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Impact of oral health preventive program using specialized audio and tactile aids in visually impaired school children. A cross-sectional study

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Abstract:

BACKGROUND: The maintenance of oral hygiene and subsequent health related issues in visually handicapped children is a challenging task. Hence, tools must be used to ensure good oral health in these children. The study aimed to analyze the effectiveness of preventive programs on oral health using specialized audio and tactile aids in visually impaired school children.

MATERIALS AND METHODS: 100 visually handicapped children were selected for the study. They were divided into two groups: Group A (Training using Braille) and Group B (training by means of audio aids). Children were trained using appropriate tools and oral health was assessed using Plaque and Gingival bleeding indices.

STATISTICAL ANALYSIS: Independent 'T-test' was used for comparing mean ± SD values.

RESULTS: Statistically significant improvements in both plaque and gingival bleeding indices were obtained on follow-up observations at 3rd and 6th months.

CONCLUSION: The use of specialized tactile and audio tools significantly improved the oral health status of visually impaired school children.

Keywords:

Audio, health, impaired, oral, prevention, tactile, visually

Introduction

The children who have special health care requirements have a higher prevalence of dental caries as well as diseases of gingiva pertaining to the physical nature of constraints, absence of personal hygiene along side negative attitude of their parents.[1] The oral health status of children diagnosed with conditions related to special needs is primarily identical with normally able children. Dietary habits, patterns affecting eating habits, medications, physical abilities, lacking oral hygiene capabilities, and parental attitudes along with that of healthcare workers altogether contribute towards a decline in oral and dental health status.[2]

Children with physically handicapping conditions such as visual impairment must have similar opportunities concerning oral as well as dental health when compared to physically healthy children. Oral health remains to be one of the greatest health care requirements among disabled individuals.[3]

It has been observed that on a routine basis, dental practitioners exhibit reluctance in providing dental and oral care to individuals especially who suffer from any kind of

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disability that is, speech difficulties, visual impairment, or hearing problems among others.[4-6]

This can be due to perception in minds, negative imageries concerning dental practice, lack of appropriate training as well as resources, difficulty in communicating with such patients, poor attitude of dentists, and an increase in the cost of health care.[7-11] Oral health is jeopardized whenever children exhibit an inability in maintaining their oral health status especially among those who have a partial or complete visual impairment. Children who suffer from visual impairment are associated with a higher prevalence of gingival diseases, dental caries as well as dental traumatic injuries.[12,13]

The conventional tool for correcting oral hygiene is the removal of dental plaque which is a primary risk factor underlying both dental caries as well as periodontal diseases. Physical disabilities like visual impairment hamper perceptive ability hence, the use of traditional techniques like using disclosing coloring agents is not possible. Hence, these visual tools have no beneficial use in blind or visually compromised children since they rely more up on tactile as well as hearing abilities in process of learning.[14]

Also, keeping such children motivated for the maintenance of proper oral and dental health for a longer duration is a challenging task. Thus, any effective oral health prevention program has specific requirements for training as well as the motivation of such differently able children regarding the occurrence of dental disorders, benefits involving proper methods of maintaining oral hygiene, nutritional factors as well as easily adaptable strategies for the prevention of dental and oral diseases.[15]

Thus, keeping view of the various challenges underlying the prevention of oral diseases in visually impaired children, this study was designed with an aim to evaluate the effectiveness of oral health preventive programs by making use of specialized audio and tactile aids on the oral health of visually impaired school children. The objectives included: 1) Assessing improvement in gingival index scores prior to and after initiating preventive programs and 2) Analyzing plaque index scores both before and after providing education regarding preventive measures using specially prepared visual and tactile aids.

Materials and Methods

Study design and settings: Present prospective cross-sectional study was conducted after obtaining ethical approval (IEC/MMN23-1E) from the Institute and after obtaining due permissions from schools of specially-abled children.

Study participants and sampling: This study involved a total of 100 children (cluster sampling) with visual impairment enrolled in special schools for physically disabled studying from class 5th to class 12th. Assessment of enrolled children was performed by observing their day to day routine, difficulties that were faced by these children in maintaining oral hygiene, expectation of children as well as official authorities and assessment of oral health requirements of selected children and planning best method for delivering oral health related information by utilizing appropriate tactile and visual aids. Selected children were divided into two groups:

a) Group A (n = 50): Visually impaired children who were educated by means of a story written in Braille writing and the use of plastic models. Teachers as well as parents were requested to read stories for these children on a monthly basis along side day-to-day discussions.

The provided models of plastic were used for providing education based on tactile sensation. Each of the child was asked to feel and tell the differences between teeth that had clean as well as unclean surfaces depicted by dental caries, calculus, and decayed roots. Methods that could prevent dental diseases were then explained on an individual basis to selected children. Demonstration of brushing technique was provided on study models for making the difference between clean and unclean surfaces clear to the children. Following this, modified Fones' technique for brushing teeth was demonstrated to the children using a toothbrush and toothpaste in their own oral cavity. Few of the plastic training models were provided to the schools for educating children on a routine basis.

b) Group B (n = 50): In this group, children with visual impairment were educated by means of audio recordings. These educational materials were provided to the school authorities as well as to the children's parents by the study investigators. Recorded audio was provided to the school on a CD (compact disc). This recording was played on a regular basis before the beginning of classes or during school assemblies.

Inclusion criteria for participants of the study were: 1) 100% visual impairment in both eyes (verified from personal school records), 2) Acceptance or cooperation by patients for performing oral cavity examination, and 3) Compliance by children and their parents (i.e., obtaining informed consent and follow up visits.

Exclusion criteria of studied children were: 1) Partial or unilateral blindness, 2) Coexisting medical or systemic diseases, 3) Lack of cooperation by children, and 4) No parental consent.

Before beginning this study, its aim and beneficial aspects for children were then explained first to the school Principal or Director, teachers, and their parents.

Written informed consent was then obtained from school authorities as well as the caretakers or parents of these handicapped children. All children were educated on oral health regardless of being included in the study sample or not. This study was then performed in accordance with guidelines approved by the World Medical Association's (WMA) Declaration of Helsinki. The study as well as the consent form was approved by the Institutional Ethical Committee.

The basic instructions for oral health were similar in both study groups. Education regarding oral health included information on dental plaque, measures for maintaining oral hygiene by means of removing dental plaque, restricting intake of sweets for up to 2 to 3 times a day, and role played by fluorides in preventing dental caries.

Instructions pertaining to oral and dental health

The 'Dental plaque' explanation was done as a sticky microbial layer forming over surfaces of teeth along with a debris layer of food particles which acts as a substrate for microorganisms. Afterwards, the children and teachers were taught the appropriate method for brushing their teeth. This was followed up by a session of answering any queries.

All the concerned teachers were then provided instructions regarding regularly educating as well as motivating the selected students for brushing their teeth in a correct manner. Additionally, the role played by sticky sugar products as an important cause of dental caries was explained to studied children along with the effect of frequency intake of sugars on dental caries. Institutional authorities were also requested to refrain accepting sweets on their birthdays from children. Additionally, they were requested to educate children and their parents to gradually replacing any form of sweets with healthy products like fruits. The use of fluoride toothpaste and its role in preventing dental caries was explained. All the study participants along with their caregivers were then demonstrated to use the correct amount of toothpaste in the form of pea sized amount for brushing their teeth.

Oral health examination for data collection

Studied children's oral health was evaluated by means of gingival and plaque indices' scores at regular intervals of a) baseline, b) three months and c) six months after implementation of this specifically designed educational program along with technique for motivation. All observations were made by a single operator.

Both the gingival as well as plaque index scores were then noted on 'six' indexed teeth i.e., 44, 16, 12, 24, 32, and 36. For the purpose of noting these index scores, facial surfaces surrounding each of the tooth surfaces were divided in 3 units: a) distal, b) middle, and c) mesial whereas the lingual surface was recorded as one unit.

All selected children were examined while they were seated on any ordinary chair. A good source of illumination either natural or artificial light was used.

Gingival index scores: Gingival index was noted following the drying of selected teeth along with gingiva by means of a chip blower. During the initial examination, the blunt end of probe was gently passed around free gingival margins for checking any spontaneous spots or points of bleeding.

Gingival index scores were recorded as:

a) '0' - Normal b) '1' - Mild inflammatory changes identified by: slight alterations in gingival color, slight edema, and no bleeding following probing; c) '2'- Moderate inflammatory changes seen as redness, edema, shiny surface, bleeding following probing d) '3'- Severe inflammatory changes associated with marked gingival redness, ulcerative surface, edema and tendency for spontaneously bleeding.

Before noting scores of dental plaque, each child was instructed for rinsing thoroughly using plain water for the removal of material alba. Though there was no visible plaque detected clinically on visual examination, the exploratory probe tip was then run over the selected tooth surface for determining its presence or absence.

Plaque index scoring: Plaque index was scored as follows a) '0': Absence of plaque on the gingival third of tooth b) '1'- no plaque on visual inspection d by naked eye c) '2' - a thin layer of dental plaque sticking on to the free margin of gingival along with adjacent area over selected tooth identified using explorer tip d) '3'- mild to moderate amount of soft accumulation of deposits in gingival pockets or over the tooth as well as gingival margins that were observed by the naked eye and e) '4'- abundant accumulation of soft deposits within gingival pockets and/or over tooth surfaces and gingival margins.

Statistical analysis: Management of obtained data followed by subsequent, data analysis was performed by making use of Statistical Package for the Social Sciences software for Windows (SPSS, Chicago, IL, USA, version 15.0).

Statistical significance for quantitative variables was done by employing an independent *t*-test in both the

study groups. The threshold of statistical significance was fixed at $P < 0.05$.

Results and Observations

Demographics

a) Age distribution: Mean ± S.D. age (in years) of participants of this study was found to be 12.75 ± 1.31 years at the time of selection for this study. Mean ± S.D. age in Groups A and B were observed to be 13.02 ± 1.16 and 14.29 ± 0.51 years in respective manner. On statistical comparison using one-way ANOVA, no statistical significance ($P = 0.06$) was found.
b) Gender-wise distribution: There were 26 male and 24 female subjects in group A and 35 males and 15 females in group B. No statistical significance ($P = 0.0$) was noted between both the study groups.
c) Oral health examination: 76% of visually impaired children in Group A and 24% of visually handicapped children belonging to Group B had no teeth-related or gingival or periodontal diseases on initial oral examination. Most of the studied children had dental caries that is 24.6% in Group A while 26.9% of studied children in Group B at base-line oral examination.

All visually impaired children in either of the studied groups used toothbrush as well as fluoridated toothpaste for brushing teeth. Most of the children brushed their teeth once daily.

Mean ± S.D. plaque score distribution, according to Silness and Loe index (1964) [Table 1 and Graph 1]: Table 1 compared mean plaque score distribution in both groups A and B at initial examination and then at three and six months follow-up after implementing of oral health program. Group A showed a decrease in mean ± S.D. plaque scores from 1.24 ± 0.3 at base-line till 1.05 ± 0.23 at three months and 1.01 ± 0.21 at sixth month follow-ups after initiating the oral health program. This decrease in mean ± S.D plaque scores was found to have statistical significance ($P = 0.02$) in the 3rd and 6th months when compared to baseline observations [Table 1].

On the other hand, mean ± S.D. plaque scores observed in Group B were found to decrease from 1.19 ± 0.42 at initial examination at baseline to 1.12 ± 0.12 at three months and 1.09 ± 0.12 at sixth month periods after implementing oral health program. This reduction in mean ± plaque scores in Group B was also found to have no statistical significance at a follow-up appointment in 3rd month (i.e., $P = 0.22$); however, at 6th month appointment, statistical significance ($P = 0.02$) was noted on comparing with base-line mean ± S.D plaque score [Table 1].

Mean ± S.D. gingival index scores as per criteria suggested by Loe and Silness: Group A demonstrated a decrease in mean ± S.D. gingival index scores which was found to havestatistical significance ($P = 0.03$) at 3rd as well as 6th months' follow-up after implementing the oral health program on comparison with the score at baseline. It was found to be 1.07 ± 0.24 (at baseline), 0.93 ± 0.47 (at three months), and 0.89 ± 0.25 (at sixth month) [Table 2 and Graph 2].

However, in Group B, a statistically significant rise in mean ± S.D. gingival index scores of 0.99 ± 0.37 at initial observation (base-line) to 1.91 ± 0.29 on follow-up at 3rd month which again decreased to 0.79 ± 0.13 on follow-up at 6 months. However, no statistical significance ($P = 0.09$) was seen when a comparison was made with baseline scores [Table 2].

Discussion

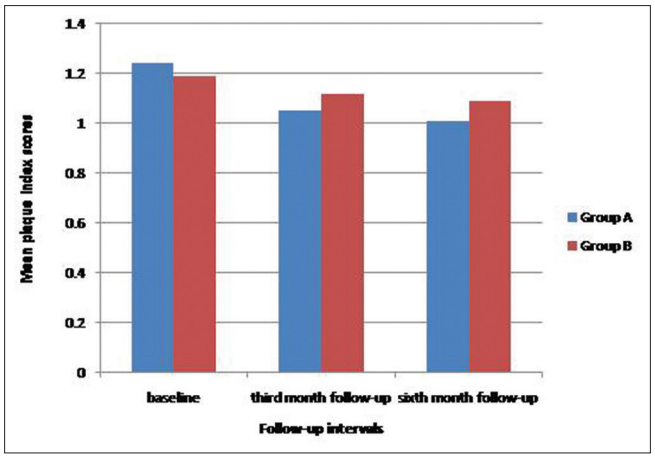
The preventive oral health related programs that are specially designed for children who need special care have 3 aspects: (a) educating patients as well as training parents along with supervisory staff; (b) integrating oral health into the daily lives of handicapped children and (c) professional oral health care at periodic intervals for treating dental caries along with disease of gingival tissues.

Table 1: Mean±S.D. plaque index scores at 1st visit (baseline), at 3rd and 6th month

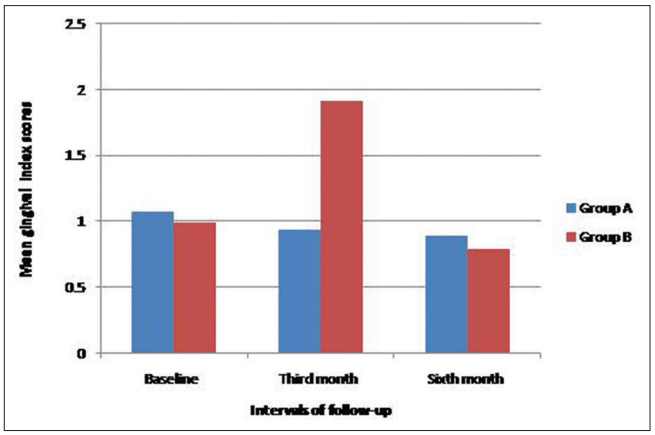
Groups studied	Mean±S.D. plaque index scores at baseline	Mean±S.D. plaque index scores at 3rd month follow-up	Mean±S.D. plaque index scores at 6th month follow-up	*P*
Group A	1.24±0.3	1.05±0.23	1.01±0.21	0.02
Group B	1.19±0.42	1.12±0.12	1.09±0.12	0.22 (baseline Vs 3rd month visit) 0.02 (baseline Vs 6th month)

Table 2: Table illustrating mean±S.D. gingival index scores at 1st baseline observation, 3rd month, and 6th month

Groups studied	Mean±S.D. gingival index scores at baseline	Mean±S.D. gingival index scores at 3rd month follow-up	Mean±S.D. gingival index scores at 6th month follow-up	*P*
Group A	1.07±0.24	0.93±0.47	0.89±0.25	0.03
Group B	0.99±0.37	1.91±0.29	0.79±0.13	0.09



Graph 1: Graph illustrating mean plaque index scores at initial, 3rd month and 6th month follow-ups



Graph 2: Graph illustrating mean gingival index scores at initial, third month and Sixth month follow-up appointments

Hence, professionals of oral health care must devise techniques that have been customized as per the handicapping condition along with appropriate skills for communicating with a specific type of special need in this study, visually impaired individuals as these individuals use other senses to visualize various structures within the oral cavity and associated dental and oral diseases. Children with visual impairment have to come face to face with challenges on a day-to-day basis including maintaining oral hygiene. Hence, they usually suffer from low quality of life pertaining to oral health.

In the present study, the mean ± S.D. age (in years) of children studied was observed as 12.75 ± 1.31 years. No statistically significant difference in gender distribution was observed. 76% and 24% of children in Group A and Group B, respectively had no dental or oral soft tissue diseases. Dental caries was found in 24.6% of Group A and 26.9% of Group B children. All handicapped children made use of toothbrush and fluoridated toothpaste for maintaining oral hygiene.

On statistical comparison, significant reduction ($P = 0.02$) in plaque scores at 3rd and 6th month follow-ups in group A. However, no statistically significant improvement was observed in group B children at the third month although a statistically significant difference ($P = 0.02$) was observed at six month follow-up.

Group A children showed a statistically significant decrease ($P = 0.03$) in gingival index scores at the 3rd and 6th month follow-up while children belonging to Group B demonstrated a statistically significant increase in mean ± S.D. gingival index scores till the 3rd month which was again found to decrease at 6-month follow-up with no statistically significant ($P = 0.09$) difference.

In present study, the selected visually handicapped children had good oral health status which is in contrast to study conducted by Chang and Shih (2004)[12] who observed that children suffering from visual loss had less amount of knowledge related to oral health care. They found that most children made use of toothbrush along with toothpaste once daily for cleaning teeth which is accordance to our study findings.

Anwer *et al.* (2023)[13] in their interventional study reported statistically significant improvement in oral hygiene status after providing educational training to visually impaired child subjects.

Shrivastava *et al.* (2021)[14] observed that periodic reinforcement of educational programs in visually impacted children significantly improved oral hygiene status.

Hebbar *et al.* (2022)[15] evaluated the oral health status among Visually Impaired (VI) and sighted children residing in the institutions and concluded that the VI children had a significantly higher prevalence of dental caries, traumatic dental injuries, and gingival inflammation with poor oral hygiene compared to sighted children.

Mahantesha *et al.* (2015)[16] explored different types of educational tools for teaching children with visual loss the importance of good oral health and reported improvement in knowledge regarding oral health as well as practice.

In the present study, improvement in parameters of oral hygiene that is plaque and gingival bleeding index scores were obtained thus, ascertaining use of educational tools such as reading material in Braille script and audio services.

In contrast to our findings, Sharififard *et al.* (2020)[17] observed no statistically significant difference after using audio or game based educational tools on visually impaired children.

Poor status of oral health affects alterations in one's appearance, defects in speech, and impact on biological and psychological health. One's aesthetic appearance, communication skills along with school as well as daily life activities lead to compromises in one's quality of life.[18,19]

Limitations

The major limitation of the study included a smaller sample size and only a few students were included in the study sample. Another potential limitation of the study is a shorter follow-up period due to the constraints in budget.

Conclusion

The use of tactile as well as audio aids can help in significantly improving the oral health status of visually impaired children which should be reinforced from time to time by parents or teachers. Hence, it can be concluded that these techniques must be included in health programs for specially abled children on an urgent basis.

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Conflicts of interest

There are no conflicts of interest.

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