

# New vision for improving oral hygiene status of visually impaired students aged from 9 to 17 years

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## ABSTRACT

**Background:** Visually impaired patients are at a higher risk of developing periodontal disease because of greater difficulty in attaining good oral hygiene. This study aims to assess and compare the oral hygiene status of visually impaired students before and after oral health education interventions using special customized methods. **Methods:** The present study was a randomized control trial of 180 visually impaired students divided into three groups. Each group includes 60 students selected randomly from blind school. Oral health education was given using Braille in Group 1, Audio Tactile performance (ATP) technique in Group 2, and a combination of Braille and ATP technique in Group 3. Plaque index (PI) scores and gingival index (GI) scores were calculated and evaluated at baseline and after 3 months. Intergroup comparison and intragroup comparison of PI and GI at baseline and 3 months was by using one way ANOVA and Paired t test, respectively. **Results:** There was a highly significant difference seen for the intergroup comparison of post PI ( $P < 0.01$ ) and post GI ( $P < 0.01$ ) with least mean in Group 3. There was a statistically highly significant difference seen for the intra group comparison of pre and post PI and GI ( $P < 0.01$ ) with lesser means in post as compared to pre in all three groups. **Conclusions:** Visually impaired children could maintain an acceptable level of oral hygiene when taught using combination of Braille and ATP technique.

**Keywords:** Audio tactile performance, braille, oral health education, oral hygiene, visually impaired

## Introduction

Over the past few decades, the prevalence of oral health diseases and conditions has been increasing at an alarming rate. The attitude of the general public with lack of social awareness or lack of education towards their oral health together with lack of services, financial resources, and training of health-care

providers have been major contributing factors in the increasing prevalence of oral diseases. This trend in increasing prevalence is evident in developing countries like India mainly among the rural population. The oral cavity is often referred to as “Window or Mirror to the overall health of the body” and divergence from health to a diseased state not only affects the personal systemic health of the patient but also his social and positive mental health. The two most common oral diseases affecting peoples of India are Dental Caries and Periodontitis. The pathological chronic inflammatory condition of supporting tissues of periodontium is called periodontitis. The prevalence of periodontitis is relatively high (55.4%, 89.2%, and 79.4% in 12, 35–44, and 65–74 year old, respectively) affecting the quality of life of Indian people.<sup>[1]</sup> It has

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been well established through literature that periodontal diseases also an association with systemic health and conditions such as diabetes, cardiovascular diseases, and pregnancy.<sup>[2-3]</sup> Constant and consistent removal of dentogingival plaque is required for maintenance of periodontal health. However, the efficiency with which one can attain and maintain proper oral hygiene varies from individual to individual. Lack of awareness about various preventive measures and inability of the patient to recognize signs and symptoms of periodontal disease further complicates the scenario.<sup>[4]</sup> The situation becomes more perplexing with specially abled peoples (physically and mentally challenged).

For centuries the specially-abled population has been considered as underprivileged in our society. Once they were regarded as “curse or ill omen” forbidden from the mainstream of society. However, the present scenario is different. The phrase “Specially Abled” has replaced words such as impairment, physically challenged, and disabled. Society has started to accept them with a warm welcome with the concept of disability being slowly removed from the mindset of their family, peers, neighbors, etc., Visually impaired constitutes a noteworthy population of specially-abled individuals. Just because a man lacks the use of his eyes does not mean he lacks vision. Visual impairment possess a significant impact on oral health increasing the risk of developing various oral diseases namely periodontal disease due to greater impairment in attaining good oral hygiene.<sup>[5]</sup> A large portion of our literature proves the relative poor oral health of visually impaired. However, they are worthy and deserved to be educated as to sighted peers. This is where health-care workers especially Dental personals come into play. It is our moral duty to highlight the importance of oral health and grant-specific treatment needs as same as provided to normal individuals. With limited resources and heavily burdened treatment needs of visually impaired, the treatment should be more focused toward prevention of oral health diseases.

Transfer of knowledge and skills as a preventive approach to oral disease, thus improving the quality of life of an individual, group, or community is referred to as oral health education. Such oral health programs aim to teach and motivate an individual to reinforce and to maintain oral health, to provide them with a healthy body and mind. Visually impaired patients are at a higher risk of developing periodontal disease. It is well known that children develop healthy habits early in life. Molding a child with proper oral health education behaviors and repeating them daily will help a child to inculcate it more promptly and to maintain it throughout their life.<sup>[6]</sup>

Although the absence of visual stimulus can prevent rapid learning in visually impaired, these individuals have a heightened tactile, sound, and speech senses. Through various techniques personalized to them functional importance of teeth and daily maintenance of oral hygiene could be thought. One such technique is the Braille system for visually impaired. Louis Braille (1809–1852) developed this technique. Braille is read by passing fingertips over characters corresponding to the relative

position of embossed points. Braille slates which constitute rows of small cells as a guide is used.<sup>[7]</sup> Oral health education provided through the Braille method has been shown to have positively enforced visually impaired to perform oral hygiene more effectively.<sup>[8]</sup>

Audio tactile performance technique (ATP) is another special personalized method which is an effective tool to educate visually impaired. The technique constitutes of mainly three components - ATP with creative use of other senses. The multisensory health education method, ATP is a communication tool to teach and allow visually impaired to efficiently maintain an acceptable level of oral hygiene.<sup>[9]</sup>

The present study aims to assess and compare the oral hygiene status of visually impaired students before and after health education interventions using special customized techniques-Braille, ATP technique and a combination of both. However, the ultimate aim is for a social cause, to recognize our responsibility as a health-care professional and to educate visually impaired regarding the importance of oral health helping them to a lead a healthy life.

## Subjects and Methods

The present study is a randomized control trial of visually impaired students from Rajasthan Netraheen Kalyan Sangh, a registered blind schools of Jaipur, Rajasthan. Ethical and Institutional permission was duly obtained. The study was approved by the Ethical Committee, RUHS College of Dental Sciences, Jaipur, Rajasthan, India. A total of 180 blind students from 9 to 17 years of age were recruited into the study. Written informed consent was obtained from each participant in Braille and their respective guardians. Students with any other impairment and uncooperative students were excluded. 180 participants were randomly divided into three groups using a lottery system. To attain an 80% power of study, 60 participants were recruited in each group. The study was carried out at various stages:

- Stage 1 (interaction): To understand the level of cooperation and to establish familiarity with students beforehand a series of interactive sessions were conducted
- Stage 2 (pre education examination): A self-structured questionnaire was developed with the help of blind school staffs. The questionnaires were used to record personal details together with the reason for blindness, method, and frequency of tooth brushing. Oral health status was recorded by using the plaque index (pre-PI) by Silness and Loe (1964) and Gingival Index (pre-GI) by Loe and Silness (1963). All examinations were performed by a single examiner, post graduate resident, Department of Periodontics, RUHS College of Dental Sciences, Jaipur, Rajasthan
- Stage 3 (health education): Total of 180 participants were randomly divided into three groups with 60 participants in each group. Health education was given using the Braille method in Group 1, ATP technique in Group 2 and a combination of both in Group 3 (BATP)

- Group 1 (braille): Since Braille is the standard method of giving education to visually impaired, oral health education is given to 60 students in this group using a Braille slate. Braille slate consists of oral hygiene instructions which included: the use of fluoridated toothpaste and a soft toothbrush, brush twice daily, decrease consumption of sugar with the inclusion of diet that is more coarse in nature, rinsing the mouth after each meal and to visit a dentist regularly every 6 months. Braille slates were prepared with the help of Blind school staffs. Children were specified to read and follow oral health instructions so that they can themselves maintain a good level of oral hygiene. Periodic reinforcements were performed at 15 days
- Group 2 (ATP): Sixty participants in this group were given oral health education using ATP technique. Importance of teeth with Fones technique of tooth brushing was first verbally informed to children (audio component). The students were made to feel their own teeth on a large model followed by practicing Fones method with assistance in the model. Until performed with ease, children were practiced. Then they were asked to appreciate the deposits in their mouth with the help of tongue (tactile component) followed by brushing their own teeth with Fones method (performance component) under assistance. The process was continued until the children performed with ease. Reinforcements with ATP technique were performed every 15 days
- Group 3 (BATP): Sixty participants in this group were given oral health education using a combination of Braille method as in Group 1 and ATP technique as in Group 2. Periodic reinforcements were carried out in every 15 days
- Stage 4 (post education examination): Oral examination was carried out at 3 months' post health education. Post-PI and post-GI were recorded. The results obtained were subjected to statistical analysis.

### Statistical analysis

Data obtained through excel sheet were subjected to SPSS Software version 19-SPSS Inc., Chicago, IL, USA. Intergroup comparison and intragroup comparison of PI and GI at baseline and 3 months were carried out by One way ANOVA and Paired *t*-test, respectively.  $P < 0.05$  was considered to be statistically significant and  $P < 0.01$  as statistically highly significant, keeping an  $\alpha$  error at 5% and  $\beta$  error at 20%, thus giving a power of the study as 80%.

### Results

Visually impaired students 9–17 years old were recruited into study with a mean age of participants being 12.27, 12.38, and 12.48 in Group 1, Group 2, and Group 3, respectively. Of 91 male children in study 29, 31, and 31 belonged to Group 1, Group 2, and Group 3, respectively. Out of 89 female children in study 31, 29, and 29 belonged to Group 1, Group 2, and Group 3, respectively. After analysis of the questionnaire, it was found that after 3 months, the number of participants using

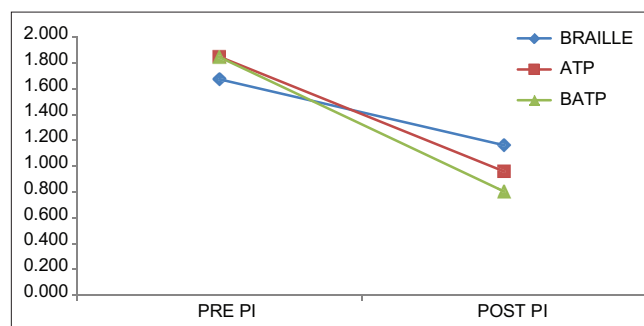
toothpaste and finger for maintaining oral hygiene reduced from 44 to 12. The number of students using toothpaste and toothbrush increased from 136 to 168. In terms of frequency, the number of students who brushed once daily reduced from 119 to 59 and the number of students who brushed twice daily increased from 61 to 121.

On intergroup comparison using one way ANOVA [Table 1], a statistical nonsignificant result was seen for pre-PI ( $P > 0.05$ ), however, there was a statistically highly significant difference seen for post-PI after 3 months ( $P < 0.01$ ) with least mean in Group 3 (BATP) [Table 2 and Figure 1]. There was a statistically significant difference seen for intergroup comparison of pre-GI with least mean in Group 1 (Braille) ( $P < 0.05$ ), however, there was a statistically highly significant difference seen for post-GI after 3

**Table 1: Intergroup comparison of pre-education plaque index and gingival index with post-education plaque index and gingival index in three groups of visually impaired children using One-Way ANOVA**

	Sum of squares	df	Mean square	F	Significance
<b>PI pre</b>					
Between groups	1.213	2	0.607	3.039	0.050
Within groups	35.340	177	0.200		
Total	36.553	179			
<b>PI post</b>					
Between groups	3.913	2	1.956	16.634	0.000
Within groups	20.819	177	0.118		
Total	24.732	179			
<b>GI pre</b>					
Between groups	1.083	2	0.542	3.388	0.036
Within groups	28.297	177	0.160		
Total	29.381	179			
<b>GI post</b>					
Between groups	5.085	2	2.542	22.294	0.000
Within groups	20.185	177	0.114		
Total	25.270	179			

Df: Degrees of freedom, PI: Plaque Index, GI: Gingival Index



**Figure 1: Comparison of pre and post PI**

Groups	Pre-PI	Post-PI
BRAILLE	1.672	1.162
ATP	1.847	0.957
BATP	1.845	0.802

**Table 2: Intergroup comparison of mean and standard deviation of preeducation Plaque Index and Gingival Index with posteducation Plaque Index and Gingival Index in three groups of visually impaired children**

Groups	n	Mean	SD	SE
PI pre				
Braille	60	1.671667	0.5135756	0.0663023
ATP	60	1.846667	0.4311855	0.0556658
BATP	60	1.845000	0.3863892	0.0498826
Total	180	1.787778	0.4518930	0.0336821
PI post				
Braille	60	1.161667	0.4250989	0.0548800
ATP	60	0.956667	0.3158881	0.0407810
BATP	60	0.801667	0.2690168	0.0347299
Total	180	0.973333	0.3717090	0.0277056
GI pre				
Braille	60	1.698333	0.4760329	0.0614556
ATP	60	1.873333	0.3821734	0.0493384
BATP	60	1.850000	0.3270308	0.0422195
Total	180	1.807222	0.4051389	0.0301973
GI post				
Braille	60	1.205000	0.4518981	0.0583398
ATP	60	1.003333	0.3236270	0.0417801
BATP	60	0.793333	0.1821404	0.0235142
Total	180	1.000556	0.3757298	0.0280052

ATP: Audio tactile performance, BATP: Braille and audio - tactile performance, PI: Plaque Index, GI: Gingival Index, SE: Standard error, SD: Standard deviation

**Table 3: Intragroup comparison of preeducation Plaque Index and Gingival Index with posteducation Plaque Index and Gingival Index in Group 1 (Braille) of visually impaired children using paired t-test**

	n	Mean	SD	SEM	t	P
PI pre	60	1.671667	0.5135756	0.0663023	14.096	0.000
PI post	60	1.161667	0.4250989	0.0548800		
GI pre	60	1.698333	0.4760329	0.0614556	18.879	0.000
GI post	60	1.205000	0.4518981	0.0583398		

PI: Plaque Index, GI: Gingival Index, SE: Standard error, SD: Standard deviation

months ( $P < 0.01$ ) with least mean in Group 3 (BATP) [Table 2 and Figure 2].

On intragroup comparison using Paired *t*-test, for Group 1 (Braille), there was a statistically highly significant difference seen for pre-post PI and GI ( $P < 0.01$ ) with lesser means in post as compared to pre [Table 3]. For Group 2 (ATP), there was a statistically highly significant difference seen for Pre-Post PI and GI ( $P < 0.01$ ) with lesser means in post as compared to pre [Table 4]. For Group 3 (BATP), there was a statistically highly significant difference seen for pre-post PI and GI ( $P < 0.01$ ) with lesser means in post as compared to pre [Table 5].

### Discussion

It is truly controversial that weather oral health education can mold and change children’s oral health behavior and knowledge,

**Table 4: Intragroup comparison of preeducation Plaque Index and Gingival Index with posteducation Plaque Index and Gingival Index in Group 2 (audio tactile performance) of visually impaired children using paired t-test**

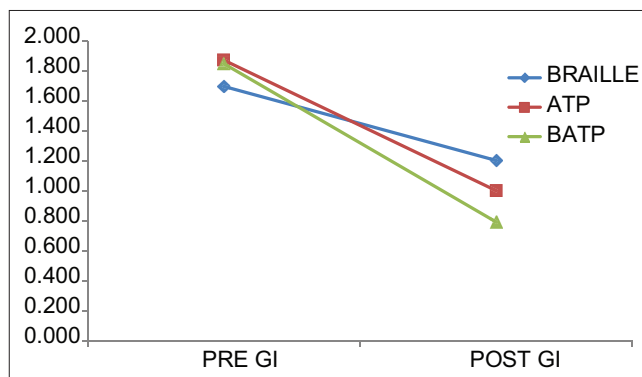
	Mean	n	SD	SEM	t	P
PI pre	1.846667	60	0.4311855	0.0556658	19.994	0.000
PI post	0.956667	60	0.3158881	0.0407810		
GI pre	1.873333	60	0.3821734	0.0493384	33.097	0.000
GI post	1.003333	60	0.3236270	0.0417801		

PI: Plaque Index, GI: Gingival Index, SEM: Standard error of mean, SD: Standard deviation

**Table 5: Intragroup comparison of preeducation Plaque Index and Gingival Index with posteducation Plaque Index and Gingival Index in Group 3 (Braille and audio-tactile performance) of visually impaired children using Paired t-test**

	Mean	n	SD	SEM	t	P
PI pre	1.845000	60	0.3863892	0.0498826	23.027	0.000
PI post	0.801667	60	0.2690168	0.0347299		
GI pre	1.850000	60	0.3270308	0.0422195	28.497	0.000
GI post	0.793333	60	0.1821404	0.0235142		

PI: Plaque Index, GI: Gingival Index, SEM: Standard error of mean, SD: Standard deviation



**Figure 2: Comparison of pre- and post-GI**

Groups	Pre-GI	Post-GI
BRAILLE	1.698	1.205
ATP	1.873	1.003
BATP	1.850	0.793

less literature evidence is available in this topic especially in cases of visually impaired.<sup>[10]</sup> However, a positive assumption should not be neglected. School oral health education programs like the present study will motivate the children to take the appropriate decision about maintaining their oral health.<sup>[11]</sup> A study by Maciel *et al.* concluded that Gingivitis is the most common periodontal condition in visually impaired.<sup>[12]</sup> To avoid complicated treatment needs, proper awareness through oral health guidance programs and periodic screening is the need for an hour to promote oral hygiene among visually impaired.<sup>[13]</sup>

It is a custom to clean the teeth daily in the morning. Majority of students used toothpaste and toothbrush to clean their teeth at baseline which increased after appropriate health education.

Some students also used finger for brushing teeth at baseline which reduced to lesser amount posteducation. Frequency of students brushing twice daily also increased post health education. Students in the present study lacked knowledge in regards to basic oral hygiene. Due to increased burdens and challenges faced the least importance was given to oral hygiene.<sup>[14]</sup> Jain *et al.* stressed the role of Dental health professionals in helping visually impaired.<sup>[15]</sup> With appropriate oral health education and behavior management techniques, a significant reduction in anxiety levels in visually impaired towards their dental treatment has been observed.<sup>[16]</sup>

In Group 1 (Braille), oral health education using Braille slates showed a statistically highly significant reduction in both the PI and GI [Table 3]. Braille, the standard method of teaching the visually impaired can be used to teach basic yet effective oral hygiene instructions to children. A study by Bhor *et al.* showed a statistically significant increase in oral health knowledge through Braille method in visually impaired students from 12 to 17 years of age.<sup>[17]</sup> With repetition and periodic reinforcements of instructions, a significant improvement in oral hygiene by Braille method could be achieved.<sup>[18]</sup> The result of the present study is in accordance with the study by Charu *et al.* who observed that visually impaired maintained a significant level of oral hygiene when taught using Braille method.<sup>[19]</sup>

In Group 2 (ATP), oral health education using the ATP method showed a statistically highly significant reduction in both the PI and GI [Table 4]. Fones method was taught to students using the ATP method in the present study as it is easier to learn. The results were per the study by Joybell *et al.* who concluded students learned Fones method easily then Modified Bass method. However, both methods are effective when taught via ATP method showed a reduction in plaque scores in visually impaired.<sup>[20]</sup> Results of the present study are in accordance with the study by Nasrin *et al.* who concluded that ATP technique to be effective in improving the oral health status of visually impaired.<sup>[21]</sup>

In Group 3 (BATP), oral health education using both Braille and ATP method showed a statistically highly significant reduction in both PI and GI [Table 5]. Intergroup comparison showed a highly significant reduction in both Post PI and Post GI with lesser means in this group. Results of the present study are in accordance with the study by Deshpande *et al.* who concluded with a combination of techniques being more effective than individual techniques.<sup>[22]</sup> A significant increase in oral hygiene status, knowledge, attitude, and practice of oral hygiene has been found when Braille was combined with ATP technique.<sup>[23]</sup> However, the present study recruited a higher number of participants in each group. PI is used to evaluate the level and rate of plaque formation on the tooth surface. GI measures the degree of inflammation. Both values reduced significantly with a combination of both techniques. Thus students were efficiently motivated and maintained a higher level of oral hygiene with combination rather than individual techniques. Combination of different senses and customized usage in visually impaired led to the results in the present study. Scrupulous training and periodic reinforcements could lead to

an improved oral hygiene status in visually impaired.<sup>[24]</sup> However, barriers still exist which prevents these visually impaired from availing proper dental treatment.<sup>[25]</sup>

Primary care physicians are our first stop for medical care. They are the best means of providing primary preventive care to a child whether sighted or blind. By emphasizing on health education and identifying risk factor, primary care physicians efficiently prevent and manage chronic diseases including oral disease. The fact that oral diseases have a significant impact on the general health of the child that too visually impaired should not be neglected. A combination of customized techniques such as Braille and ATP techniques like in the present study could be used to give basic instructions and navigate them to a state of good oral health for longevity and better quality of life.

The limitations of the present study include, degree of visual impairment (fully or partial) were not taken into consideration. The duration of the study was only 3 months. Evaluation after a longer period would have provided more validated results. Only Fones technique of tooth brushing was taught to the students, no education on the use of any interdental cleaning aids was taught. After completion of the study, all students were educated and motivated with a combination of both Braille and ATP method and their respective dental findings treated.

In summary, there was a highly significant reduction in PI and GI in Group 3 in which oral hygiene instructions were using a combination of Braille and ATP technique in visually impaired than in Group 1 and Group 2 in which instructions were only given using either Braille or APT techniques respectively. Thus, children in Group 3 were efficiently motivated and maintained a significant level of oral hygiene than Group 1 and Group 2.

## Conclusions

Visually impaired could maintain an acceptable level of oral hygiene when taught using a combination of Braille and ATP technique for oral health education. Although individually effective a combination proved more effective. Dental health professionals through oral health education programs should not only motivate and train visually impaired to attain good oral hygiene but also educate parents, guardians, and peers in helping them attain self-esteem and self-dependency in life. Although hurdles exist in doing so visually impaired are worthy and deserve to get the same opportunities as those who are healthy. It is the moral duty of a dental health professional to aid them in attaining oral health irrespective of someone's disability, ultimately enabling them to live a prosperous and healthy life.

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## Conflicts of interest

There are no conflicts of interest.

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