A prospective case–control study to evaluate oral health status before and after intervention using different dental aids in children with visual impairment

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INTRODUCTION

Oral health has a profound effect on the general health of children. 1, 2 This becomes still more important in children with special health-care needs. Oral hygiene habits acquired during childhood such as brushing frequency, flossing, and use of mouthwash; usually continue as adults, affecting permanent dentition. 3 Hence, if good oral hygiene practices are started at an early age, they can be maintained throughout life. Individuals who require assistance for disabilities that may be medical, mental, or psychological are included in the “special health care” category. Among the various categories of individuals with special health-care needs, visually impaired people face greater challenges, surviving day to day. 4, 5 Visual impairment also known as vision loss is reduced vision not corrected by glasses or contact lens.

Blindness is defined by the World Health Organization (WHO) 6 as “visual acuity of <3/60, or a corresponding visual field loss to <10°, in the better eye with the best possible correction. Visual impairment affects around 285 million people, of which 246 million have low vision and 39 million are visually impaired. Classification of visual impairment adopted by the WHO when the vision in the best possible glass correction in the better eye is less than 3/60 or corresponding visual field loss of <10° in the better eye with the best possible correction.

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eye is classified as mild, moderate, severe, and profound [Table 1].

A major dental problem in children with special health-care needs is poor oral hygiene, which can result in increased incidences of dental caries, gingivitis, and periodontal disease.[6,7] The most obvious reason for the poor oral hygiene of such children is their inability to clean the oral cavity adequately.[8,9] In contrast to children with normal abilities, disabled children have different day care requirements which they are unable to manage on their own. As a consequence, most often, either partial or complete dependence in performing their daily care activities is observed in these children.[9]

Few studies have been conducted to determine the oral health status and knowledge of visually impaired children in India; the information available for visually impaired children is still scarce. To our knowledge, not many studies have been conducted to evaluate oral health status, before and after intervention using dental aids such as mouthwashes and powered brushes in children with visual impairment. This study, therefore, aimed to evaluate the efficacy of manual, powered brushes, and mouthwashes which are commercially available, on the oral hygiene status of visually impaired and sighted children as well as intended to compare if any difference exists between the manual, powered brushes, and mouthwash or if all three have equal efficacy in maintaining the oral hygiene index simplified (OHIS), Turesky-Gilmore-Glickman modification of the Quigley-Hein Plaque Index (TQPHI) and decayed missing filled teeth (DMFT) scores in visually impaired and sighted counterpart. The null hypothesis tested was that efficacy of manual brush, powered brush, and mouthwash has no difference in maintaining the oral health status of visually impaired and normal children.

Objectives
1. To assess and compare the oral health status of visually impaired and normal children
2. To compare and evaluate the efficacy of manual, powered brushes, and mouthwash in improvising the oral health status, assessed by determining OHIS, TQPHI, and DMFT scores in visually impaired and sighted children aged 5–18 years.

MATERIALS AND METHODS

A prospective case–control study to evaluate oral health status before and after intervention using different dental aids in children with visual impairment was conducted in Jodhpur city, Rajasthan. Before the commencement of the study, an approval for the study protocol was granted by the Ethics committee of Vyas Dental College (Application number-VDCH/IEC/19/2017). The entire methodology and clinical protocol of the study were performed in line with the ethical principles established under the Declaration of Helsinki.

A total of 90 children aged 5–18 years attending school participated in the study after taking an informed consent from both the schools and their local guardians. Children/guardians were given both verbal and written information regarding the aim of the study, and they gave signed consent to participate in it. Forty-five visually impaired children (study group) studying at a residential school for the visually impaired in Jodhpur were selected from 62 students. The remaining 45 normal children (age and sex matched with the visually impaired children) (control group) were recruited (after screening of 87 students) from a nearby private school located in the same locality. Each group was further divided into three intervention subgroups. For the purpose of randomization, the allocation of subjects into subgroups was carried out based on the lottery method. The subgroups were:

1. Subgroup A: Manual toothbrushes
2. Subgroup B: Manual brushes with medicated mouthwashes
3. Subgroup C: Power toothbrushes.

The students were gathered in a hall within the school premises and were individually interviewed about their usual oral hygiene practices. Clinical examination of all the students was meticulously carried out in proper illumination with diagnostic instruments. The acquired data were recorded by one recorder on an earlier developed examination form. This was followed by oral prophylaxis by ultrasonic scaling to bring their oral health status to a uniform level. The periodontal evaluation, including oral hygiene, plaque, and gingival scores was a part of the examination. For each subject – OHI-S Index by John C Greene and Jack R Vermillion (1964), Plaque Index by TQPHI (1970), DMFT and deft Index by Henry T. Klein Carole E. Palmer and Knutson J. W. (1938) were recorded at the baseline. Before the commencement of the study, the entire research protocol was explained to all students individually. For the visually impaired children, the Tell-Feel-Do principle was followed, allowing them to touch and feel the dental instruments to be used ahead of the oral examination. Fones brushing technique, for a duration of 2–3 min twice daily with a soft-bristled brush (Oral B Pro Health gum care toothbrush) was explained, demonstrated, and taught to all the children/guardians/caregivers. They were also advised to dispense pea-sized toothpaste and change the brush regularly, after every 2–3 months or at the first sign of fraying of the bristles. Children were advised to rinse with 10 mL of 0.2% w/v chlorhexidine gluconate (Hexidine, ICPA Health products ltd.) half an hour after brushing for 1 min twice daily. They were also instructed not to rinse their mouth, eat, or drink anything thereafter for 20 min. They were cautioned not to swallow the mouthwash and about brown staining of teeth, change in taste, and burning sensation which may appear transiently while using the mouthwash. Children allotted to the powered toothbrush group (Braun/Oral-B Vitality Cross Action 2D electric toothbrush) were instructed to use the brush with the bristles at right angles to the gingival margin or sulcus for the same duration and frequency as the manual brush group. All the subjects in each subgroup were provided with the same mouthwashes, manual and powered toothbrushes, and fluoridated toothpastes (Colgate total) during the entire

| Table 1: World Health Organization classification of visual impairment |
|---------------------------|-----------------------------|
| Range                     | Type of visual impairment  |
| 20/30-20/60               | Mild                        |
| 20/70-20/160              | Moderate                    |
| 20/200-20/400             | Severe                      |
| 20/500-20/1000            | Profound                    |
| >20/1000                  | Near total visual impairment|
| No light perception       | Visually impaired           |
duration of 6 months for uniformity of the study. Oral hygiene
instructions and brushing techniques were demonstrated for
manual, power toothbrushes, and mouthwashes. Brushing
time was instructed as 2 min each time, twice a day. Pea size
amount of toothpaste was instructed to be dispensed on the
toothbrush for which a demonstration was given to the subjects
as well as to the caretakers of the visually impaired children.
The indices were recorded on 0 (baseline), 30 days (1 month),
90 days (3 months), and 180 days (6 months), respectively. New
manual toothbrushes, battery, and new head of power brushes
were provided to the study population at the end of 3rd month.

Out of 90 students, six dropped out of the study, four and
two from the visually impaired and normal sighted group,
respectively. At the end of 1st month, there was one dropout from
the manual brush subgroup, of the visually impaired group, and one
from the mouthwash subgroup, of the normal sighted group.
At the end of 3rd month, there were three dropouts from the
visually impaired group, two and one from power brush and
manual brush, respectively, and one from the power brush
subgroup, of the normal sighted group [Flowchart 1]. All the
collected data were analyzed using Statistical Package for the
Social Sciences SPSS v.22.0 (SPSS Inc, Chicago, Illinois, USA).

RESULTS

The scores of the various indices at the different time intervals
were recorded and statistically analyzed using the ANOVA test,
Chi-square test, and student paired test [Table 2 a and c]. A total
of 90 children aged 5–18 years attending school participated
in the study. Out of the 90 examined students, 42 (46.6%) were
male and 48 (53.3%) were female [Graph 1]. There were
12 (13.3%), 30 (33.3%), and 48 (53.5%) children from the age
range of 5–8, 9–13, and 14–18 years, respectively, as depicted
in Graph 2. Compliance for brushing frequency after 1 month
was 98%, 99%, 99.1% and after 6 months was 90%, 93%, 86% in
subgroups A, B, and C respectively. Since oral prophylaxis was
done to all the children, there was no significant difference seen
in mean scores of TQHPI and OHIS at day 0, so both the study
and control groups were considered homogenous at baseline.

The TQHPI mean values for subgroups A, B, and C of both the
visually impaired and normal children were 2.42, 1.72, and 2.24,
which showed a statistically significant decrease to 2.19, 1.53,
and 1.52, respectively after 1 month [Table 3a]. After 3 months,
a slight increase in TQHPI mean value was observed in power
brushes (1.83), whereas manual brushes and mouthwashes
also showed a reduction, with mean values of 2.16 and 1.32,
respectively [Table 3a]. A slight increase in plaque scores of
subgroups A and C to 2.31 and 2.09 was noted after 6 months,
whereas subgroup B continued to show reductions (1.01)
[Table 3a]. Group wise reduction in plaque scores from 2.32–1.81
and 1.94–1.77 was also noticed in normal and visually impaired
children, respectively [Table 3b]. Marginally higher plaque scores
were observed in normal children (2.49, 0.96, and 2.05) in all the
subgroups A, B, and C in comparison to their visually impaired
counterparts (2.14, 1.06, and 2.13) respectively [Table 3c].

The mean OHIS value of subgroup A (manual brushes)
showed a reduction from baseline of 2.83–2.58 at the end of 3
months and a slight increase to 2.74 after 6 months [Table 2a].
Subgroup B (mouthwashes) demonstrated a decline from
baseline score of 2.37 to 1.60 after 6 months. Power brushes
showed a noteworthy decrease from 2.57 to 1.77 after 1 month,
followed by a slight rise to 2.03 and 2.36 after 3 and 6 months,
respectively [Table 2a]. Group wise comparison of visually
impaired and normal children showed a greater reduction
in the first 3 months in both the groups, after which a slight
increase in the visually impaired group was seen, whereas
normal children showed no change [Table 2b].

After 1 month, a statistically significant greatest reduction
in TQHPI and OHIS scores in power brushes was observed
in comparison to manual brushes and mouthwashes [Tables 2a and 3a]. Mouthwash demonstrated the greatest
reduction in both the groups after 6 months [Tables 2b and 3b].
The mean TQHPI and OHIS values of subgroup B at the end of
6 months were 1.01 and 1.60 respectively, which were the least.

The mean deft and DMFT values of visually impaired
and normal children at baseline, 1, 3, and 6 months were
2.67, 2.66, 2.54, and 2.54 and 3.44, 3.39, 3.24, and 3.14,
respectively [Table 4a-c]. In the present study, no statistically
significant reduction in the DMFT scores with the use of any
of the adjuncts was noted.

DISCUSSION

Several previous studies have reported that visually impaired
children had poor oral hygiene in comparison to their sighted...
Table 2a: Comparison of mean oral hygiene index simplified scores of subjects using different dental aids (manual toothbrush, mouthwashes, and powered brushes) at various time intervals (0, 1, 3, and 6 months)

| Group          | OHIS (baseline) | OHIS (1 month) | OHIS (3 months) | OHIS (6 months) |
|----------------|-----------------|----------------|-----------------|-----------------|
|                | n   | Mean | SD  | n   | Mean | SD  | n   | Mean | SD  | n   | Mean | SD  | P    | Interpretation |
| Manual brush   | 29  | 2.83 | 1.16 | 29  | 2.64 | 1.01 | 28  | 2.58 | 0.88 | 28  | 2.74 | 0.87 | 0.205 | Significant   |
| Mouthwash      | 28  | 2.37 | 0.90 | 29  | 2.20 | 0.86 | 29  | 1.87 | 0.74 | 29  | 1.60 | 0.68 | 0.96   | Significant   |
| Power brush    | 27  | 2.57 | 0.83 | 30  | 1.77 | 0.47 | 26  | 2.03 | 0.40 | 26  | 2.26 | 0.40 | 0.152 | Significant   |
| Total          | 84  | 2.59 | 0.98 | 88  | 2.20 | 0.88 | 83  | 2.16 | 0.77 | 83  | 2.19 | 0.83 | 0.000 | Significant   |

P<0.05 significant. OHIS – Oral hygiene index simplified; SD – Standard deviation; n – Number of subjects; P – Probability value

Table 2b: Comparison of mean oral hygiene index simplified scores of visually impaired and normal vision children at various time intervals (0, 1, 3, and 6 months)

| Group          | OHIS (baseline) | OHIS (1 month) | OHIS (3 months) | OHIS (6 months) |
|----------------|-----------------|----------------|-----------------|-----------------|
|                | n   | Mean | SD  | n   | Mean | SD  | n   | Mean | SD  | n   | Mean | SD  | P    | Interpretation |
| Normal         | 43  | 2.82 | 1.03 | 44  | 2.31 | 1.02 | 42  | 2.30 | 0.94 | 42  | 2.30 | 1.01 | 0.026 | Significant   |
| Visually impaired | 41  | 2.36 | 0.88 | 44  | 2.09 | 0.71 | 41  | 2.01 | 0.51 | 41  | 2.09 | 0.59 | 0.231 | Significant   |
| Total          | 84  | 2.59 | 0.99 | 88  | 2.20 | 0.88 | 83  | 2.16 | 0.77 | 83  | 2.19 | 0.83 | 0.000 | Significant   |

P<0.05 significant. OHIS – Oral hygiene index simplified; SD – Standard deviation; n – Number of subjects; P – Probability value

Table 2c: Group wise comparisons of mean oral hygiene index simplified scores of subjects using different dental aids (manual toothbrush, mouthwashes, and powered brushes)

| Group          | Category | OHIS (Baseline) | OHIS (1 month) | OHIS (3 months) | OHIS (6 months) |
|----------------|----------|-----------------|----------------|-----------------|-----------------|
|                | n   | Mean | SD  | n   | Mean | SD  | n   | Mean | SD  | n   | Mean | SD  | P    | Interpretation |
| Manual brush   | 15  | 3.22 | 1.15 | 14  | 3.21 | 1.01 | 14  | 3.07 | 0.96 | 14  | 3.17 | 0.97 | 0.026 | Significant   |
| Visually impaired | 14  | 2.43 | 1.06 | 15  | 2.11 | 0.69 | 14  | 2.09 | 0.41 | 14  | 2.31 | 0.48 | 0.000 | Significant   |
| Mouthwash      | 29  | 2.83 | 1.16 | 29  | 2.64 | 1.01 | 28  | 2.58 | 0.88 | 28  | 2.74 | 0.87 | 0.000 | Significant   |
| Visually impaired | 14  | 2.28 | 0.97 | 15  | 2.08 | 0.89 | 15  | 1.85 | 0.84 | 15  | 1.59 | 0.83 | 0.000 | Significant   |
| Power brush    | 28  | 2.37 | 0.90 | 29  | 2.20 | 0.86 | 29  | 1.87 | 0.74 | 29  | 1.60 | 0.68 | 0.000 | Significant   |
| Visually impaired | 14  | 2.96 | 0.75 | 15  | 1.71 | 0.42 | 13  | 1.99 | 0.33 | 13  | 2.18 | 0.31 | 0.000 | Significant   |
| Total          | 84  | 2.57 | 0.83 | 88  | 1.77 | 0.47 | 83  | 2.07 | 0.47 | 83  | 2.35 | 0.47 | 0.000 | Significant   |

OHIS – Oral hygiene index simplified; SD – Standard deviation; n – Number of subjects

Table 3a: Comparison of mean plaque scores of subjects using different dental aids (manual toothbrush, mouthwashes, and powered brushes) at various time intervals (0, 1, 3, and 6 months)

| Group          | TQHPI (baseline) | TQHPI (1 month) | TQHPI (3 months) | TQHPI (6 months) |
|----------------|-----------------|-----------------|-----------------|-----------------|
|                | n   | Mean | SD  | n   | Mean | SD  | n   | Mean | SD  | n   | Mean | SD  | P    | Interpretation |
| Manual brush   | 29  | 2.42 | 0.94 | 29  | 2.19 | 0.97 | 28  | 2.16 | 0.76 | 28  | 2.31 | 0.77 | 0.004 | Significant   |
| Mouthwash      | 28  | 1.72 | 0.70 | 29  | 1.53 | 0.66 | 29  | 1.32 | 0.63 | 29  | 1.01 | 0.60 | 0.001 | Significant   |
| Power brush    | 27  | 2.24 | 0.75 | 30  | 1.52 | 0.57 | 26  | 1.83 | 0.45 | 26  | 2.09 | 0.52 | 0.000 | Significant   |
| Total          | 84  | 2.13 | 0.85 | 88  | 1.75 | 0.81 | 83  | 1.77 | 0.72 | 83  | 1.79 | 0.86 | 0.000 | Significant   |

P<0.05 significant. TQHPI – Turesky-Gilmore-Glickman modification of the Quigley-Hein Plaque Index; SD – Standard deviation; n – Number of subjects; P – Probability value

Table 3b: Comparison of mean plaque scores of visually impaired and normal vision children at various time intervals (0, 1, 3, and 6 months)

| Category       | TQHPI (baseline) | TQHPI (1 month) | TQHPI (3 months) | TQHPI (6 months) |
|----------------|-----------------|-----------------|-----------------|-----------------|
|                | n   | Mean | SD  | n   | Mean | SD  | n   | Mean | SD  | n   | Mean | SD  | P    | Interpretation |
| Normal         | 43  | 2.32 | 0.84 | 44  | 1.87 | 0.79 | 42  | 1.83 | 0.75 | 42  | 1.81 | 0.90 | 0.030 | Significant   |
| Visually impaired | 41  | 1.94 | 0.82 | 44  | 1.62 | 0.81 | 41  | 1.70 | 0.68 | 41  | 1.77 | 0.83 | 0.152 | Not significant |
| Total          | 84  | 2.13 | 0.85 | 88  | 1.75 | 0.81 | 83  | 1.77 | 0.72 | 83  | 1.79 | 0.86 | 0.400 | Not significant |

P<0.05 significant. TQHPI – Turesky-Gilmore-Glickman modification of the Quigley-Hein Plaque Index; SD – Standard deviation; n – Number of subjects; P – Probability value
Table 3c: Group wise comparison of plaque index of subjects using different dental aids (manual toothbrush, mouthwashes, and powered brushes)

| Group          | Category    | TQHPI (Baseline) | TQHPI (1 month) | TQHPI (3 month) | TQHPI (6 months) |
|----------------|-------------|------------------|-----------------|-----------------|-----------------|
| Manual         | Normal      | 15               | 2.53            | 0.93            | 14              | 2.46            | 0.90            | 14              | 2.39            | 0.78            | 14              | 2.49            | 0.78            |
|                | Visually impaired | 14      | 2.31            | 0.98            | 15              | 1.94            | 1.00            | 14              | 1.94            | 0.71            | 14              | 2.14            | 0.75            |
| Power brush    | Normal      | 29               | 2.42            | 0.94            | 29              | 2.19            | 0.97            | 28              | 2.16            | 0.76            | 28              | 2.31            | 0.77            |
|                | Visually impaired | 14      | 1.75            | 0.73            | 15              | 1.52            | 0.64            | 15              | 1.29            | 0.63            | 15              | 0.96            | 0.62            |
|                | Total       | 28               | 2.72            | 0.70            | 29              | 1.53            | 0.66            | 29              | 1.32            | 0.63            | 29              | 1.01            | 0.60            |
| Mouth wash     | Normal      | 14               | 1.68            | 0.69            | 14              | 1.55            | 0.69            | 14              | 1.36            | 0.65            | 14              | 1.06            | 0.60            |
|                | Visually impaired | 13      | 1.80            | 0.67            | 15              | 1.37            | 0.64            | 13              | 1.81            | 0.57            | 13              | 2.13            | 0.65            |
|                | Total       | 27               | 2.24            | 0.75            | 30              | 1.52            | 0.57            | 26              | 1.83            | 0.45            | 26              | 2.09            | 0.52            |

TQHPI – Turesky-Gilmore-Glickman modification of the Quigley-Hein Plaque Index; SD – Standard deviation; n – Number of subjects

Table 4a: Comparison of mean decayed missing filled teeth scores of subjects using different dental aids (manual toothbrush, mouthwashes, and powered brushes) at various time intervals (0, 1, 3, and 6 months)

| Group          | DMFT (baseline) | DMFT (1 month) | DMFT (3 month) | DMFT (6 months) |
|----------------|-----------------|----------------|----------------|-----------------|
| Manual brush   | 29              | 3.27           | 2.66           | 28              | 2.96            | 2.69           | 28              | 2.96            | 2.69           |
| Mouth wash     | 28              | 3.03           | 3.39           | 29              | 3.07            | 3.44           | 29              | 2.97            | 3.34           |
| Power brush    | 27              | 2.87           | 2.53           | 30              | 2.87            | 2.53           | 26              | 2.73            | 2.16           |
| Total          | 84              | 3.06           | 2.86           | 88              | 3.03            | 2.87           | 83              | 2.89            | 2.76           |

Table 4b: Comparison of mean decayed missing filled teeth scores of visually impaired and normal vision children at various time intervals (0, 1, 3, and 6 months)

| Group           | DMFT (baseline) | DMFT (1 month) | DMFT (3 month) | DMFT (6 months) |
|-----------------|-----------------|----------------|----------------|-----------------|
| Normal          | 43              | 3.44           | 2.73           | 44              | 3.39           | 2.74           | 42              | 3.24           | 2.62           |
| Visually impaired | 41          | 2.67           | 2.95           | 44              | 2.68           | 2.99           | 41              | 2.54           | 2.89           |
| Total           | 84              | 3.06           | 2.86           | 88              | 3.03           | 2.87           | 83              | 2.89           | 2.76           |

Table 4c: Group wise comparison of decayed missing filled teeth index of subjects using different dental aids (manual toothbrush, mouthwashes, and powered brushes)

| Group          | Category    | DMFT (Baseline) | DMFT (1 month) | DMFT (3 month) | DMFT (6 months) |
|----------------|-------------|-----------------|----------------|----------------|-----------------|
| Manual         | Normal      | 15              | 4.13           | 2.59           | 14              | 4.00           | 2.63           | 14              | 3.64           |
|                | Visually impaired | 14      | 2.40           | 2.53           | 15              | 2.40           | 2.53           | 14              | 2.29           |
| Power brush    | Normal      | 14              | 3.80           | 3.10           | 14              | 3.80           | 3.10           | 15              | 3.60           |
|                | Visually impaired | 14      | 2.27           | 3.59           | 14              | 2.29           | 3.73           | 14              | 2.29           |
|                | Total       | 28              | 3.27           | 2.66           | 29              | 3.17           | 2.66           | 28              | 2.96           |
| Mouth wash     | Normal      | 14              | 4.20           | 3.23           | 15              | 4.20           | 3.23           | 14              | 3.60           |
|                | Visually impaired | 14      | 3.33           | 3.72           | 15              | 3.33           | 3.72           | 13              | 3.08           |
|                | Total       | 27              | 2.87           | 2.53           | 30              | 2.87           | 2.53           | 26              | 2.73           |

P<0.05 significant. DMFT – Decayed missing filled teeth; SD – Standard deviation; n – Number of subjects; P – Probability value
is also impacted by associating medical conditions present along with blindness. Psychological implications, including sadness, anxiety, and depression are also associated with blindness or low vision.\[17\]

In accordance with previous studies, the manual toothbrush group showed a reduction in oral hygiene and plaque scores in both the normal and the visually impaired children.\[18,19\] This could probably be credited to the increased frequency of brushing after the subjects were educated about the importance of oral care and taught the correct brushing technique. The 1st month TQHPI and OHIS scores in power brushes indicated a statistically significant greater reduction than other subgroups. This is in agreement with previous studies where power brushes showed significantly more plaque reduction.\[20,21\] This could be attributed to the “Novelty effect” or “gadget appeal” of the power toothbrushes and higher compliance rates (99% after 1 month). Bright, colorful shades, newly designed soft round handles enabled easier use for children. These features may have contributed to the good compliance even in normal children. Increasing the study duration for 6 months minimized the novelty effect by testing the brushes over a relatively long period of time in order to allow the novelty effect to subside or disappear. Later, it was observed that power brushes proved to be a less efficient, especially in a visually impaired group because of their inability to properly use and maintain them. Similar results were reported by William and Ash and Warren et al.\[22,23\] Another concern encountered with power brushes of few visually impaired children was that they became nonfunctional, and had to be sent back to the company for repair, furthermore children could not clean the brush heads properly so it had to be frequently replaced.

The final results demonstrated a greater decrease in the TQHPI and OHIS scores in mouthwash during the entire study period of 6 months. This could be attributed to the effectiveness of chlorhexidine which is beyond dispute recognized as the gold standard as an antiplaque agent. Its broad antimicrobial spectrum and substantivity make it an ideal adjunct to toothbrushing. A wealth of research supports its use as a mouthwash due to its superior ability in maintaining optimal gingival health as well as excellent oral hygiene benefits. The “EASY USE” of mouthwashes among the subjects could be another important factor for the better performance of mouthwashes. Due to the good taste, easy use, and ease of maintenance of mouthwashes, they had a good compliance rate (93%). It can be inferred that in visually impaired children, when mouthwash was used as an adjunct to manual...
toothbrush a greater reduction in plaque, oral hygiene score was observed than the other subgroups. Previous studies have also suggested that mechanical methods can be insufficient in the absence of hygiene habits and the inability to perform correct toothbrushing.[23] Furthermore, it has been reported that brushing for 2 min removed only 50% of the plaque.[23] This has also been supported by the International Association for Dental Research 2002 where the benefit of oral rinsing with chemotherapeutic as an adjunct for controlling plaque and maintain gingival health has been advocated.[26]

In the present study, DMFT scores among the visually impaired were found to be 2.67 which was consistent with another Indian study (DMFT- 2.16).[27] It was lesser than the normal children (DMFT-3.44), which was disagreement with previous researches where it was reported to be higher.[27,28] This may be because visually impaired children were residing in the hostel and all the three meals were provided by the school authority only and in between snacks were not allowed. Hence, the frequency of sugar exposure was probably less in visually impaired children as compared to normal children and caregivers enforced a mandatory oral hygiene routine. The higher DMFT scores even in the normal children could be due to variations in examination procedures in different studies, effect of socioeconomic status, and diet consumption. However, there are quite a number of studies examining deft and DMFT scores of disabled children and some authors report lower values among this group than among the general population of children.[29,30] A slight reduction in the deft and the DMFT values in normal children (control group) were seen in the present study, which could be due to the shedding of deciduous teeth. No new cases of dental caries were reported during the entire study period of 6 months suggestive of improvement of overall oral hygiene.

CONCLUSIONS

Within the limitation of this study, it can be concluded that among the various dental aids used in the study (manual brushes, mouthwashes, and powered brushes) on the visually impaired group and control group, mouthwash showed a significant reduction in plaque scores, oral hygiene scores as compared to powered toothbrushes, and manual brushes alone at the end of the study. Future research projects should be undertaken with a bigger sample size and with a longer duration of follow-up periods to elucidate the actual effectiveness of these dental aids in maintaining the oral hygiene status of such specialized requirement groups as visually impaired individuals.

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Conflicts of interest
There are no conflicts of interest.

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