

Effect of an Audio Tactile Performance Technique for Visually Impaired Children on Their Oral Health Status

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Abstract Background: It is difficult to treat visually impaired children's teeth, and extensive treatment may require sedation and/or general anesthesia. Therefore, the focus should be on prevention of disease. Audio Tactile Performance technique is a specialized method aimed at educating children with vision impairment about mouth hygiene. **Aim:** This study aimed to evaluate the effect of an audio tactile performance technique for visually impaired children on their oral health status. **Method:** Pre-experimental research design was carried out at Al-Noor and Al-Amal School for the Blind, Mansoura City, Dakahlia Governorate, Egypt, on 98 children who always attend school. Using four tools for data collection: a structured interview questionnaire sheet, a tooth brushing skills checklist, an Oral Assessment Guide, and assessment of satisfaction about audio tactile performance technique. **Results:** Before applying ATP technique, the majority of visually impaired children had a poor level of total knowledge, all children were unskilled in tooth brushing, and the minority were without oral problems. Post applying ATP technique, the majority of visually impaired children had an average level of total knowledge, the majority were skilled in tooth brushing, more than one third was without oral problems, and more than three quadrants were very satisfied with ATP technique. **Conclusion:** The oral health of visually impaired children was positively affected after applying ATP technique. **Recommendation:** Engage ATP technique programs as a health educational method for visually impaired children.

Keywords: Audio Tactile Performance technique, Oral health, Visually impaired children

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1. Introduction

Vision loss in children had a great effect on their development that led to defects in adaptation, learning, educational processes, and independence, and may have sensory or motor impairment [1]. Improper teeth brushing may contribute to poor oral health in visually impaired children, which in turn increases the prevalence of diseases in the gum and periodontal, tooth decay, and trauma [2].

One of the challenges to oral health for visually impaired children is the high prevalence of dental caries. Causes of poor oral hygiene are infrequent dental visits and the mother's low educational level [3]. There are a lot of other causes that tend to raise oral problems, including people's ignorance and an inadequate understanding about oral health, their bad habits when it comes to brushing and flossing, eating unhealthy food, and their mental health issues, including anxiety, melancholy, and depression, infrequent dental visits, and mother's low educational level [4].

Poor dental hygiene in children has several effects on children like; physical pain that leads to sleeping, eating, and behavioral problems [5]. The major obstacles to providing dental care for children with visual impairments include the attitude of patients and caregivers, transportation issues, a lack of resources or financial concerns, a shortage of social consciousness, a lack of services, and providers' education and training [6]. It can be quite a challenge for visually impaired children to keep their teeth clean [7]. Oral health education is a method for promoting oral health in dentistry. There are a variety of oral health educational pamphlets available in Braille, auditory-tactile performance methods, and tactile models to assist children with visual impairments, depending on their specific needs [8].

There is a need for attitude modifications for children and their parents and caregivers. Dental health education, braille educational books, diet counseling along with preventative measures, instructions for removing plaque, frequency and timing of oral hygiene procedures, and audio-tactile performance techniques are other aspects of improving oral health status for individuals with visual impairment [9].

Audio tactile performance technique (ATP) is an educational health method that is specially designed and a very effective communication tool to educate those children regarding maintenance of oral health [10]. It begins with an interactive session (audio) that focuses on building a solid rapport with children. Next, with the help of an educator, they will learn to brush a huge model of their teeth by touching it (tactile) [11]. They were instructed to use their tongues to feel their teeth, and the children were shown how to brush their teeth with help (performance) [10]. As a result, we were developing some educational sessions for visually impaired children that contained the use of ATP technique, to teach the children with vision impairment the correct method of tooth brushing and evaluating the outcomes of using ATP technique, so this study was conducted.

1.1. Significance of the Study

Every minute, one out of every five children will go blind; of those, half will not survive more than a year or two after losing sight. This amounts to around half of all childhood blindness cases. Childhood blindness is estimated to account for around one third of the overall economic cost of blindness [12]. The necessity of proper oral hygiene is often overlooked and unsatisfied among visually impaired individuals, and there is a significant communication barrier between visually impaired people and dentists. As a result, dental care ranks high among the most neglected and unmet needs [11].

Oral health education can help in closing the communication gap between children who are visually impaired and their dentists or nurses. The ATP methodology is a new approach to health education that teaches visually impaired children dental hygiene maintenance in a way that a dentist or nurse can teach it to them [13]. Visually impaired children are considered one of the neglected groups in Egypt. In our study, we will highlight this category of children. The number of children at Al-Noor and Al-Amal School for the Blind is increasing every year. In 2020, there were 81 children, in 2021, there were 85 children and now, in 2022, there are 91 children. This is the first study on Egypt aimed at helping visually impaired children learn the right technique of tooth brushing by using ATP technique, to help them in the maintenance of gingival health and plaque removal efficacy among institutionalized visually impaired children of Mansoura City.

1.2. Aim of the Study

Evaluate the effect of an audio tactile performance (ATP) technique for visually impaired children on their oral health status.

1.3. Research Hypotheses

Children who receive nursing interventions by audio tactile performance (ATP) technique are expected to have fewer complications in oral problems.

2. Subjects and Method

2.1. Research Design

A pre-experimental research design was used.

2.2. Setting

The study was carried out at Al-Noor and Al-Amal School for the Blind, Mansoura City, Dakahlia Governorate, Egypt. Children join it from the nursery stage at age 5 years to the secondary stage.

2.3. Subjects

A convenience sample of available children in Al-Noor and Al-Amal School (N = 96) who were present in the aforementioned context throughout the time that data was being collected.

Inclusion criteria: children who were

- With different degrees of visual impairment
- Aged from 5 years to 18 years old.

Exclusion Criteria:

- The majority of the school days have passed without the children's regular attendance.
- Children were receiving orthodontic appliances.
- Children who had intellectual disabilities among the children.

2.4. Data Collection Tools

The data were collected using the following four tools:

Tool I: A structured interview questionnaire sheet

The questionnaire was designed by the researcher after a thorough review of the related literature and studies [14,15,16,17].

Part one: demographic characteristics of children with vision impairment (pretest), such as name, age, sex, educational level, accommodation at school, family type, cause of blindness, degree of blindness, whether one of the parents suffered from blindness, and level of caregiver education.

Part two: past dental history of children with visual impairment (pretest). It was asking about receiving a training session about oral hygiene, visiting a dentist, having a dental procedure before, having gum bleeding or swelling, having a toothache within 6 months, and having difficulty biting hard food or chewing in the past 6 months.

Part three: knowledge of children with visual impairment about the oral cavity (pretest, immediate post and post 3 months), which includes their knowledge about the functions of the oral cavity, mouth structure, the tongue as a muscular organ, palate deviation, primary teeth and permanent teeth number, the classes of teeth, using the incisor teeth, and teeth tending to erupt last.

Part four: oral hygiene knowledge of children with visual impairment (pretest, immediate post and post 3 months). It was asking about the relation between dental health and general health, the definition of caries and its

causes, whether the child thought bacteria could cause dental caries, whether soft drinks or soda were affecting dental health, whether sugars were leading to dental caries, whether the child thought brushing teeth on a regular basis protected his / her teeth, whether the child visited the dentist regularly, and whether dental caries could lead to bad effects on his / her teeth.

Part five: dental hygiene behaviors among visually impaired children (pretest, immediate post and post 3 months). It was asking the child about having a toothbrush, what type of tooth brush he/ she used, whether the child brushed his/ her teeth regularly, how often the child should brush his/ her teeth, duration of the tooth brushing process, what the recommended duration of using a toothbrush is, whether the child thinks about the necessity of dental floss, whether the child used any mouthwash, whether the child used fluoridated toothpaste, how often the child drank soda or juice and ate sweets, and whether the child was able to brush his/ her teeth with or without help.

Scoring system

Visually impaired children's knowledge about oral health status before and after the application of ATP technique was scored one for each correct answer and zero for incorrect, missed, or unknown answers. The total knowledge score was (30) marks.

The knowledge level was classified into three categories [14]:

- Poor = scores less than or equal to 50% of total scores (≤ 15 marks)
- Average = scores more than 50% to 75% of total scores. (from 16 - 22 marks).
- Good = scores more than 75% of total scores. (> 23 - 30 marks).

Part six: Barriers for accessing dental service among visually impaired children (pretest): availability of dental services, transportation, cost, education and training of service providers, dental office times are convenient for the child and the family, does the dental office have access (help in place) for children, are there adequate facilities to provide dental care for children, was the long waiting time for dental service, did the child feel fear from dental work or feel embarrassed, or were there any psychological barriers?

The barriers were classified into five categories [18].

Tool II: Tooth brushing skills checklist

It was adopted by the researcher after a thorough review of the related literature and studies [19]. The tool was used to assess children's tooth brushing performance process by using ATP technique (pretest, immediate post and post 3 months). It was scored one if the skill was done and zero if the skill was not done, missed, or unknown.

The skill level was classified into the following two categories [19].

- Unskilled = scores less than or equal to 50% of total scores. (≤ 18 mark).
- Skilled = scores more than 50 % of total scores. (> 18 mark).

Tool III: Oral Assessment Guide (OAG)

The Oral Assessment Guide (OAG) was used by the researcher to evaluate changes in the oral cavity (pretest and post 3 months). The OAG is comprised of eight categories of assessment of the mouth, which include

swallow, lips, tongue, saliva, mucous membrane, gingivae, tooth, and voice [20].

Scoring system

Each item in the assessment guide was valued at 3 marks, with a total score of 24 marks. The total score for the children's Oral Assessment Guide (OAG) was classified into the following three categories [20]:

- Without oral problems less than or equal to 33.3% (≤ 8 marks)
- Slight to moderate oral problems from 37.5% to 50% (from 9 - 12 marks)
- Severe oral problems from 54.1% to 100% (from 13 - 24 marks)

Tool IV: Assessment of visually impaired children's satisfaction of audio tactile performance technique (post 3 months)

It was adapted by the researcher after a thorough review of the related literature and studies to assess children's satisfaction of audio tactile performance technique [21]. It consists of 5 statements.

Scoring system

The following is a breakdown of the responses: 4 for extremely satisfied, 3 for satisfied, 2 for neither satisfied nor dissatisfied, 1 for very dissatisfied, and 0 for very unsatisfied.

The satisfaction level was classified into four categories (21):

- Very dissatisfied (from 0 - 5). Scores less than 31, 25 % of total scores.
- Dissatisfied (from 6 - 10). Scores from 37.5 % to 62, 5 % of total scores.
- Satisfied (from 11 - 14). Scores from 68.75% to 87, 5 % of total scores.
- Very satisfied (from 15 - 16). Scores from 93.75 % to 100 % of total scores.

Operational design

It includes the preparatory phase and exploratory phase.

1. The preparatory phase

A review of related literatures that covering various aspects of oral hygiene, and audio tactile performance (ATP) technique and tools were developed by the researcher.

Study tools (I, II, and IV) were subjected to content validity testing by members of the jury to guarantee that the tools were up to snuff, and any necessary adjustments were made.

After informing the children of the study's goals, the researcher sought their consent to do the experiment. The child was not included in the study because he or she declined to take part.

The internal consistency of the study tools was tested by using Cronbach's alpha coefficient test; $r = 0.76, 0.83$ and 0.87 for tool I (part 3, 4, & 5 respectively).

2. Exploratory phase

It includes pilot study and fieldwork.

a). Pilot study

Ten percent of the overall sample size (nine students) chosen at random from the school participated in a pilot study to test the usability, validity, and clarity of the research instruments, as well as to identify potential roadblocks to data collection and how to overcome them. Since no substantial adjustments were needed to the study

instruments, the participants from the pilot study were incorporated into the study's overall sample.

b). Fieldwork

Data collection period

Data collection extended over a period of six months from the first of October 2023 to the end of April 2024, except for January 2024. The researcher attended three days per week in the study setting from 8.00 am to 1.00 pm.

Study framework

The framework of the study was carried out in four phases as follows:

Phase 1: Assessment phase (Initial data collection)

- The researcher introduced herself during the first interview, the nature and aim of the study had been clarified before beginning to obtain their acceptance & involvement and to complete research instruments.
- Children assessed individually after fulfilling the criteria of selection using tools I, II, III and IV

Phase 2: Planning phase (Development of educational sessions)

The researcher created the learning sessions based on the preliminary data assessment of the children's knowledge and habits.

- o **First and second sessions:** they covered the definition and importance of oral hygiene, the structure of the mouth and its common oral problems, prevention, management, and complications of oral problems.
- o **Third session:** it discussed tips to ensure and maintain oral hygiene and steps of tooth brushing by audio tactile performance technique.
- o **Fourth session:** it covered re-demonstration items related to educational sessions and correct steps of tooth brushing by ATP technique.

Phase 3: Implementation of learning sessions

The studied visually impaired children were divided into groups; each one consisted of approximately 3 to 5 children. Each session started in the morning at 9.00 am. Various teaching media were used, such as booklets in Braille and educational tooth maket and simple words were used during the session by the researcher.

Phase 4: Evaluation of learning sessions' effectiveness (immediate post-test and post 3month test)

Every child was interviewed separately after the learning sessions were conducted to evaluate the level of knowledge and practice (**immediate post and post 3 months**) by using tool (I) part (3, 4& 5) and tool (II). An evaluation was conducted after 3 months to evaluate the level of satisfaction with ATP technique (**post 3 months**).

Administrative Design

Protocol and tool were signed by the Vice Dean for Post-Graduate Studies of Mansoura Faculty of Nursing. Then an official approval was obtained from her to carry out the study.

An official approval, signed protocol, and tool were submitted from the Vice Dean for Post-Graduate Studies of Mansoura Faculty of Nursing to the Director of the Directorate of Education in Dakahlia to obtain permission to conduct the study in school.

Addressed a letter from the Directorate of Education in Dakahlia directed to the head of the school in a previously mentioned setting, and after explaining the goal of the

study to collect data, we were able to acquire her oral permission to conduct the study.

Ethical Considerations

The Research Ethics Committee of the Faculty of Nursing at Mansoura University gave their stamp of approval so the study could go on.

Each child was asked to verbalize their consent to participate in the study once the purpose was explained to them. The data was acquired in a way that ensured its anonymity and confidentiality, and it was utilized exclusively for study. Every participant was informed that they could discontinue the study whenever they wanted, free of charge.

Statistical Analysis of the Data

The data was fed, and IBM SPSS software package version 20.0 was used for data analysis. The qualitative data are described in numbers and percentages. The Shapiro-Wilk test was confirmed to describe the distribution's normality. Chi-Square and Monte Carlo tests were used to compare qualitative data between groups as appropriate. Friedman test was used to compare between more than 2 studied periods. Binary logistic regression was used to assess the effect of the combination of more than 2 independent variables on dichotomous outcomes using Stepwise / forward Wald / Enter technique. Significant occurred when ($p \leq 0.05$) and highly significant when ($p \leq 0.001$).

3. Results

Table 1 illustrated that more than half (51%) of the studied visually impaired children were in the age group 6 - 11 years and in primary stage. More than half (54.2%) of them were females. Less than three quarters (72.9 %) were not accommodated at school. Less than two thirds (65.6%) were from nuclear families and the minority (5.2%) were from single parent families. The majority (93.8% and 92.7% respectively) were congenital and complete blindness. The majority (91.7%) of studied visually impaired children's parents did not suffer from blindness. Regarding the educational level of children's caregivers, nearly half (47.9 %) of them were diplom.

Figure1 illustrated that less than one third (31.5%) of the studied visually impaired children complained of gum pain, and less than one quarter (22.9% & 20.8% respectively) complained of toothache and chewing difficulty.

Table 2 showed that the majority (97.7%) of the studied visually impaired children had a poor level of knowledge about oral cavity before the implantation of the program, which markedly observed that the majority (84.4 & 93.8% respectively) had a good level of knowledge immediate post and post 3 months of the implantation of the program, with a highly statistically significant difference ($P = 0.001$).

Table 3 indicated that nearly one quarter (24%) of the studied visually impaired children had a good level of knowledge about oral hygiene before the implementation of the program, which markedly increased to the majority (90.6% & 93.8% respectively) having a good level of knowledge immediate post and post 3 months of the implantation of the program, with a highly statistically significant difference ($P = 0.001$).

Table 4 revealed that the majority (91.7%) of the studied visually impaired children had a poor level of knowledge about dental hygiene behaviors before the implantation of the program, which markedly observed that the majority (92.7% & 89.6% respectively) had a good level of knowledge immediate post and post 3 months of the implantation of the program with a highly statistically significant difference ($P = 0.001$).

Table 5 showed that the majority (88.5%) of the studied visually impaired children had a poor level of knowledge about oral cavity, oral hygiene, and dental hygiene behaviors before the implantation of the program, which markedly observed that the majority (95.8% & 96.9% respectively) had an average level of knowledge immediate post and post 3 months of the implantation of the program with a highly statistically significant difference ($P = 0.001$).

Figure 2 clarified that the majority (94.8%) of the studied visually impaired children reported that long waiting times for dental services are the main barrier to asking for dental services.

Table 6 clarified that (0%) all of the studied visually impaired children were unskilled in tooth brushing skills before the implantation of the program, which markedly observed that the majority (92.7% & 86.5% respectively) were skilled in immediate post and post 3 months' test after the implantation of the program with a highly statistically significant difference ($P = 0.001$).

Table 7 clarified that after applying of ATP technique, the minority (18.8%) of the studied visually impaired children without oral problems in the pretest increased to more than one third (38.6%) of them in the posttest after 3 months with a highly statistically significant difference ($P = 0.002$). While more than one third (33.3%) of the studied visually impaired children complain of severe oral problems before the program, which are decreasing to minor (12.5%) in them with a highly statistically significant difference ($P = 0.006$) after 3 months of the program implementation.

Figure 3 showed that more than three quadrants (79.2%) of the studied visually impaired children are very satisfied in the post 3 months' test.

Table 1. Percentage Distribution of the Studied Visually Impaired Children According to Their Demographic Characteristics (No=96)

Children's characteristics		No.= 96	
		No.	%
Age in years	4 to 5 yrs.	7	7.3
	6 to 11 yrs.	49	51
	12 to 14 years	21	21.9
	15 to 18 yrs.	19	19.8
	Mean $\pm$ SD 10.57 $\pm$ 3.57		
Sex	Male	44	45.8
	Female	52	54.2
Educational level	Nursery stage	7	7.3
	Primary stage	49	51
	Preparatory stage	21	21.9
	Secondary stage	19	19.8
Accommodation at school	Yes	26	27.1
	No	70	72.9
Family type	Nuclear family	63	65.6
	Single-parent family	5	5.2
	Extended family	28	29.2
Cause of blindness	Congenital	90	93.8
	Acquired	6	6.2
Degree of blindness	Complete	89	92.7
	Partial	7	7.3
Parents suffering from blindness	One of them	2	2.1
	Both	1	1
	None of them	88	91.7
	Family member	5	5.2
Educational level of caregiver	Illiterate	4	4.2
	Read and write	3	3.1
	Incomplete education	2	2.1
	Diplom	46	47.9
	Bachelor	41	42.7
	More	0	0

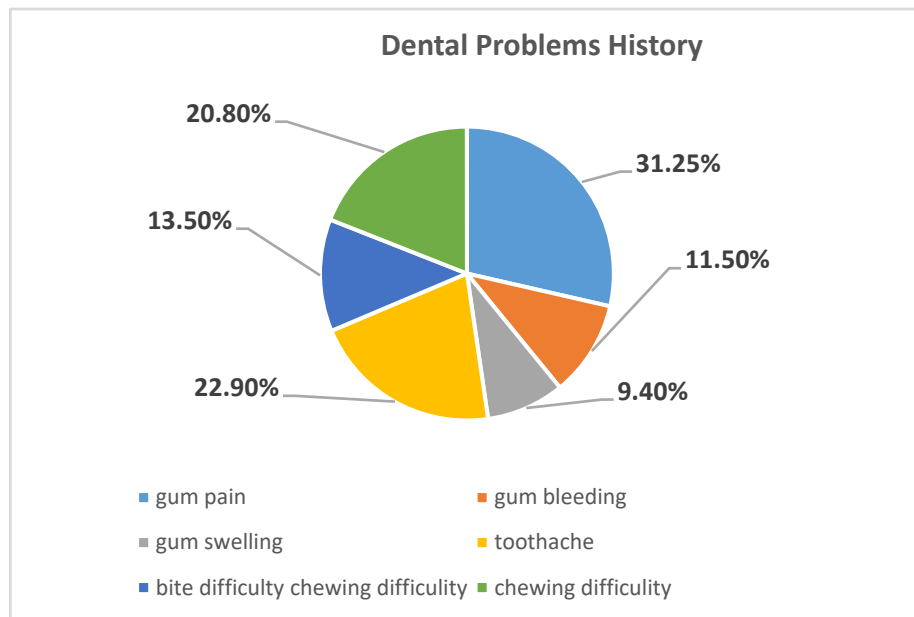


Figure 1. Dental Problems History of the Studied Visually Impaired Children (No=96)

Table 2. Level of the Studied Visually Impaired Children' Knowledge About Oral Cavity Pre and Post ATP Technique (No=96)

Level of knowledge	Pre		Immediate post		Post 3 month		Test of significance	P Value
	No	%	No	%	No	%		
Poor	92	97.7	2	2.1	1	1	Fr=155.4	P1=0.001* P2=0.001* P3=0.063
Average	2	2.1	13	13.5	5	5.2		
Good	0	0	81	84.4	90	93.8		

Fr: Friedman test

*statistically significant,

p1: difference between pre and immediate post

p2: difference between pre and post 3 months

p3: difference between immediate post and post 3 months.

Table 3. Level of the Studied Visually Impaired Children' Knowledge About Oral Hygiene Pre and Post ATP Technique (No=96)

Level of knowledge	Pre		Immediate post		Post 3 months		Test of significance	P Value
	No	%	No	%	No	%		
Poor	17	17.7	1	1	2	2.1	Fr=121.96	P1=0.001* P2=0.001* P3=0.104
Average	56	58.3	8	8.3	4	4.2		
Good	23	24	87	90.6	90	93.8		

Fr: Friedman test

*statistically significant

p1: difference between pre and immediate post

p2: difference between pre and post 3 months,

p3: difference between immediate post and post 3 months.

Table 4. Level of the Studied Visually Impaired Children' Knowledge About Dental Hygiene Behaviors Pre and Post ATP Technique (No=96)

Level of knowledge	Pre		Immediate post		Post 3 months		Test of significance	P Value
	No	%	No	%	No	%		
Poor	88	91.7	0	0	1	1	Fr=155.89	P1=0.001* P2=0.001* P3=0.390
Average	8	8.3	7	7.3	9	9.4		
Good	0	0	89	92.7	86	89.6		

Fr: Friedman test

*statistically significant

p1: difference between pre and immediate post

p2: difference between pre and post 3 months

p3: difference between immediate post and post 3 months.

Table 5. Total Level of the Studied Visually Impaired Children' Knowledge About Oral Cavity, Oral Hygiene, And Dental Hygiene Behaviors Pre and Post ATP Technique (No=96)

Level of knowledge	Pre		Immediate post		Post 3 months		Test of significance	P value
	No	%	No	%	No	%		
Poor	85	88.5	0	0	2	2.1	Fr =153.62	P1=0.001* P2=0.001* P3=0.195
Average	11	11.5	92	95.8	93	96.9		
Good	0	0	4	4.2	1	1		

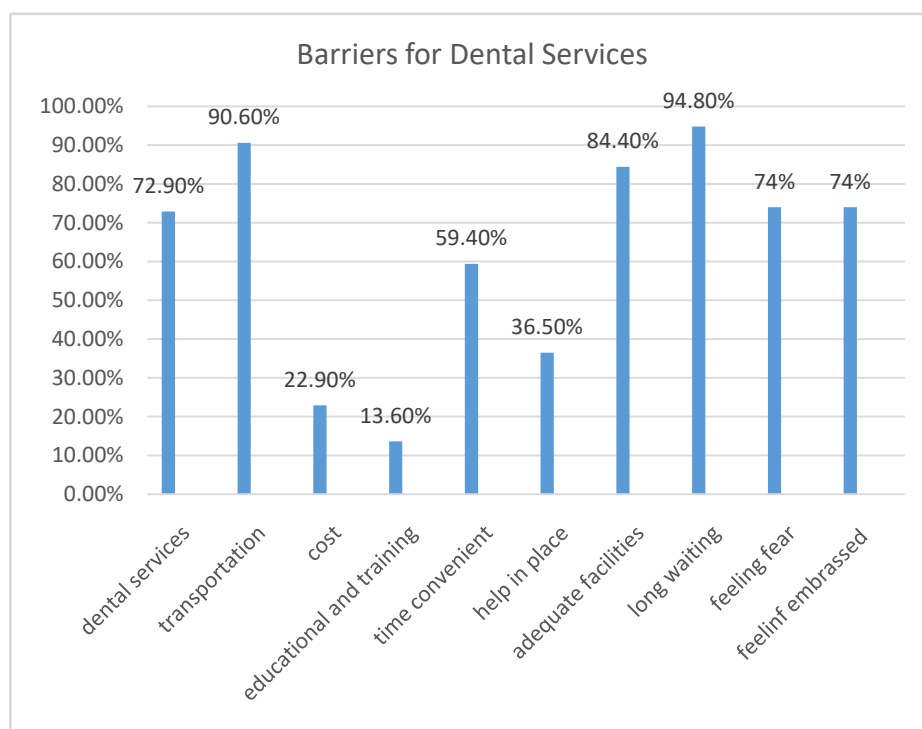
Fr: Friedman test

*statistically significant

p1: difference between pre and immediate post

p2: difference between pre and post 3 months

p3: difference between immediate post and post 3 months.

**Figure 2. Percentage Distribution of the Barriers of Accessing Dental Service for the Children with Visual Impairment (No=96)****Table 6. Percentage Distribution of the Studied Visually Impaired Children's Skills of Tooth Brushing (No=96)**

	Pre		Immediate post		Post 3 months		MC Nemar test	P value
	No	%	No	%	No	%		
Skilled	0	0	89	92.7	83	86.5	Mc1 =16.35 Mc2=2.0 Mc3=2.0	P1=0.001* P2=0.001* P3=0.156
Unskilled	96	100	7	7.3	13	13.5		

The McNemar test of significant,

*statistically significant

p1: difference between pre versus immediate post

p2: difference between pre versus post 3 months

p3: difference between immediate post versus post 3 months.

Table 7. Percentage Distribution to Oral Assessment Guide of the Studied Visually Impaired Children Pre and Post ATP Technique (No=96)

	Pre		Post 3 months		Mc Nemar test	P value
	No	%	No	%		
Without problems	18	18.8	37	38.6	9.19	0.002*
Slight to moderate oral problems	46	47.9	47	48.9	0.021	0.885
Sever oral problems	32	33.3	12	12.5	11.79	0.0006*

The McNemar test of significant

*statistically significant

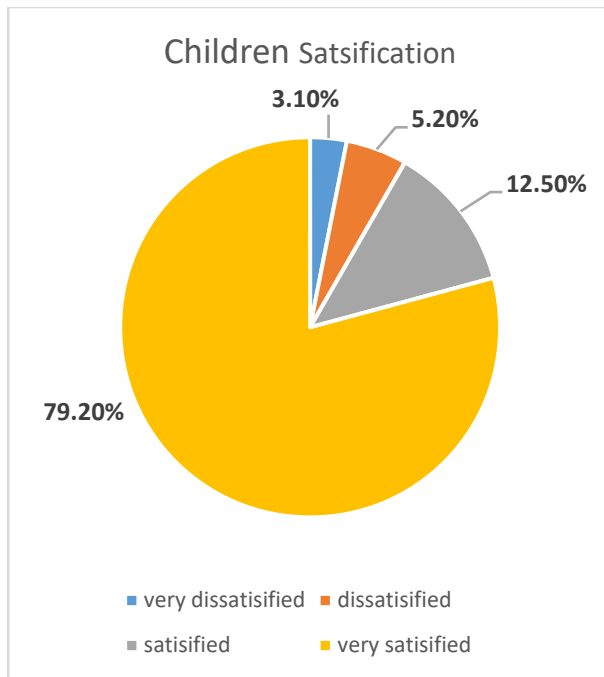


Figure 3. Percentage Distribution to Satisfaction of the Studied Visually Impaired Children to Audio Tactile Performance (ATP) Technique (No=96)

4. Discussion

Children with visual impairments often have difficulties in effectively brushing their teeth, as they struggle with the accurate positioning of the toothbrush and executing appropriate brushing motions that avoid damaging adjacent oral structures due to unreliable visual cues. Consequently, it is essential to provide thorough instruction on the proper maintenance of oral tissues and teeth for these children [22]. Hebbal and Ankola developed a tailored approach for learning oral practices of hygiene for visually impaired children, referred to as "ATP." This method proved to be more effective than traditional teaching techniques [23]. Hence, the purpose of this study was to evaluate the effect of an audio tactile performance technique on the status of oral health for visually impaired children at Al-Noor and Al-Amal School for the Blind, Mansoura City, Dakahlia Governorate, Egypt.

Regarding the age, the findings of the current study show a mean age of the studied visually impaired children of 10.57 ± 3.57 , and more than half of them were in the age group 6 - 11 years and in the primary stage. This finding was in accordance with [24] who conducted a study about "Oral health of visually impaired schoolchildren in Khartoum state, Sudan" stated that the age range of the study participants was 6– 18 years with a mean age of 11.8 ± 3.1 .

The current study findings revealed that more than half of the studied visually impaired children were females. On the contrary, [25] who conducted a study about "Effectiveness of different oral health education interventions in visually impaired school children" that was conducted in India, mentioned that around three quarters of participants were male participants. This finding may be related to the difference in male to female

ratio between Egypt and India. In India the sex ratio was 944 females per 1,000 males in 2016, but in Egypt females represented 48.6%, according to population estimates on 1/1/2024, bringing the gender ratio to 106%.

Results of the current study illustrated that less than three quarters of studied visually impaired children were not accommodated at school. This finding may be related to our studied visually impaired children not liking school protocol, among other things, being bound to an excessive number of regulations, eating awful cafeteria food, and not having much freedom. On the contrary, [26] who conducted a study about "Satisfaction of students with visual impairment within different school settings" that was carried out at James Madison University that located in Virginia's Shenandoah Valley in USA stated that the majority of the studied visually impaired children were accommodated at school.

The present study showed that the majority of parents' of studied visually impaired children did not suffer from blindness. Perhaps this result is associated with hereditary factors didn't play a vital role in visual loss in our students. On the contrary, [27] who conducted a study about "Causes of blindness and visual impairment among students in integrated schools for the blind in Nepal" stated that the majority of children's parents complain about blindness.

In the current study, it's observed that less than one third of children complained of gum pain, and less than one quarter complained of toothache and chewing difficulty. This finding is supported by [28] who conducted a study about "Screening of visually impaired children for health problems" stated that nearly one quarter of the children had gum pain, toothaches, and chewing difficulty.

Regarding knowledge about the oral cavity of the studied visually impaired children, the current study revealed that the majority had a poor level of knowledge in the pretest. While the majority had a good knowledge in the immediate post and the post 3 months' test with a highly statistically significant difference. This finding may be due to a lack of focus on educational, preventive programs, and a shortage of available appropriate educational methods might help to keep those with disabilities adequately informed. This finding was in conflict with the study of [29] who conducted a study about "Knowledge of dental health and oral hygiene practices of Taiwanese visually impaired and sighted students" who stated that most children who were visually impaired possessed a higher level of expertise and were more knowledgeable about the function and anatomy of the mouth.

Regarding knowledge about oral hygiene of the studied visually impaired children, the present study showed that nearly one quarter had a good level of knowledge in the pretest that increased to the majority having a good knowledge about oral hygiene in the immediate and the posttest with a highly statistically significant difference. It is possible that dental practitioners are failing to make use of adaptive technologies and provide education in alternative formats suitable for visually impaired populations. Once these formats are used, there is an improvement in the level of knowledge. The results were consistent with those of the study by [13] who conducted

a study about "Effectiveness of a novel oral health education technique in maintenance of gingival health and plaque removal efficacy among institutionalized visually impaired children of Bhubaneswar city: A randomized controlled trial" stated that pre-intervention and post-intervention knowledge scores of the subjects were statistically significantly different.

Regarding knowledge about dental hygiene behaviors of studied visually impaired children, the present study showed that the majority showed a poor knowledge of in the pretest. While the majority showed a good knowledge in the immediate post and post 3 months' test with a highly statistically significant difference. This finding may be the least importance was given to dental hygiene behaviors, as a result of not learning how to take care of one's teeth on one's own, and not having an adult supervise brushing, that decreased post educational program. This finding agrees with [30] who conducted a study about "New vision for improving oral hygiene status of visually impaired students aged from 9 to 17 years" stated that students in the present study lacked knowledge in regard to basic dental hygiene behaviors and with appropriate oral health education and the using of behavior management approaches has led to a considerable improvement in the dental hygiene habits of visually impaired pupils and a marked decrease in their anxiety levels regarding these activities.

The current study revealed that the majority of studied visually impaired children showed a poor knowledge of oral cavity, oral hygiene and dental hygiene behaviors in the pretest. While the majority of them showed an average knowledge in immediate post and post 3 months' test with a highly statistically significant difference. Based on the researcher's perspective, this discovery could be a result of the difficulties visually impaired youngsters encounter when it comes to maintaining good dental hygiene practices that improved in the immediate and the post program. This finding agrees with [31] who conducted a study about "Assessment of oral health educational program on oral health status of visually impaired children in New Delhi" stated that using the instructional program, students who are completely blind or have low vision were able to enhance their oral health knowledge and hygiene practices by the end of the study compared to the beginning.

The current study revealed that the majority of studied visually impaired children reported that long waiting times for dental services are the main barrier to asking for dental services. This finding may be because of our study participants may experience heightened sensitivity to noise and other environmental stimuli, making dental visits a terrifying prospect for them. These findings were disagreeing with [32] who conducted a study about "The barrier to accessing dental healthcare services among the institutionalized visually impaired adults: A qualitative study" stated that Major obstacles to dental service utilization within this demographic include the most commonly cited ones (fear, expense, and lack of perceived need) as well as worry and anxiety.

Regarding tooth brushing skills by using ATP technique, it is clarified that all studied visually impaired children are unskilled in the pretest. It's also observed that

the majority of them are skilled in immediate post and post 3 months' test with a highly statistically significant difference. Based on the researcher's perspective, this finding may be due to a lack of adequate instructions towards proper care of the teeth and oral tissues before and its improvement after the program and the fact that this technique stimulates the cognitive centers, enabling a better recall memory of oral health education given. This disagrees with [10] who conducted a study about "Comparison of two brushing methods- Fone's vs modified bass method in visually impaired children using the audio tactile performance (ATP) technique" stated that three quadrants of participations could brush their teeth correctly before, and after the educational course, the majority of participants could.

The current study revealed that more than one third of the studied visually impaired children complain of severe oral problems before the program which are decreasing to minor of them with a highly statistically significant difference after 3 months of the program implementation. Based on the researcher's perspective, these findings suggested that the inability of visually impaired children have to overcome obstacles to good dental hygiene because regular at-home cleanings don't get all the plaque. Things got better after the intervention. This finding agrees with [7] who conducted a study about "Effectiveness of "audio-tactile performance technique" to improve the oral hygiene status of visually impaired schoolchildren" stated that most visually impaired children's dental health improved after using the "Audio-tactile Performance technique (ATP)" to teach them how to maintain proper oral hygiene.

The result revealed that more than three quadrants of the studied visually impaired children were very satisfied in the post 3 months' test regarding ATP technique. This may be due to blind or low vision children relying on their other senses, including hearing, smell, taste, touch, kinesthetic, and visual, to navigate their near environments, so the combination of all helps and makes children more satisfied with educational methods. This finding agrees with [23] who conducted a study about "Efficacy of a modified audio-tactile performance technique with braille (ATPb) on the oral hygiene status of visually-impaired children" stated that when asked about their overall experience with this assistive technology, visually impaired children expressed a high degree of satisfaction.

5. Conclusion

Based on the findings of the current study, it is concluded that

There was an improvement in the studied visually impaired children' knowledge and skills about oral hygiene after the application of the learning sessions. Additionally, children who received nursing interventions by audio tactile performance (ATP) technique had fewer complications in oral problems after applying ATP technique which proves of the research hypotheses. As well as, the majority of studied children expressed satisfaction with ATP technique applying.

6. Recommendations

In light of the findings of the current study, the following recommendations are suggested:

- Ongoing and relevant training programs to enhance the oral hygiene knowledge and habits of visually impaired youngsters.
- Support a culture of using the educational materials appropriate for visually impaired children, like Brille educational booklet.
- Engage the ATP technique programs as a health educational method for children with vision impairment.

Further studies are needed

- Conducting the same study in other Egyptian schools for visually impaired students so that we can generalize and compare our results internationally.

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Declaration of Conflicting Interests

The author affirms that they have no competing interests with respect to other research.

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