvement in daily oral care routines, such as helping with toothbrushing and scheduling regular dental visits, is essential [Marshall et al., 2007]. Caregivers need to be equipped with knowledge and skills to support their children's oral health effectively. Training programs can provide them with strategies to manage challenging behaviours and sensory sensitivities, as well as techniques for teaching and reinforcing oral hygiene practices [Marshall et al., 2007]. Additionally, dental professionals play a significant role by providing education and training to caregivers, as well as adapting their approach through in autism-friendly practices, such as using clear communication, providing a calming environment, and being patient and flexible, to suit the needs of children with autism [Loo et al., 2008]. Several strategies can be employed to motivate children with autism to engage in oral hygiene practices. Behavioural interventions, such as positive reinforcement and visual supports, have shown promise in this regard [Atif et al., 2024]. Positive reinforcement involves rewarding the child for performing desired behaviours, which

can help in building positive associations with oral hygiene activities [Horner et al., 2002]. Visual supports, such as picture schedules and social stories, can aid in understanding and following oral care routines by providing clear, step-by-step instructions [Kuo and Mirenda, 2003]. Furthermore, sensory adaptations, such as using toothpaste with mild flavors or toothbrushes with soft bristles, can help in reducing sensory discomfort and make the experience more tolerable. Occupational therapy interventions can also be beneficial in addressing sensory processing issues and improving fine motor skills required for effective toothbrushing [Case-Smith and Arbesman, 2008]. The aim of the present study was to assess the effectiveness of oral hygiene motivation using technological aids (video modelling) compared to traditional verbal and demonstrative motivation in children with ASD.

Materials and methods

Study Design and Population

The study was conducted at the Unit of Dentistry and Oral Surgery, Subunit of Pediatric Dentistry, University Hospital of Pisa. The inclusion criteria were as follows: (i) age between 8 and 14 years; (ii) diagnosis of ASD; (iii) reported brushing frequency less than once a day; (iv) presence of gingival inflammation; (v) moderate to severe plaque accumulation; and (vi) willingness to be included in the study and compliance to study follow-ups. Patients were excluded in cases of: (i) recent scaling session (within the last 6 months); (ii) use of additional oral hygiene aids (manual/electric toothbrushes, mouthwash, dental floss/interdental brushes); (iii) ongoing orthodontic treatment; and (iv) refusal to participate in the study. A written informed consent form was signed by the parents/caregivers for study participation. The study was approved by the Institutional Review Board of the University Hospital of Pisa and conducted in accordance with the principles outlined in the Declaration of Helsinki.

Randomisation and allocation concealment

Participants were randomly allocated to the test or control group in a 1:1 ratio using a computer-generated table created with a true random number generator. After the randomisation list was produced, each code was placed in a sealed opaque envelope, which was only opened during the first oral hygiene session. Randomisation and allocation concealment were managed by a researcher who was not involved in any other aspect of the study.

Study groups

The study groups corresponded to the two oral hygiene motivation protocols employed. Group 1 (G1) received oral hygiene instruction through a live demonstration. Each child was educated in front of a mirror using their own toothbrush, with instructions to replicate the demonstrated brushing movements. Group 2 (G2) received oral hygiene instructions using video modelling technique through a video sent via email. The video featured background music and lasted 2 minutes, instructing patients to brush their teeth for the duration of the song.

Clinical assessment and study timepoints

At baseline (T0), full mouth plaque score (FMPS) [O'Leary et al., 1972] full mouth bleeding index (FMBS) [Ainamo and Bay, 1975] and Frankl Behavior Rating Scale score [1962] were collected for each patient. Brushing frequency and snack intake frequency were also investigated. FMPS was determined by examining each tooth surface for the presence or absence of plaque. Each surface

was evaluated and given a score of 1 for the presence of plaque and 0 for the absence. Six sites per tooth were assessed (distobuccal, buccal, mesiobuccal, distolingual, lingual, and mesiolingual). The average plaque score was expressed as a percentage, representing the proportion of sites with plaque out of the total number of examined sites [O'Leary et al., 1972]. FMBS was measured dichotomously following periodontal probing. The average bleeding score was reported as a percentage, representing the proportion of sites that exhibited bleeding out of the total number of sites examined [Ainamo and Bay, 1975]. The Frankl scale was devised to assess the behaviour of children in dental settings and plan the necessary steps to ensure effective and safe dental care [Frankl et al., 1962]. This scale helps dental professionals evaluate and categorise a child's response to dental treatment, aiding in the development of appropriate management strategies. The scale consists of four categories:

- Frankl 1 (Definitely negative): the child refuses treatment, cries forcefully, exhibits fearfulness, or is extremely uncooperative. Any attempt to treat the child is unsuccessful.
- Frankl 2 (Negative): the child is reluctant to accept treatment, is uncooperative, and has some negative attitude but is not forcefully resistant. Some treatment can be performed with difficulty.
- Frankl 3 (Positive): the child accepts treatment but may be cautious or reserved. The child follows the dentist's directions cooperatively but may show some hesitation or minor signs of negativity.
- Frankl 4 (Definitely positive): the child is completely cooperative, interested in the dental procedures, and shows a good rapport with the dentist. The child displays a positive attitude throughout the treatment.

Brushing frequency was categorised as twice a day, once a day, few times a week. Snack intake was recorded as the number of snacks consumed per day outside of regular mealtimes and dichotomously classified as <3/day and ≥3/day. Following the initial assessment, an oral hygiene session was scheduled and involved scaling and assignment to one of the study groups. At T1 (oral hygiene session), patients were assigned to one of the treatment groups (G1 or G2). At the three-month follow-up (T2), patients were reassessed. All parameters initially measured at T1 were recorded again for both G1 and G2, allowing for a comparative analysis of the results obtained from each motivational approach.

Sample size estimation

With the significance level set at 5%, a minimum of 25 subjects per group was required to achieve 80% power. To account for a potential 10% drop-out rate, the final sample size was increased to 29 participants per group, resulting in a total of 58 participants.

Statistical Analysis

Data collected from the study were processed using Stata software for statistical analysis (StataCorp. 2023. Stata Statistical Software: Release 18. College Station, TX: StataCorp LLC). Initial homogeneity of the two groups was verified using the chi-square test and the t-test. Pearson's chi-square test was applied to assess the differences in the indices at T1 and T2.

To determine the relative effectiveness of the two motivational strategies, a two-sample proportion test was used. A confidence interval of 95% and a p-value of less than 0.05 were considered

statistically significant for this analysis.

Results

Sample characteristics

Fifty-eight participants (13 females and 45 males) were enrolled among the 257 patients attending the Autism Dental Service of the Subunit of Pediatric Dentistry. G1 included 5 females and 24 males, while G2 included 8 females and 21 males. No significant differences between groups were detected at baseline in terms of age, gender distribution, oral hygiene, snack intake, clinical indices and Frankl scale. Results are summarised in Table 1.

Clinical parameters

A significant reduction in FMPS was noted among the total sample, with a mean FMPS of 73.2% in G1 and 68.1% in G2 ($p<0.05$). In G1, 4 patients (13.8%) experienced a reduction of FMPS $<10\%$ compared to 7 patients (24.1%) of G2 ($p<0.05$). FMPS $<25\%$ was noted in 8 patients (27.6%) in G1 and 9 patients (31%) in G2, in the absence of statistically significant differences. The remaining patients (17 in G1, 13 in G2) maintained plaque levels $>25\%$. FMBS significantly decreased in both groups compared to baseline, with a mean of 52.3% in G1 and 46.8% in G2 ($p<0.05$). FMBS $<10\%$ was achieved in 2 patients (6.9%) of G1 and 9 patients (31%) in G2 ($p<0.001$). FMBS $<25\%$ was present in 13 patients (44.8%) of G1 and 14 patients (48.3%) of G2. The remaining patients (14 in G1, 6 in G2) maintained FMBS $<25\%$.

Frankl Scale

The Frankl scale results improved in 6.9% of G1 and 13.3% of G2. No significant differences were present between groups, with both methods having comparable effects on the Frankl scale scores.

Brushing frequency

Improvement in terms of toothbrushing frequency was observed in G2, with 72.4% of patients increasing brushing frequency to twice a day compared with 65.5% of G1, in the absence of significant differences between groups.

Snack Intake Frequency

In G1, 20.7% of patients reduced snack intake < 3 snacks per day, compared with the 51.7% of G2. The differences between the two groups were significant ($p<0.05$), with video modelling having a positive impact on reducing the frequency of snack intake.

Discussion and Conclusion

The present data found that video modelling was significantly more effective than traditional verbal and demonstrative methods in motivating oral hygiene among paediatric patients with ASD. This is evident in the overall improvement rates, snack intake frequency, and gum index. However, the plaque index and Frankl scale scores did not show significant differences between the two methods, indicating that further research may be needed to explore these aspects more comprehensively. The findings highlight the potential benefits of integrating video modelling into oral hygiene education for children with ASD, providing a more engaging and effective approach to improving their oral health practices. This study found that 62.07% of patients motivated through video modelling improved their dental brushing habits, compared to only 3.45% of patients motivated through traditional methods. This aligns with research suggesting that children, especially those with ASD, often learn more effectively from videos than live demonstrations [Du et al., 2020]. Video modelling offers several advantages: it remains effective even when the live model is absent, can be reviewed multiple times, and serves as a positive reinforcement tool [Alnamkany et al., 2019]. These benefits are particularly significant for children who learn primarily through visual channels [Lopez Cazaux et al., 2019]. As reported by Nikopoulos and Keenan [2007] video modelling is particularly effective in patients undergoing Applied Behavior Analysis (ABA) therapy. It is important to recognise that autistic children often have factors that increase their risk of developing caries [Ferrazzano et al., 2020; Mansoor et al., 2018]. Poor brushing habits, often due to difficulties parents and caregivers encounter when brushing the children's teeth, contribute to this increased risk [Stein et al., 2012; Bagattoni et al., 2021]. However, a significant portion of autistic children cannot brush their teeth independently, and the use of manual toothbrushes is more common among them than electric ones [Kuter and Guler, 2019]. Nevertheless, our results suggest that adequate training may contribute to an improvement in gingival inflammation. The reduction in gingival inflammation was observed in more than half of the patients in the video modelling group, indicating the importance of effective motivation techniques in improving oral health outcomes. Plaque reduction was not significant, suggesting that the increase in brushing frequency alone might not be sufficient to reduce plaque immediately. This is particularly true for patients with ASD, who may require a longer training period to master complex oral hygiene techniques compared to typically developing children [Dangulavanich et al., 2017]. Various studies have attempted to illustrate the significance of oral health in autistic children in relationship to dietary habits, including the consumption of soft and sweet foods. Careful monitoring of sugar consumption by caregivers and parents, rather than by the children's oral hygiene practices, may lower caries incidence [Pi et al., 2020]. In our sample, 51.72% of patients motivated through video modelling

	G1		G2	
AGE (mean $\pm$ SD)	10.6 $\pm$ 2.5		10.9 $\pm$ 2.4	
FEMALE GENDER (n, %)	5 FEMALES (17.2%)		8 FEMALES (27.6%)	
	T1	T2	T1	T2
FMPS (mean $\pm$ SD)	84.7 $\pm$ 11.2%	85.1 $\pm$ 9.7%	73.2 $\pm$ 8.4%	68.1 $\pm$ 9.1%
FMBS (mean $\pm$ SD)	64.6 $\pm$ 13.1%	62.3 $\pm$ 12.3%	52.3 $\pm$ 10.4%	46.8 $\pm$ 11.3% **
FRANKL SCALE (mean $\pm$ SD)	2.6 $\pm$ 0.4	2.8 $\pm$ 0.7	3.1 $\pm$ 0.3	3.6 $\pm$ 0.2
BRUSHING FREQUENCY TWICE A DAY (n, %)	3 (89.7%)	4 (86.2%)	19 (65.5%)	21 (72.4%)
SNACK INTAKE < 3 /DAY (n, %)	2 (93.1%)	1 (96.5%)	6 (20.7%)	15 (51.7%) *

* $p<0.05$, ** $p<0.001$ indicating significant differences between G1 and G2 at T2.

TABLE 1. Sample characteristics and study outcomes.

showed significantly improved dietary habits, consistently with previous evidence [Bordini et al., 2020]. Such positive results can be partly ascribed to the education provided to parents and caregivers, who play a crucial role in monitoring and managing mealtimes. These findings highlight the importance of involving family members in the educational process to ensure the establishment of healthier eating habits [Castilho et al., 2013]. Cooperation in dental settings is closely linked to the establishment of a mutual trust bond between the dentist and the patient [Lowental et al., 1981]. Effective prevention in dental care is crucial to avoid or limit dental problems, which can be challenging to manage, particularly in paediatric patients with ASD. Ensuring these patients approach dental sessions with tranquility is essential [Herrera-Moncada et al., 2019]. Continuous oral health maintenance instruction through images, photos, and videos enable quick and effective communication [Lowental et al., 1981]. Our results therefore align with current literature, as highlighted by the improvement in the Frankl scale was in both groups. The present study has some limitations. Firstly, a longer follow-up may be required to assess the effects of motivation on the long term. Secondly, the inclusion of a larger patients sample may be needed to further corroborate the present results. Finally, due to the relatively short follow-up it was not possible to detect the effects on motivation on caries development. Nevertheless, the use of video modelling has proven to be a valuable aid in motivating oral hygiene in paediatric patients with ASD. Oral hygiene education is a crucial preventive measure for maintaining oral health, enabling early intervention to correct poor habits and prevent more complex dental problems. For patients with ASD, promoting adequate eating habits and establishing a consistent oral hygiene routine may facilitate a treatment plan tailored to each child's unique needs, while enhancing enhances patient cooperation and trust.

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