

The impact of school-based social media and online technology on oral health education for individuals with disability

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Abstract

Aim: To evaluate the impact of school-based online communication methods on the oral health-related behaviors of individuals with disability.

Method: A prospective interventional study was conducted on 154 students (age 3–22 years) with various disabilities attending educational centers. A clinical examination was carried out before and after a school-based online educational program. Online in-person sessions were held for the participants, and educational videos were shared with parents and teachers over social media. The clinical examination included the Special Olympics HAS form, (1) Oral Hygiene Index—Simplified (OHI-S) (2) and the Modified Frankl Behavior Index. (3) Dietary and oral hygiene habits were collected via parent-administered questionnaires.

Results: Improvements in behavior in a dental setting ($p < .001$), oral hygiene levels ($p < .001$) and dietary choices ($p < .001$) were observed throughout the study.

Conclusion: Oral health education online modalities can be used effectively by dental professionals to educate individuals with disabilities and their carers regularly, thus helping improve oral health and rapport with dental professionals.

KEYWORDS

communication, cooperation, dietary choices, disability, online technology, oral health

1 | INTRODUCTION

Individuals with disabilities encounter multiple barriers to oral health management.⁴ Although caries rates may not be higher than those of the general population, this group of dependent people receive less dental care and are disproportionately affected by poorer oral hygiene, periodontal disease, untreated caries and edentulism.⁵ Beyond dental care, additional burdens/responsibilities related to general and medical care can be considerable.

Up to 76% of individuals with a disability are administered prescription medications, 42% require additional medical or educational services, 32% require treatment for ongoing behavioral or developmental problems, and a further 21% attend special therapies, including physical, occupational and speech therapy.⁵ This can be overwhelming and have an impact on the daily activities of their families.

Nonetheless, guardians are to be made aware of the link between oral and general health and development

and about the lifelong negative consequences of poor oral hygiene and lack of dental treatment on their children's quality of life and developmental needs.^{6,7} Early and ongoing structured support offering preventive education for guardians/carers is necessary to avoid dental problems and complex treatment needs.⁸

The use of social media and technology can be a way for oral health providers⁹ and all health professionals to repeatedly reach students and guardians/educators¹⁰ without visiting the schools. When learning new concepts, children with disabilities, especially those with intellectual disabilities, benefit from repetition and reinforcement using multimedia-based learning methods.¹¹ The school could be the ideal place for reinforcing oral health education⁷ with regular and targeted oral health education, ideally by dental professionals.

The benefits of this approach for individuals with disabilities are potentially profound: it maintains an ongoing rapport with the dental team, facilitates communication with the parents/guardians/educators, and can serve as a quick point of reference.

The objective of this study was to evaluate the impact of online educational modalities for individuals with disabilities and their guardians/educators on behavioral changes, oral hygiene levels and dietary choices.

2 | MATERIALS AND METHODS

2.1 | Ethical aspects

A research proposal in line with the ethical recommendations of the Declaration of Helsinki was approved by the University of Malta Research Ethics Committee Approval Reference (DSG/2018-19/023). Parents/guardians were provided with an information package and a consent form that was distributed by the school administration. Parents were informed that they would be asked to answer two anonymous questionnaires and that their child would undergo two clinical examinations, between which were the online educational interventions for both child and guardian/teachers.

2.2 | Study population

The target population for this prospective interventional study was (1) 250 students attending the five Educational Resource Centers offering free government funded full-time education to individuals with disability and complex needs, and (2) their respective parents/guardians, and their educators.

2.3 | Data collection

2.3.1 | Student population

The participants were grouped into six categories according to their type of disability. These consisted of Autism (Code 1), Cerebral Palsy (Code 2), Down syndrome (Code 3), Epilepsy (Code 4), Global developmental delay (Code 5) and Others (Code 6). The undiagnosed students or whose conditions were rare were placed in the "Others" group.

2.3.2 | Questionnaire

A previously piloted and sequentially refined and validated self-administered questionnaire¹² in both English and the native language was distributed via Google Forms to parents/guardians of all participants. During the piloting phase of the questionnaire, the Cronbach's alpha between languages was 0.8, and within languages was 0.9. The questionnaire enquired about sociodemographic factors, parental perceptions of oral health, oral health habits and general health factors related to their child. Respondents were asked to report the frequencies of consumption of cariogenic and erosive foods and drinks per week. A combination of closed and open-ended questions was included. The questionnaire was administered twice; before and after the educational intervention and the dental screenings.

Cooperation level changes in the dental setting as reported by the parents/guardians were recorded as either "increased", "same", "decreased" or "don't know". Parents/guardians were asked to rate the anxiety level of their child during interim dental appointments on a Likert scale type question with 1 "very anxious" to 10 being "not anxious".

Dietary habits were measured by identifying the cariogenic food items listed and their frequency of consumption as reported in the questionnaires. The number of exposures to cariogenic food items per child per day from a scale of 0 – maximum number per day was recorded.

2.4 | Clinical examination

The oral screenings were held under standardized conditions, by the same dental surgeon positioned in front of the participant, in the school premises during school hours in their respective classrooms, with the child sitting in a chair or wheelchair. The clinical oral findings were recorded using the Special Olympics International Healthy Athletes Screening (HAS) form,¹³ caries experience was

recorded using the DMFT and dmft indices,¹⁴ plaque and calculus were charted using the Oral Hygiene Index—Simplified (OHI-S) by Greene and Vermillion.² Behavior was scored according to the Modified Frankl Behavior Index.³ This scale ranges from “definitively positive”, to “positive”, “negative positive”, “negative” to “definitively negative”, coded as 1–5, respectively.

The examiner wore personal protective equipment and used sterile wrapped packs containing two front surface reflecting mirrors. A Daray X200LED mobile examination light provided a standardized source of light delivering 8000 lux at 1 m and 32,000 lux at 0.5 m (Daray Lighting Ltd., Leighton Buzzard, Luton, UK). Duplication of examinations of four randomly selected children at each visit was carried out to check for intra-examiner reproducibility. The clinical examinations were repeated a year and a half later.

2.5 | Educational intervention

Student: In-person oral health education videoconferencing sessions for students were carried out using the Microsoft Teams communication platform. Three videoconferencing sessions each lasting 30 min, were held per class. The topics discussed included dietary advice, oral hygiene and the acclimatization with the dental clinic and with clinical procedures. The sessions were held between the researcher—a special care dentist, located in a dental clinic environment, and the students in class where the view was projected onto an interactive classroom whiteboard. Students were presented oral health education topics, games regarding oral hygiene, healthy eating, and the dental clinic environment, were shown what happens during a dental visit and were familiarized with the clinical environment. Students and educators had the opportunity to interact and ask questions. The multimedia resources were prepared and executed by the researcher who is a special care dentist with prior experience in preparing material for online dissemination. The content of the sessions was set at the level of age and cognitive ability of the resource center concerned.

Each participant was also provided with oral health educational resources that could be used both in class and at home to reinforce the messages shared during videoconferencing sessions.

Parent/Guardian: Videos lasting 6 min each and covering oral health information topics tailor-made for individuals with special needs were recorded and uploaded on YouTube to be viewed as often as required. Links to the videos were sent to the parents via email by the school administration and shared on the schools' social media pages. The only means of control of the visualization of

these recordings by parents/guardians was by noting the number of views.

2.6 | Data analysis

An intra-examiner reliability analysis using the Kappa statistic was performed to determine consistency of scores.

Descriptive statistics and tests for normality of data were performed. The Modified Frankl Behavior Index Scores, Simplified Oral Hygiene Index scores and cariogenic food exposure scores were treated as repeated measures and tested using the Wilcoxon Signed Rank test. Distributions of DMFT scores, anxiety scores, cooperation scores and oral hygiene index scores were tested against the six categories of the various medical conditions using the Kruskal-Wallis Test. Pairwise comparisons of the specific medical conditions were carried out for the number of cariogenic food episodes per day and improvement in cooperation rates. The independent variables including oral hygiene practices, types of drinks consumed, types of snacks consumed, types of resources used were analyzed as categorical variables. The Pearson Chi-squared test was used to analyze the differences in proportions in the categories presenting in the six categories of medical conditions. Responses to closed questions to the questionnaire were converted to numerical format, and responses to open-ended questions were summarized into themes. This allowed for entry into IBM SPSS and statistical analysis. Statistical tests were carried out using SPSS 20.0 software (IBM Company, Chicago, IL, USA). Statistical significance for all tests was set at $p < .05$.

3 | RESULTS

About 154 students (75%) attending four of the Educational Resource Centers participated in the study with 49 (32%) female and 105 (68%) male participants. The mean age was 16 (SD \pm 5.6) years. About 129 parents/guardians consented to take part in the study. All participants were exposed to the videoconferencing sessions and the school-based resources and all parents were given access to the YouTube videos. At T0 a total of 38 participants across the four Resourced Centers were not examined as they were absent on the day of visit. At T1, a further 39 participants were lost to the study as they were absent on the day or had progressed on to another Resource Centre that did not participate in the study. Furthermore, upon re-opening of schools after the COVID-19 pandemic closures, some participants continued with online education either due to vulnerability due to medical conditions or due to resistance to adhere to protective measures such as wearing of a mask.

TABLE 1 Change in oral health parameters.

Clinical parameter	T0 (N = 116)	T1 (N = 87)	Outcome
DMFT	2.96	3.51	Negative
Caries prevalence	54.6%	62%	Negative
Restorative index	0.56	0.70	Positive
Care index	0.45	0.60	Positive
Significant caries index (SiC)	7.8	8.9	Negative
Mean simplified oral hygiene index	2.5	1.7	Positive
Mean debris score	1.5	1.1	Positive
Mean calculus score	1.0	0.6	Positive

The study sample was composed of individuals with Autism (39%), Cerebral Palsy (16%), Down Syndrome (17%), Epilepsy (5%), Global developmental delay (6%) and Others (14%).

3.1 | Intra examiner reliability

Kappa values for intra-examiner agreement reliability analysis were 0.908 for Frankl Behavior Index ($p < .001$), .672 for the Debris Index component of the Oral Hygiene—S index ($p < .001$) and .702 ($p < .001$) for the Calculus Index component score of the Oral Hygiene Index—Simplified Index.

3.2 | Examinations

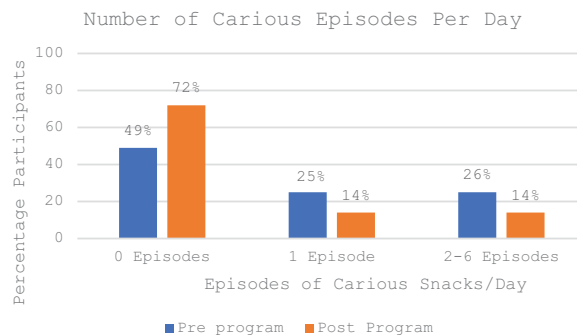
Two examinations were held one and a half years apart. Table 1 presents the change in oral health parameters over the duration of the study.

3.3 | Dietary choices

A statistically significant reduction in carious snack episodes per day following participation in the school-based program was noted (Wilcoxon Signed Rank Test $z = -4.907$, $p < .001$) (Figure 1). The mean rank score for the number of carious episodes per day decreased from pre-program (mean rank 36.7) to post-program (mean rank 30.7).

3.4 | Drinks

Both before and after the school-based program, the two most commonly consumed groups of drinks were water (52%) and soft drinks (47%); however, the group of

**FIGURE 1** Change in snacking habits.

children with epilepsy consumed soft drinks at a significantly greater amount than water (χ^2 (15, $n = 98$) = 30.4, $p = 0.010$). After the school-based program, there was a greater preference for soft drinks (60%) across all medical conditions (χ^2 (210, $n = 54$) = 29.023, $p = .001$).

3.5 | Oral hygiene

A statistically significant improvement in the Simplified Oral hygiene Index scores following participation in the School-Based Program was observed (Wilcoxon Signed Rank test $z = 351.0$, $p < .001$) with the mean score for all participants improving from 2.5 to 1.7.

3.6 | Type of toothbrush

The use of the electric toothbrush increased from 20% pre-program to 42% post program. The group of children significantly using the electric toothbrush the most (39%) were those affected by cerebral palsy (χ^2 (20, $n = 115$) = 33.9, $p = .027$).

3.7 | Rinsing after brushing

There were significant differences across medical conditions relating to the habit of rinsing after brushing. Children with autism persisted most in rinsing after brushing both before (83%, $N = 30$) and after (82%, $N = 14$) the School-Based Program. This pattern was repeated in the Downs Syndrome group (72%, $N = 13$, 75%, $N = 9$, respectively) (χ^2 (10, $n = 115$) = 20.6, $p = .024$).

3.8 | Parental assistance with brushing

Index score ($r = -0.217$, $n = 82$, $p = .05$) with a higher level of education of the father associated with a lower

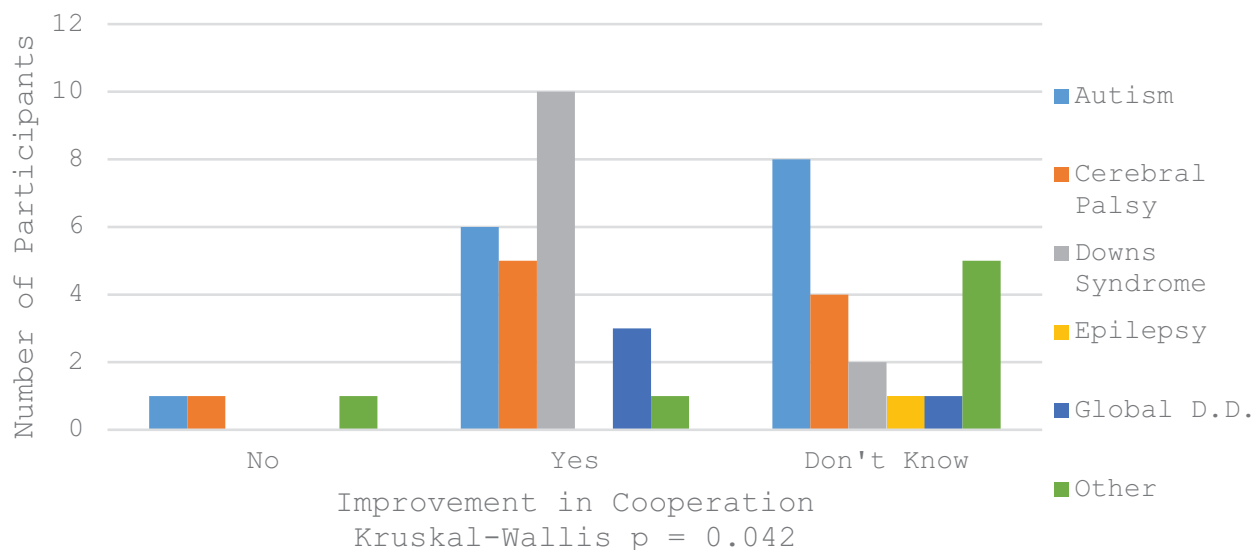


FIGURE 2 Parental perception of improvement in cooperation level at following dental visits.

Simplified Oral Hygiene Index score. The relationship between the level of education of the mother and the Post Program Simplified Oral Hygiene Index score was not significantly correlated. The Downs syndrome group represented the greatest percentage (36.8%) who brush independently as compared to 11% of those with Global Developmental Delay, 8.9% of those with autism and 5.6% of those with cerebral palsy. Fifty five percent of those children with cerebral palsy have their teeth brushed by their parent/guardian ($\chi^2(20, n = 114) = 54.117, p < .001$).

However, a Pearson correlation coefficient test found a significant negative correlation between the level of education of the father and the Post Program Simplified Oral Hygiene.

3.9 | Parental perception in improvement in cooperation levels

Parental perception of improvement in cooperation levels of the participants with parental/guardian instructions to change habits were assessed in terms of changes in oral hygiene habits, tooth brushing and dietary choices at home and behavior during dental visits. While there was no significance across medical conditions in terms of dietary choices ($p = .066$) and cooperation with toothbrushing at home ($p = .056$), a significant association was observed in terms of improved cooperation at the following dental visits (Kruskal-Wallis $p = .042$) (Figure 2).

Parents reported that the availability of online educational material to be viewed at will effectively overcame the difficulties of attending worktime or after-hours

informational seminars that previously interfered with work/family logistic issues and travelling time.

3.10 | Cooperation levels

3.10.1 | Modified Frankl behavior index

Figure 3 shows the mean behavior score as per the Frankl Behavior Index according to the medical condition, with 1 being Definitely Positive Behavior and 5 being Definitely Negative Behavior. A Wilcoxon Signed Rank test revealed a statistically significant improvement in Modified Frankl Behavior scores following participation in the School-Based Program, $z = 0.00, p < .001$ across all conditions.

Pairwise comparisons of the various medical conditions according to levels of cooperation at subsequent dental visits yielded the following significant results between select groups as shown in Table 2.

4 | DISCUSSION

This study shows that following a school-based online oral-health program, students with disabilities showed statistically significant improvements in behavior in the dental setting at subsequent dental screening, in the scores of the Simplified Oral Hygiene Index and in dietary habits, recording a reduced frequency of intake of cariogenic foods per day. These findings were supported by the perceptions of their parents/guardians. Therefore, the conceptual hypothesis that the use of online methods of

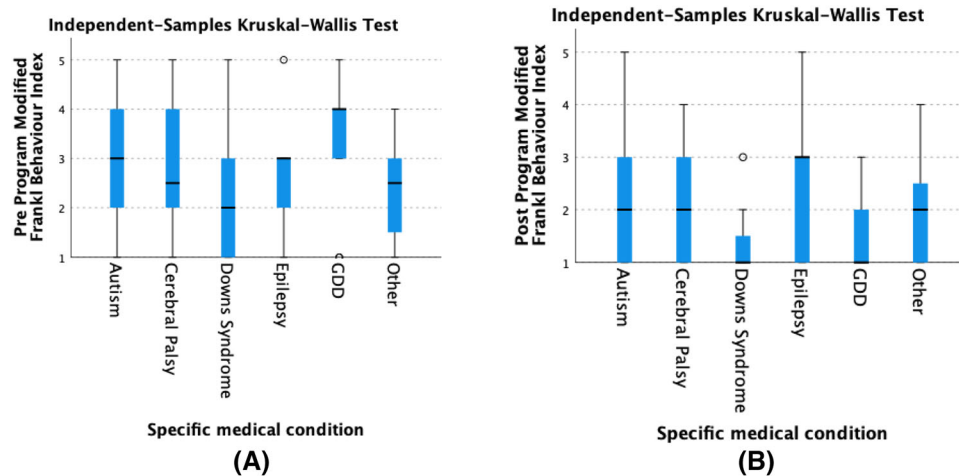


FIGURE 3 Modified Frankl behavior scores pre (A) and post (B) program for various medical conditions.

TABLE 2 Pairwise comparisons of the various medical conditions according to levels of cooperation at subsequent dental visits.

Medical condition	Test statistic	Standard error	Std. test statistic	Sig
Downs syndrome–autism	21.190	8.132	2.606	0.009
Downs syndrome–epilepsy	−34.141	12.527	−2.726	0.006
Cerebral palsy–epilepsy	−27.174	12.629	−2.152	0.031

communication is effective in bringing about change in behavioral habits related to the oral health of individuals with disability was accepted.

4.1 | Behavior

The principles of behavioral sciences are central to the dental treatment of child/adolescent patients and more so in the treatment of individuals with a disability where communication problems and sensory concerns complicate issues of dental phobia and anxiety. Multiple hospital visits with invasive procedures as experienced by these patients, increase the possibility of challenging behavior also spilling into the dental operatory. In this study, the participants with Global Developmental Delay presented with the worst initial behavior. These patients frequently exhibit multiple disabilities all requiring several medical visits, however, this study demonstrated that this group were the most amenable to behavioral improvement following the school-based program. Down's syndrome patients showed the best overall behavior while the patients with epilepsy were the least influenced by the program. These findings highlight the need to tailor oral health care delivery and educational resources according to the varying abilities of the patients and the realities of the families. In accordance with previous literature,¹⁵ this study reports that meetings of short duration allow for familiarization with the oral health operator and the operatory. The repeated regular

use of recorded instructional videos demonstrating operatory procedures and techniques providing reinforcement of messages and desensitization of fearful procedures without the constraints of time, travel and the anxiety related to the operatory and a dental procedure were successful in not only improving cooperation in the dental operatory but in also increasing compliance with changing oral health-related practices at home, as was reported by the parents.

Lack of compliance during dental procedures is one of the most common reasons for unmet needs within the special needs community. This study reports a post-program increase in levels of caries detected despite improved oral hygiene levels and improved dietary habits. It may be considered that the improved cooperative behavior at the second visit allowed for a more accurate caries diagnosis. The improved behavior skills allowed for treatment to take place; this explains the increase in the care index and the restorative index and a decrease in the mean calculus score.

4.2 | Education

Education of parents/guardians is crucial as most individuals with disability rely on their parents/guardians for the implementation of oral care choices and changes.¹⁶ Following the COVID-19 pandemic, education has been revolutionized, with parents becoming familiarized with

the use of technology and online learning. The use of social media such as YouTube is widely used for the dissemination of oral health messages and education.¹⁷ Likewise, this study created videos made available via the online video platform YouTube, shared over social media, making them available to all participants. In order to achieve good participation and maximum retention of information, it was ensured that the videos were easily accessible, comprehensive, relevant, set at the correct cognitive level and were short and concise. These videos were successful in bringing about the improvements observed that depended on direct parent/guardian involvement. These videos also overcame the previously reported time and logistical barriers associated with attending day-time, on-site educational meetings.

Children and young adults are familiar with and use technology daily, some of the students using electronic devices to communicate. Interactive videoconferencing sessions with multimedia tools provided in the classroom were prepared for the students. It is recognized that students with disability present difficulties in retaining concentration and cooperating with online educational sessions¹⁸ and providing active engagement.¹⁹ However, video-based instruction providing ongoing stimuli via video modelling and video instruction has been shown to be a powerful learning tool for individuals with Autism and other developmental disabilities.^{19,20} This study utilized the more recent version of video-based instruction, Simultaneous Video Modelling (SVM)²¹ whereby the students view a task (e.g. toothbrushing) and are then immediately asked to repeat the steps involved. This strategy has been used to teach children with disabilities social skills and play skills with a noted improvement in student motivation and the acquisition of skills.^{21,22}

The results of this study imply that the use of instructional/educational videos to be used in a synchronous or asynchronous fashion together with in-person online sessions allow for learning new skills that promote independent functioning while also overcoming health inequalities usually presenting to socioeconomically disadvantaged families.

4.3 | Oral hygiene

Toothbrushing is a skill usually learned by the age of six in neurotypical children; however, individuals with disabilities often struggle to learn how to brush independently. Additionally, cognitive and profound intellectual disabilities combined with sensory issues make toothbrushing challenging for parents/guardians of individuals with disability. Despite expected differences due to disability associated malocclusion, gingival overgrowth and lack

of self-cleansing ability due to muscle weaknesses, this study reports no differences in oral hygiene scores following the school-based program. This could be explained by the fact that toothbrushing was being carried out by the parents/guardians as instructed by the online educational videos. The most remarkable improvement in oral hygiene cooperation, as reported by parents, was within the group of Down Syndrome group. This finding affirms the literature that states that although individuals with Down Syndrome might take longer to acquire a new skill,²³ they still are capable of doing so.

The autistic and Down syndrome participants were reported to be the most resistant to comply with the change to spitting after brushing. This could be due to the hypersensitivity issues in the autistic group wanting to clear all taste and textures from the mouth after brushing in combination with their tendency for repetitive inflexible routines that are hard to break. The inflexibility to change in patterns learnt, could explain the persistence of the Downs syndrome group with wanting to rinse after brushing. These differences highlight the importance of tailored educational messages according to disability.

4.4 | Diet

This study reports a statistically significant reduction in the number of episodes of cariogenic snacks per day that the participants indulged following the school-based oral health program. Besides parental knowledge and socio-economic factors, dietary habits were seen to be associated with features linked to the disability, sensory issues, specific nutritional requirements, medications and/or lifestyles.

The school-based online oral health program did not have any effect on the consumption of soft drinks. The epilepsy group participants were those that significantly consumed most soft drinks. About 56% of antiepileptic medications cause xerostomia; this could explain why this group of participants were the greatest consumers of soft drinks. It is imperative that further online educational material focuses on the importance water as the main beverage and that parents are made aware of the addictive nature and sugar content of soft drinks.

5 | LIMITATIONS

Participants of different abilities may have been grouped in same classes making it difficult to adapt the educational material according to cognitive levels. Additionally, computer literacy may have been an issue amongst the parents of the older students. A drawback of using videos

is that instant feedback and the creation of a rapport with the audience/guardians was not possible. Additionally, data collected via the questionnaire may be affected by respondent bias.

6 | CONCLUSION

This study has shown that an online school-based oral health program that targeted both students and their guardians/educators, was successful in improving cooperation levels, oral health status and dietary choices; factors that are mostly parent/carer dependent. Such results suggest that similar school-based projects should become implemented as an integral component of school curricula. This would help to improve oral health and reduce the biological burden on individuals with disability and their families and reduce fiscal burden on the state.

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CONFLICT OF INTEREST STATEMENT

The authors declare that there is no conflict of interest.

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