



# **Evaluation of the Effectiveness of Three Oral Health Education Interventions in Maintaining Oral Hygiene of Cerebral Palsy Children**

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

**Introduction:** Cerebral palsy [CP] is a group of neuromuscular disorders which affects the development of movement and posture, limiting normal functional activity. Thus, it is presumed to establish an early contact with CP children to diagnose oral diseases and to introduce certain preventive home care measures to maintain good oral health. This study was conducted to check the effectiveness of three different oral health education modalities among cerebral palsy patients.

**Methodology:** A cross-sectional interventional study was conducted among 60 Cerebral Palsy children aged 8 to 15 years from the selected residential schools for neurodevelopmental disabilities of Vadodara. Participants from a particular school were divided randomly into 3 groups based on different oral health education modalities. Group A: These children and their caretaker were given normal verbal instruction on how to brush their teeth by Fone's technique on a one-to-one basis. Group B: These children and their caretaker were given a tooth brushing demonstration on a tooth model. Group C: These children and their caretaker were shown an audiovisual clip showing how to brush. The oral hygiene practice was reinforced every visit. OHI-S index was

recorded on the day of the demonstration, 7 days and 14 days by the principal investigator, and analyzed.

**Results:** The audio-visual method group showed a marked reduction in the OHI-S score measured from baseline to day 14 when compared to the verbal and model group that is  $1.76 \pm 0.96$  when compared to other two groups that are group A with OHI-S score  $2.36 \pm 0.96$  and GROUP B with OHI-S score  $2.51 \pm 0.87$ . The confidence of the interval was  $-CI=0.044-1.470$ . The results were the statistically significant result. ( $p$  value  $< 0.035$ ) Also, Group C showed a significant reduction in the DI scores as compared to the other two groups.

**Conclusion:** The audiovisual method with brushing video can be effectively used to maintain the good oral hygiene and gingival health of children with Cerebral Palsy. The audiovisual method helps to overcome their motor difficulties and their limited ability to perform dental plaque control.

*Keywords: Cerebral palsy; oral hygiene; oral health education; audio-visual.*

## 1. INTRODUCTION

The American Academy of Pediatric Dentistry (AAPD) defines individual with special health care needs (SHCN) as “any physical, developmental, mental, sensory, behavioral, cognitive, or emotional impairment or limiting condition that requires medical management, health care intervention and/or use of specialized services or programs”. Individuals with special health care needs often have limitations in performing oral hygiene practices that may be due to their potentially limited motor, sensory, and intellectual abilities resulting in them having poor oral health [1]. One of the groups being that of Cerebral Palsy. Thus, introducing modified oral hygiene practices could be beneficial to maintain adequate oral hygiene for individuals with Cerebral Palsy.

Cerebral palsy [CP] is a group of neuromuscular disorders which affects the development of movement and posture, limiting normal functional activity. Thus, it is presumed to establish an early contact with CP children to diagnose oral diseases and to introduce certain preventive home care measures to maintain good oral health [2].

With multiple physical and functional limitations, oral health takes a back seat in CP patients, adding up to more deterioration in the existing condition of the patient. The matter of concern in a child with Cerebral Palsy is multifactorial, these children are usually served a soft diet, high in carbohydrates and sweetening agents. Increased food clearance time from the mouth due to abnormal muscular functions of the tongue, lips, cheeks, and swallowing pattern. These children also lack synchronized muscle movement and coordination which makes tooth brushing very ineffective among them. The combination of all

these factors predisposes these children to a higher risk for oral diseases [3]. These individuals need continuous monitoring in their dietary habits, proper oral hygiene maintenance, and regular oral health check-up [4].

In the dental office, dentists find it difficult to deal with children with CP in terms of cooperation as they are highly sensitive to physical contact and unusual stimuli such as dental instruments noise, sudden artificial light, and dental chair posture. Dental management of children with CP is often challenging and requires patience, skill, and knowledge. In one of the studies, visit Dental clinic was also reported low particularly in the CP group, where only 22% had ever visited a dental clinic [5]. Awareness regarding proper oral health has to be raised and preventive measures should be encouraged to cater to the issues thereby enhancing the quality of life.

Oral hygiene practices can be made more interesting by adding some entertainment along with it like audiovisual aids to evoke interest among the children and the caregivers. This can be made by repeated reinforcement of oral hygiene instructions. Audiovisual aids are one of the most common and useful tools in the field of oral health education and health promotion, as these methods leave behind a long-lasting impression on the target population [6–8]. Videos can offer an adequate level of teaching, and information passed on through video can be repeated as and when required. (9,10) Many Studies utilizing audio-visual-based oral health education have found them to be effective in enhancing oral health knowledge and acceptability by the target groups [6–8].

Many studies have been conducted to check the effectiveness of various oral health education interventions in special health care need children

population [2,11–13]. Thus, the present study was conducted to compare the effectiveness of three different modalities of oral health education intervention among children with cerebral palsy. It was hypothesized that there would be no significant difference in the effectiveness of these three different modes of health education used in the study.

## 2. METHODOLOGY

A cross-sectional interventional study was carried out among 8–15-year-old Cerebral Palsy (CP) children residing in selected special schools of Vadodara city. The study was commenced after obtaining institutional ethical committee approval (SVIEC/ON/DENT/20002 Dated 21<sup>st</sup> February 2020) and permission from the Principal of concerned schools. Keeping the level of significance as 95% and power of study as 80%, the sample size was estimated to be 20 in each group. The study was conducted at three residential centers for neurodevelopmental disabilities. The Cerebral Palsy patients residing in these centers were recruited based on the inclusion and exclusion criteria. Children of either gender, between the age range of 8-15 years, diagnosed with CP with Intelligent Quotient (IQ) between 40-70 were included. Data on IQ was obtained from medical records. Children with a known history of comorbid diseases influencing oral health status, children who lacked manual dexterity or with a severe physical disability, those who underwent any other dental treatment in the last 6 months, and those uncooperative

were excluded after the necessary screening. Written informed consent was obtained from the caretaker.

20 children from each school fulfilling the inclusion criteria were included. Each child included in the study was examined under adequate day-light and in a position comfortable to the child to record the baseline score of Oral Hygiene Index Simplified (OHI-S).

The lottery method was used to allocate the method of Oral Health Education Intervention for each school. The schools were coded as Group A (Verbal Oral Health Education intervention group), Group B (Tooth Model Oral Health Education intervention group), and Group C (Audiovisual-Video clip Oral Health Education intervention group).

All the caretakers and the institution staff were given a health talk on the importance of oral hygiene and trained how to assist the children while brushing, following the instructions of the group they belong to. They were also given a pamphlet on oral hygiene instruction, the tooth model, and the video according to their groups.

Simplified Oral Hygiene Index (OHI-S) was used to record the oral hygiene score on the day of demonstration (Baseline- Score 0), 7<sup>th</sup> day (Score 1), and 14<sup>th</sup> day (Score 2) by the principal investigator, and the oral hygiene practice was reinforced in every visit (Fig. 1).

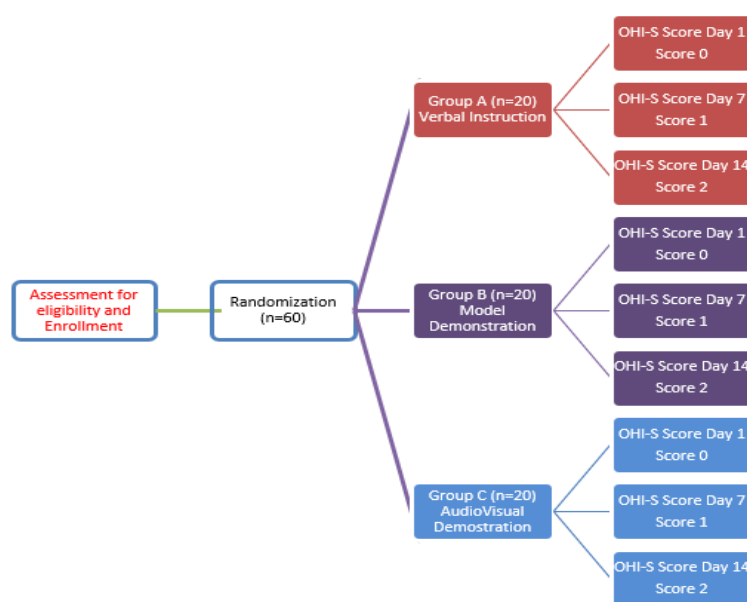


Fig. 1. Assessment for eligibility and Enrolment

## 2.1 Development of Health Education Materials and Study Tools

An animated video was specifically designed focusing on oral hygiene maintenance for CP children. The video was developed at the Department of Pediatric and Preventive Dentistry. The video highlights the importance and significance of good oral health, brushing technique (Fone's brushing method), rinsing/wiping after every meal, healthy diet, Dental check-up visit, and professional oral preventive procedures.

## 2.2 Clinical Parameters

Oral hygiene status was assessed using the Simplified Oral Hygiene Index (OHI-S) for permanent teeth given by Greene and Vermillion [14].

## 2.3 Oral Health Education Intervention

In Group A (Verbal Oral Health Education intervention group), the Caretaker and the study participants received verbal instruction on a one-to-one basis regarding how to brush their teeth by Fone's technique. They were also given information related to other healthy oral hygiene practices such as a healthy diet, the importance of fluoridated toothpaste, rinsing after meals, oral preventive procedures, and improvising the importance of oral health care services. The children were made to brush under the supervision of the investigator and caretaker for the first time. Toothbrush and paste were provided by the investigator. All the doubts or difficulties were addressed at the end of the session.

In Group B (Tooth Model Oral Health Education intervention group), the Caretaker and the study participants were given a tooth brushing demonstration on the tooth model. They were also given information related to other healthy oral hygiene practices such as a healthy diet, the importance of fluoridated toothpaste, rinsing after meals, oral preventive procedures, and improvising the importance of oral health care services. The children were made to brush under the supervision of the investigator and Caretaker before they start brushing their teeth. Toothbrush and paste were provided by the investigator. All the doubts or difficulties were addressed at the end of the session.

In Group C (Audiovisual-Video clip Oral Health Education intervention group), the Caretaker and

the study participants were shown an especially developed audiovisual video clip demonstrating how to brush. They were also given information related to other healthy oral hygiene practices such as a healthy diet, the importance of fluoridated toothpaste, rinsing after meals, oral preventive procedures, and improvising the importance of oral health care services. The brushing technique explained in the video was Fone's Technique. Thereafter children were made to brush under the supervision of the investigator and caretaker before they start brushing their teeth. Toothbrush and paste were provided by the investigator. All the doubts or difficulties were addressed at the end of the session.

Participants and caretakers were unaware of the method used in the other group as one school was selected for one intervention. Each session of health education was reinforced individually in every visit.

The oral hygiene scores were then entered into the computer (MS-Office, Excel 2020) and subjected to statistical analysis using IBM® SPSS®(Statistical Package for Social Sciences) Version 26.0 statistical analysis software to evaluate the effectiveness of oral hygiene practice among the three groups. Categorical variables were presented in number and percentage (%), and continuous variables were presented as mean  $\pm$  SD. The intragroup and intergroup relationship between oral hygiene education intervention practices were statistically analyzed by using ANOVA and Post Hoc test. The level of significance was set at 5%.

## 3. RESULTS

A total of 60 children between 8-15 years of age participated in the study. The mean age of the sample was  $11.65 \pm 2.49$  years which comprised 32 male and 28 female participants. (Table 1)

It was found that both the components of OHI-S i.e. the Debris and Calculus index scores gradually decreased with every visit. Hence the OHI-S scores also decreased in all three groups on the subsequent two visits (on 14<sup>th</sup> day). In group A, OHI-S scores reduced from  $3.26 \pm 0.87$  to  $2.36 \pm 0.96$  after 14 days. In Group B, the mean score for OHI-S reduced from  $3.17 \pm 1.07$  to  $2.51 \pm 0.87$  and in Group C the mean score of OHI-S reduced from  $3.07 \pm 0.86$  to  $1.76 \pm 0.96$ . (Table 2).

Concerning Debris, there was a significant reduction in debris scores for Group C compared

to group A and group B at 14 days. However, the Debris score in Group B was more than group A, though not statistically significant. The mean difference in debris score between Group A and B was -0.17 (p= 0.54), the mean difference in debris score between group B and C was 0.6150 (p=0.001) and the mean difference between group A and C was 0.44 (p=0.026). After 7 days, a significant reduction in debris score was found only between Group A and C (A>C) with a mean difference of 0.45 (p= 0.04).

Calculus Index scores however did not change significantly neither between the groups nor between the visits of the group. Hence post hoc test was not computed.

After 14 days, the OHI-S score for Group C was significantly less than Group B. The mean difference in scores between group B and C was 0.75 (p=0.03). A statistically significant change in OHI-S scores was found only after 14 days (Table 3).

**Table 1. Sample Distribution with Mean Age of Participants**

Sex	Group A	Group B	Group C	Total
Male	9 (45%)	10 (50%)	13(65%)	32 (53%)
Female	11 (55%)	10 (50%)	07 (35%)	28 (47%)
Mean Age in years	12.15±2.13	10.6±2.30	12.2±2.76	11.65±2.49

**Table 2. Oral Hygiene Status in Participants measured as OHI-S Scores**

Particulars	Visit	Group	A	B	C	p-value
DI	Baseline		1.39±0.48	1.43±0.51	1.24±0.46	0.431
	7 <sup>th</sup> Day		1.21±0.53	1.19±0.63	0.75±0.57	<b>0.026*</b>
	14 <sup>th</sup> Day		0.78±0.67	0.96±0.44	0.34±0.40	<b>0.001*</b>
CI	Baseline		1.86±0.57	1.70±0.69	1.82±0.52	0.685
	7 <sup>th</sup> Day		1.81±0.68	1.66±0.71	1.63±0.60	0.665
	14 <sup>th</sup> Day		1.64±0.63	1.50±0.65	1.50±0.67	0.678
OHI-S	Baseline		3.26±0.87	3.17±1.07	3.07±0.86	0.831
	7 <sup>th</sup> Day		3.07±0.84	2.90±1.14	2.39±1.01	0.093
	14 <sup>th</sup> Day		2.36±0.96	2.51±0.87	1.76±0.96	<b>0.033*</b>

\* Significant

**Table 3. Intergroup and Intragroup Comparison in Simplified Oral Hygiene Index Score on 14<sup>th</sup> Day**

Oral Hygiene Status	(I) groups	(J) groups	Mean Difference (I-J)	p-value	95% Confidence Interval	
					Lower Bound	Upper Bound
Debris Index	A	B	-.1750	.541	-.571	.221
		C	.4400(*)	.026	.044	.836
	B	A	.1750	.541	-.221	.571
		C	.6150(*)	.001	.219	1.011
	C	A	-.4400(*)	.026	-.836	-.044
		B	-.6150(*)	.001	-1.011	-.219
Calculus Index	A	B	.1335	.796	-.365	.632
		C	.1755	.675	-.323	.674
	B	A	-.1335	.796	-.632	.365
		C	.0420	.978	-.456	.540
	C	A	-.1755	.675	-.674	.323
		B	-.0420	.978	-.540	.456
Oral Hygiene Index Simplified	A	B	-.1565	.858	-.870	.557
		C	.6005	.115	-.113	1.314
	B	A	.1565	.858	-.557	.870
		C	.7570(*)	.035	.044	1.470
	C	A	-.6005	.115	-1.314	.113
		B	-.7570(*)	.035	-1.470	-.044

#### 4. DISCUSSION

Developmental disabilities broadly consist of Mental Retardation, Cerebral Palsy, Epilepsy, and Autism. The American Association on Mental Deficiency has defined Mental Retardation as "significantly sub-average intellectual functioning which exists concurrently with a deficit in adaptive behavior, and is manifested during the developmental period" [15]. CP is one of the neuromuscular diseases mainly characterized by specific motor skill problems, delayed developmental milestones as well as physical findings like abnormal muscle tonus, reflexes, or persistent infantile reflexes. [16,17]. All such problems make it mandatory for the parents, caregivers, and dentists to explain these individuals, oral hygiene maintenance in a manner that would be most acceptable to them. This study found that the Audiovisual mode of delivery of oral hygiene instructions to these children was the most effective method for Cerebral Palsy children.

Wyne A concluded that the oral hygiene status of children with CP was fair in 55.8% and poor in 34.6%. Oral hygiene status is directly related to caries status in children [4,18]. The results were in accordance with other studies [19,20].

Many researchers compared the most effective method of oral hygiene instructions method in Children with special health care needs [21–25]. Kristin compared computer-teaching format or the self-care instructions in children [21]. Goyal et al assessed and compared the effectiveness of Manual toothbrushing reinforced with audiovisual instructions with powered toothbrushing among mentally challenged individuals [22]. Vajawat studied oral hygiene practices and oral health status in autistic patients, [23]. Asma conducted a study to evaluate the effectiveness of audiovisual modeling on behavioral change of autistic children towards oral and dental care [24]. Maiya compared different mechanical and chemotherapeutic methods in cerebral palsy children, [25]. Kumar compared the effectiveness of conventional and game-based teaching on the level of knowledge and practice regarding oral hygiene [26].

In our present study, we compared the Audiovisual method with a demonstration using the tooth model and verbal instructions. We found that the Audiovisual Group showed a significant reduction in the OHI-S score on the

14<sup>th</sup> Day, when compared to the other two groups ( $p=0.035$ ) (Confidence of Interval- $CI=0.044-1.470$ ) not only that, on the 14<sup>th</sup> day, the Audiovisual group had significantly lower DI scores than verbal group( $p=0.026$ ) ( $CI=0.44-0.836$ ) and Tooth Model group ( $p=0.001$ ) ( $CI=0.219-1.011$ ). Our study was conducted in 3 special schools with children with cerebral palsy. They all had a similar background and were not suffering from severe motor disabilities. With guidance, the children could somehow manage to brush their teeth. This shows that audiovisual aid of demonstrating oral hygiene method was perceived better by children with CP. Similar results were observed in a study by Medha VPK et al.[27] and Asma [24].

The probable reason for accepting audiovisual intervention maybe was the effect of picture and sound together that created a better impact on their understanding of the procedure. Whereas only pamphlets and demonstrations could have been more volatile and boring. Thus, the children had accepted the former technique better [22].

It is sad but fact of life that oral health care is usually neglected where parents of CP children are concerned, this may be possible since the CP condition itself is of major concern. The present study draws attention to the oral health of individuals with special health care needs Considering all this, there is a need of raising oral health awareness followed by preventive measures, early screening, and prompt treatment, thus preventing further harm and complication of inadequate oral health. This is a shared responsibility of not only the parents or caretakers of these children but also the team of physicians, dentists, nurses, physical therapists to improve their oral health by all means irrespective of their disability.

The present study had certain limitations. Generalizing the mode of prevention in all strata of children having CP is not ideal. The sample was obtained from only 3 special institutions, where all the children were from similar socioeconomic statuses. Hence it may not represent the entire population of individuals suffering from cerebral palsy.

#### 5. CONCLUSION

In conclusion, the Audio-Visual oral health education intervention has been found to be most effective in improving the child's oral health. An audio-Visual method is favorable since the

technology revolution makes it simpler and more understandable for imparting oral health education. The findings could be beneficial in improving the oral health of cerebral palsy children and could be included in the oral health promotion strategies for these individuals with special health care needs.

## CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the author(s).

## ETHICAL APPROVAL

The study was commenced after obtaining institutional ethical committee approval (SVIEC/ON/DENT/20002 Dated 21<sup>st</sup> February 2020) and permission from the Principal of concerned schools.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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