Effectiveness of Braille and audio-tactile performance technique for improving oral hygiene status of visually impaired adolescents

Sushmita Deshpande, Ladusingh Rajpurohit, Vivian Varghese Kokka

Abstract:
Background: Visually impaired people encounter numerous challenges in their daily life which makes it a cumbersome task to pay special attention to oral health needs. Furthermore, there is little knowledge about oral health practices among caretakers and visually impaired individuals, due to which oral health is often neglected when compared to the general health. Hence, there was a need to educate visually challenged individuals about oral hygiene practices in a customized format so that the comprehension of brushing techniques could be conveyed at its best.

Materials and Methods: The present study was a randomized control trial of sixty visually impaired adolescents who were divided into three groups of 20 each. In Group 1, Braille was used, whereas in Group 2, audio-tactile performance (ATP) technique and in Group 3, a combination of both the methods were used to teach tooth brushing as a part of oral health education. Pre- and post-plaque index score using Silness and Lo (1967) after health education were calculated and tabulated for statistical analysis.

Results: The postintervention mean plaque index score increased in Group 1 from 29.45 to 42.98, whereas the mean plaque index score decreased in Groups 2 and 3 from 30.83–29.9 to 30.23–18.73, respectively. Intergroup comparison of postplaque index score using Kruskal–Wallis and ANOVA analysis showed significant difference among all three study groups.

Conclusion: The combination of Braille and ATP technique of health education served as the most effective medium to teach oral hygiene methods to visually impaired adolescents.

Key words: Audio-tactile performance, Braille, oral hygiene, visually impaired

INTRODUCTION

Oral health science has progressed by leaps and bounds in the past three decades. However, there is still the prevalence of oral diseases. This situation becomes more complicated when it comes to physically challenged population, especially the visually impaired. This visually handicapping condition makes daily activities, a daunting task. Although their general health is taken care by their parents or caretakers, but the maintenance of good oral health is often neglected. This stems from the fact that there is no awareness regarding good oral health and this population seek oral health care only when there is pain. Enlightenment of good oral hygiene practices to these adolescents with special health-care needs is hindered due to factors such as fear, lack of time, and unavailability of financial resources. However, the visually impaired adolescent also has equal rights and deserves to be educated as their sighted peers. Hence, it becomes obligatory for us as dentists to emphasize the importance of oral health care and provide comprehensive dental treatment to these individuals. Communication and exchange of knowledge is essential to establish trust between a dentist and the special adolescent. Furthermore, it is important to inculcate proper oral hygiene habits in these pupils in their formative years, so that they constantly maintain good oral health throughout their life.

The visually impaired depend on senses such as sound, speech, and touch (tactile perception) to orient themselves to their environment; hence, various techniques have to be custom made to teach these individuals, so that they can perform their daily chores. Acknowledging this fact, Louis Braille, a French educator, presented a tactile method known as the Braille system.
Braille is a system of bumps and indentations on a surface to represent letters that can be recognized by touch. Braille characters are coded into small rectangular blocks, known as cells, using raised dots. This Braille method is used extensively to give education to visually impaired individuals. Various studies on oral health education have indicated that, when tactile aids were used along with the Braille method and proper verbal instructions (audio aids), the visually challenged populations were able to perform oral hygiene techniques more effectively, therefore maintaining good oral hygiene.

With the vision to improve the knowledge, behavior, and attitude pertaining to oral health an innovative technique known as audio-tactile performance (ATP) technique was introduced to teach Fones technique of tooth brushing in visually impaired adolescents. Studies have shown that this customized technique is very effective tool to educate these individuals.

Literature is devoid of studies which combine Braille and ATP technique as a method of oral health education for the visually impaired. Hence, the present study was planned to assess and compare the oral hygiene of visually impaired patients before and after oral health education interventions using Braille and ATP technique.

**MATERIALS AND METHODS**

Institutionalized visually impaired adolescents with the informed consent of their respective guardians in Pimpri Chinchwad Municipal Corporation from Maharashtra, India, were selected as participants in the study. Students with any other disability or syndrome and uncooperative individuals were excluded from the study.

**Stage I**

The project was approved from institutional ethical board. The institution in which the study was to be carried out was a registered institute for blind boys. Written consent was obtained from this institute before the study could be performed. Furthermore, a written assent using braille was obtained from the adolescent boys participating in the study. A sample size of sixty was calculated based on a previous study taking 95% confidence interval and 80% power of the study. The sixty study participants ranging from age 12–16 years were selected using simple random sampling. Table of random numbers were used to allocate the adolescents into three groups of 20 each.

On the first day, there was an interactive session which enabled our team to establish a friendly relation with the participants. Cooperation from students and staff was also understood at this stage and was found to be satisfactory. A self-structured questionnaire which was tested and validated by the authors was then used to obtain the personal information, oral hygiene practices and 24 h’ diet history of the participants. Oral health status was assessed using Plaque index given by Loe in 1967. Later, the participants were randomly divided into three groups of 20 each.

**Stage II**

Oral health education was given using Braille and ATP technique to the visually impaired adolescents based on the groups they belonged.

**Group 1**

In this group, oral health education was imparted using Braille, as it was the standard method used for giving education to the visually impaired. Braille slate was prepared with the help of blind school staff. Five golden rules (1) brush twice daily with fluoridated toothpaste and a soft-bristled toothbrush (morning and night), (2) rinse mouth after every meal, (3) decrease the sugar consumption, (4) Consume more fibrous diet (fruit and vegetables), and (5) regular dental checkup after every 6 months) to maintain good oral hygiene were written on the Braille slate. The golden rules were written in regional language (Marathi). The staff of the school helped to convert it into Braille and also to back translate it in English. Participants were given these slates to read and were informed to maintain oral health following the above rules. The information given to the participants was reinforced on the 7th day and after 1 month from the day they were first educated about oral health.

**Group 2**

Oral health education was given using ATP technique in this group. The participants were first verbally informed about the importance of the teeth and were made to feel the teeth on a large sized model on which the Fone’s method of brushing was taught with assistance. The participants were then asked to feel their own teeth with their tongue and were trained to appreciate the deposits when roughness was felt. The examiner visually inspected and confirmed the ability of the participants to identify deposits on their teeth. This was followed by teaching the participants the Fone’s method of brushing teeth with assistance in the oral cavity. The process was continued till they learnt to brush properly. Staff of the school and caretakers of the school monitored the brushing of all students. Reinforcement of the brushing technique was carried out on the seventh day and after one month from the day the patients were first educated using ATP.

**Group 3**

Oral health education using the combination of both Braille method and ATP Technique was used in this group. The participants were given Braille slates and were also taught to brush the teeth by ATP technique as it was taught to participants in Group 1 and Group 2, respectively. As mentioned above for the two groups, reinforcement in this group was also carried out on the seventh day and after 1 month.

**Stage III**

At the end of the study, oral health status of the study participants was obtained using plaque index. Furthermore, at the end of the study Group 1 was given oral health education using ATP technique and Group 2 participants were given Braille slates, so that all participants have equal access to both the educational tools.

The data were processed and analyzed using SPSS software version 19-SPSS Inc. Chicago, IL, USA. Comparison of the study groups, before and after intervention was performed based on suitable statistical method. The results were compiled and subjected to Wilcoxon sign rank, Kruskal–Wallis ANOVA, and Mann–Whitney U-test.
RESULTS

After analysis of the self-structured questionnaire, it was found that all the study participants were using toothbrush and a fluoridated toothpaste to brush their teeth regularly, 73.3% brushed once and others twice. Most of the students brushed their teeth horizontally while 15% used circular method. When the sugar score was assessed using sugar score criteria given by Papas,[7] 11.7% of the participants scored excellent, 75% scored good while 13.3% were in the watch out zone.

At the baseline, among twenty study participants of Group 1, 15 participants had scored fair on the plaque index, whereas only five participants had low plaque score to be in the good category. After the intervention using the Braille technique, there was an improvement in the plaque index, in which 9 individuals scored good and 11 scored fair on the plaque index (P = 0.001).

Initially, in Group 2, it was observed that only one participant scored poor, whereas 13 were in the fair category and 5 participants scored good. After receiving health education using ATP technique, 18 students were categorized as good and only one was candidate scored fair on the plaque index (P = 0.001).

In Group 3, where oral health education was given using both Braille and ATP technique, statistically significant result was obtained when before and after intervention scores were compared. The final plaque scores were the least in this group. Four students had scored excellent, 15 were in the good category, and only one student scored fair (P = 0.001) Comparison of before and after intervention plaque score was done in all the three groups (P = 0.945, P = 0.001), respectively [Table 1].

Comparison of preintervention plaque score in Group 1 and 2 was found to be statistically insignificant (P = 0.797) and postintervention plaque scores was found to be significant (P = 0.004) respectively [Table 2]. Comparison of preintervention plaque score in Group 1 and 3 showed insignificant result (P = 0.756), whereas after intervention, results were significant, (P = 0.001) [Table 3]. Comparison between Group 2 and 3 before intervention showed insignificant difference (P = 0.935) but after intervention showed significant difference (P = 0.014) respectively [Table 4].

DISCUSSION

Health education and health promotion positively alters knowledge, behavior, attitude, beliefs, and perception toward health. It therefore, has the potential to prevent wide range of diseases from its inception.[8] Although literature has established the effectiveness of oral health education, very less information is available regarding the oral health of individuals with special health-care needs, especially the visually challenged.[9] Realizing the scarcity of data and as a social responsibility toward the specially abled, this study was performed.

This study was done in an institution where the visually impaired adolescents were living a disciplined life. When a self-structured questionnaire was used to assess the knowledge regarding the oral health in these individuals, it was found that they used fluoridated toothpaste and toothbrush to clean their teeth. Availability of the toothbrush and toothpaste was not a problem to the institution due to generous sponsorships. The majority of them brushed once a day and changed the brush only when fraying of bristles was observed. Although the students knew the importance of teeth, but still many of them suffered from oral health problems and lacked knowledge regarding proper brushing techniques. Similarly, a study by Jain et al., which compared oral hygiene practices, oral hygiene, and periodontal status between visually impaired and sighted

| Table 1: Comparison of pre- and post-intervention plaque score in three groups of visually impaired children |
|---------------------------------------------------------------|
| **Group** | **n** | **Mean rank** | **P** |
|-------------------------|--------|--------------|------|
|            | Preintervention | | | |
| Braille | 20 | 29.45 | 0.945 |
| ATP | 20 | 30.83 | 0.945 |
| Braille + ATP | 20 | 30.23 | 0.945 |
| Total | 60 | | |
|            | Postintervention | | | |
| Braille | 20 | 42.98 | 0.001* |
| ATP | 20 | 29.90 | 0.945 |
| Braille + ATP | 20 | 18.73 | 0.001* |
| Total | 60 | | |

*Kruskal-Wallis ANOVA test, P<0.05. ATP – Audio-tactile performance; At 95% confidence interval, P value less than 0.05 is considered to be statistically significant

| Table 2: Comparison of pre- and post-intervention plaque score in Braille and audio-tactile performance group of visually impaired children |
|---------------------------------------------------------------|
| **Group** | **n** | **Mean rank** | **P** |
|-------------------------|--------|--------------|------|
|            | Preintervention | | | |
| Braille | 20 | 20.02 | 0.797 |
| ATP | 20 | 20.98 | 0.797 |
| Total | 40 | | |
|            | Postintervention | | | |
| Braille | 20 | 25.75 | 0.004* |
| ATP | 20 | 15.25 | 0.004* |
| Total | 40 | | |

*Mann-Whitney U-test, P<0.05. ATP – Audio-tactile performance; At 95% confidence interval, P value less than 0.05 is considered to be statistically significant

| Table 3: Comparison of pre- and post-intervention plaque score in Braille and Braille and audio-tactile performance of visually impaired children |
|---------------------------------------------------------------|
| **Group** | **n** | **Mean rank** | **P** |
|-------------------------|--------|--------------|------|
|            | Preintervention | | | |
| Braille | 20 | 19.93 | 0.756 |
| Braille + ATP | 20 | 21.08 | 0.756 |
| Total | 40 | | |
|            | Postintervention | | | |
| Braille | 20 | 27.73 | 0.001* |
| Braille + ATP | 20 | 13.28 | 0.001* |
| Total | 40 | | |

*Mann-Whitney U-test, P<0.05. ATP – Audio-tactile performance, At 95% confidence interval, P value less than 0.05 is considered to be statistically significant

| Table 4: Comparison of pre- and post-plaque score in Groups 2 and 3 (audio-tactile performance and Braille and audio-tactile performance) of visually impaired children |
|---------------------------------------------------------------|
| **Group** | **n** | **Mean rank** | **P** |
|-------------------------|--------|--------------|------|
|            | Preintervention | | | |
| ATP | 20 | 20.35 | 0.935 |
| Braille + ATP | 20 | 20.65 | 0.935 |
| Total | 40 | | |
|            | Postintervention | | | |
| ATP | 20 | 25.05 | 0.014* |
| Braille + ATP | 20 | 15.95 | 0.014* |
| Total | 40 | | |

*Mann-Whitney U-test, P<0.05. ATP – Audio-tactile performance; At 95% confidence interval, P value less than 0.05 is considered to be statistically significant
children; concluded that gingival health of blind students was compromised due to their inability to visualize plaque despite excellent oral hygiene aids.\(^\text{[10]}\)

Majority of the students had mixed diet because of the institutional setting and belonged to "good zone" on the sugar score criteria given by Papas. However, few students still belonged to the "watch out zone," as the parents were allowed to frequent them with sweets.\(^\text{[7]}\)

Visually challenged population depends on audio and tactile sensation to orient themselves to their surroundings.\(^\text{[4]}\)

Taking into account this fact, Hebbal M. et al. introduced the ATP technique, which successfully proved that customized techniques with proper training and periodic reinforcement can have positive impact on oral health of these special children. As the study participants were living in a residential school with a regulated lifestyle, it was easy to teach them the ATP technique. Even the staff of the school and caretakers were trained and well oriented with the technique and were instrumental in reinforcing it on the students. In the present study, it was observed that the visually challenged students easily learned Fone's brushing method using the ATP technique. This observation was also seen in a study by Joybell C. et al. who compared the Fones and Modified Bass methods using ATP technique in visually impaired children.\(^\text{[4]}\)

Complete oral prophylaxis was performed in all study groups, so as to maintain a common baseline data; as a result of which most of the participants had a score which was fair on the plaque index.

In Group 1, after the intervention using the Braille technique four more students reached the good score category who were initially classified as fair. The result obtained was found to be similar to a study performed by Kumar et al., who studied the effectiveness of Braille and fluoridated dentifrices on visually impaired children. They also observed significant decrease in OHI-S scores in fluoridated group when oral health education was given using Braille as a medium.\(^\text{[7]}\)

The ATP technique when used, resulted in a significant improvement in oral hygiene maintenance which was similar to studies conducted by Hebbal and Joybell.\(^\text{[1,4]}\)

The plaque scores reduced significantly, therefore, placing eighteen pupils in the good category as compared to only seven students before the intervention. Whereas, in Group 3, where oral health education was given using both Braille and ATP technique, excellent results were obtained when before and after intervention scores were compared. This could be attributed to the combination of Braille and proper customized brushing technique (ATP) which helped the adolescents to learn better.

As all the study participants underwent oral prophylaxis before the intervention; therefore, score comparison between Group 1, 2, and 3 was not significant initially. When postintervention scores were compared the scores were statistically significant. These findings are in accordance with the study performed by Yalcinkaya and Atalay in which oral hygiene techniques were reinforced three times in 2 months interval.\(^\text{[11]}\)

When the number of participants who improved their oral hygiene after the intervention was compared between Group 1 and 3; it was statistically evident that the combination of Braille and ATP technique did extremely well. This confirms the fact that when proper instructions regarding oral hygiene maintenance are given, oral health status of this special population is improved. This is in correlation with studies conducted by O'Donnell and Crosswaite\(^\text{[12]}\) and Schnuth.\(^\text{[13]}\) Furthermore, the use of an innovative technique such as ATP definitely helps in educating the visually challenged. Although the number of participants having lower plaque scores were less in Group 3 as compared to Group 2 but it was not statistically significant. Although the study included only adolescent boys, it would be important to have interventions which include visually impaired girls and smaller children to establish the effectiveness of Braille and ATP in a wider range of population.

**CONCLUSION**

Although Braille and ATP technique for oral health education were effective tools when used individually, the combination of the two techniques proved to be more effective. More research in the direction of customization of educational and oral hygiene aids for visually impaired is the need of the hour. It is also important to educate the parents, teachers, and caregivers of visually challenged individuals and make them aware of the importance of oral health care and its impact on the general health. There is also a social responsibility of dentists and community as whole to work in unison to improve the life of individuals with special health-care needs.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**

1. Hebbal M, Ankola AV. Development of a new technique (ATP) for training visually impaired children in oral hygiene maintenance. Eur Arch Paediatr Dent 2012;13:244-7.

2. Anaise JZ. Periodontal disease and oral hygiene in a group of blind and sighted Israeli teenagers (14–17 years of age. Community Dent Oral Epidemiol 1979;7:353-6.

3. Mahoney EK, Kumar N, Porter SR. Effect of visual impairment upon oral health care: A review. Br Dent J 2008;204:63-7.

4. Joybell C, Krishnan R, Suresh Kumar V. Comparison of two brushing methods-fones vs. modified bass method in visually impaired adolescent using THE Audio Tactile Performance (ATP) Technique. J Clin Diagn Res 2015;9:ZC19-22.

5. Aviv R. Listening to Braille. N Y Times 2009; Sunday Magazine 2010:p. MM42. Available from: http://www.nytimes.com/2010/01/03/magazine/03Braille-t.html?mcubz=3. [Last accessed on 2017 Oct 18]

6. Loe H. The gingival index, the plaque index and the retention index systems. J Periodontol 1967;38:Suppl: 610-6.

7. Papas N. Nutrition in Clinical Dentistry. 3rd ed. Philadelphia: Published by Saunders; 1989.

8. Bimstein E, Jerrell RG, Weaver JP, Dailey L. Oral characteristics of children with visual or auditory impairments. Pediatr Dent 2014;36:336-41.

9. Sharma A, Arora R, Kenchappa M, Bhayya DP, Singh D. Clinical
evaluation of the plaque-removing ability of four different toothbrushes in visually impaired children. Oral Health Prev Dent 2012;10:219-24.

10. Jain A, Gupta J, Aggarwal V, Goyal C. To evaluate the comparative status of oral health practices, oral hygiene and periodontal status amongst visually impaired and sighted students. Spec Care Dentist 2013;33:78-84.

11. Yalcinkaya SE, Atalay T. Improvement of oral health knowledge in a group of visually impaired students. Oral Health Prev Dent 2006;4:243-53.

12. O'Donnell D, Crosswaite MA. Dental health education for the visually impaired child. J R Soc Health 1990;110:60-1.

13. Schnuth ML. Dental health education for the blind. Dent Hyg (Chic) 1977;51:499-501.