

**ORAL HYGIENE STATUS EVALUATION IN VISUALLY AND AURALLY  
IMPAIRED CHILDREN, COMPARING DIFFERENT MODES OF  
COMMUNICATION- ATP TECHNIQUE VS AUDIO AIDS & SIGN  
LANGUAGE VS VIDEO AIDS**

**Dissertation**

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*In the partial fulfilment of the requirements for the degree*

**Of**

**MASTER OF DENTAL SURGERY**

**In**

**PEDODONTICS AND PREVENTIVE DENTISTRY**

**By**

**Dr. Monisha Divya Moses**

*Under the guidance of*

**Dr. Subash Singh**

**Reader**

**Department of Pedodontics and Preventive Dentistry**

**BABU BANARASI DAS COLLEGE OF DENTAL SCIENCES,**

**LUCKNOW**

**(Faculty of Babu Banarasi Das University)**

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I hereby declare that this dissertation entitled “**ORAL HYGIENE STATUS EVALUATION IN VISUALLY AND AURALLY IMPAIRED CHILDREN, COMPARING DIFFERENT MODES OF COMMUNICATION- ATP TECHNIQUE VS AUDIO AIDS & SIGN LANGUAGE VS VIDEO AIDS**” is a bonafide and genuine research work carried out by me under the guidance of **Dr. Subash Singh**, Reader, Department of Pedodontics and Preventive Dentistry, Babu Banarasi Das College of Dental Sciences, Babu Banarasi Das University, Lucknow, Uttar Pradesh.

Date:

Place:

**Dr. Monisha Divya Moses**

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**Dr. Subash Singh**  
Reader  
Pedodontics and Preventive Dentistry  
Babu Banarasi Das College of Dental Sciences,  
Babu Banarasi Das University,  
Lucknow (U.P.)

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**Dr. Somya Govil**  
Reader  
Pedodontics and Preventive Dentistry  
Babu Banarasi Das College of Dental Sciences,  
Babu Banarasi Das University,  
Lucknow (U.P.)

**ENDORSEMENT BY THE HOD / HEAD OF THE  
INSTITUTION**

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**Prof. (Dr.) Neerja Singh**  
Professor & Head  
Pedodontics and Preventive Dentistry  
Babu Banarasi Das College of Dental Science, Babu  
Babu Banarasi Das University,  
Lucknow (U.P.)

**Prof. (Dr.) B. Rajkumar**  
Dean, Professor & Head  
Endodontics and Conservative Dentistry  
Banarasi Das College of Dental Sciences,  
Babu Banarasi Das University  
Lucknow (U.P.)

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## ***INTRODUCTION***

### ***“Mouth is the mirror of the body”.***

Health is ‘a state of complete physical, mental, and social well-being, rather than solely by absence of disease or infirmity.’ Oral health and quality oral health care contribute to holistic health.

A healthy mouth is the reflection of a healthy individual. Oral health has a strong biological, psychological and social projection as it affects functions like mastication, aesthetics, phonetics and self esteem of an individual. It is a major determinant and an important aspect of overall health for all children, and is particularly more important for children with special health care needs.<sup>1</sup> Oral diseases represents a major health problem among individuals with disabilities.<sup>2</sup>

Attitudes to oral health, oral hygiene and dental attendance and the relative value placed upon these factors must be viewed in the context of illness, disability, socioeconomic status and stresses imposed upon daily living for the individual, family and care takers. A poor oral health may add an additional burden in terms of overall general health, dignity and self-esteem, social integration and quality of life.

***“The best and most beautiful things in the world cannot be seen or even touched – they must be felt with the heart.” –Helen Keller.***

The eye and ear are both marvelously complex and sensitive organs of the human body. Visual and hearing impairment are few of the major disabilities affecting many children world-wide. They put the child at risk for reduced cognitive skills along with communication deficits, making it a challenge to perform every day basic activities. These in turn contribute to a poor systemic and oral health of the child.

Blindness has been defined by the WHO as having a “visual acuity of less than 3/60m or corresponding visual field loss in the better eye with the best possible correction”, meaning that whilst a blind person could see 3 meters, a non-visually impaired person could see 60 meters. The first estimated of the global data on blindness was published in 1995 which was based on the world population data for 1990. The prevalence of blind children globally is 1.4 million, three-quarters of whom live in the poorest regions of Africa and

Asia. Total visual impairment affects more than 15 million people. The overall incidence of blindness in children is about 1 in 3000, 46% of these children were born blind, and an additional 38% lost their sight before the age of 1 year. The WHO in 2009 estimated that globally 314 million people were visually impaired and 45 million of them were blind. India is home to 407 million children under the age of 16 (approximately 40% of total population) out of which 32,000 are expected to be blind.<sup>3</sup> This alone accounts for 1/5<sup>th</sup> of blind children worldwide.<sup>4</sup>

Deafness is known to exist since the beginning of recorded history. A “deaf” child is one who does not have sufficient residual hearing to enable them to understand speech successfully even with a hearing aid, without special instruction. 6.3% or approximately 63 million people are suffering from significant auditory loss, 2% of which are children.<sup>5,6</sup> According to 2005 estimates of WHO, 278 million people have disabling hearing impairment worldwide. In India, 63 million people suffer from significant auditory loss. According to the National Sample Survey Organization in India 0.4% of 1065.40 million children are hearing impaired and every child in 1000 live births suffers from hearing impairment. Nationwide disability surveys have estimated hearing loss to be the second most common cause of disability. Hearing impairment puts the child at a risk of speech and language deficits.

Children with special health care needs have an increased risk for caries and periodontal diseases as well as a higher propensity for poorer oral hygiene than children with no impairment.<sup>7</sup> Sight and sound are two of the most important senses for understanding and appreciating the world around us. When these are impaired in childhood, they limit the individual’s capacity to interact with the environment. They can have detrimental effects on the physical, neurological, cognitive, emotional as well as dental development.

Dental care is the most common unmet need of children with special health care needs. India being a developing nation has its drawbacks especially when it comes to children with visual and hearing impairment as they do not get the care and treatment they should. This may be due to lack of awareness, lack of resources, or due to a low socio-economic status and non-affordability.



Many dentists do not understand these disabilities and the unique problems that such children exhibit. As the dentist begins to understand the complexity of each form of disability and their characteristics, they will be able to plan and treat more effectively and efficiently.

For years, various methods of communication have been used for each group respectively for their ease and comfort. Over the years these modes of communication has been modified and evolved. The best mode of communication is still a topic of debate and discussion.

This study will be conducted to assess the oral health status of visually and aurally impaired children and to evaluate effective modes of communication to educate them for maintenance of oral health. By evaluating two different modes of communication in each group respectively, we will find a better and easy-to-grasp mode of communication for these children. This in turn will make it convenient to educate them on how to maintain a good oral hygiene and also follow up on how well they can retain the methods taught to them.

If good oral health is to become a reality in the future for people with special needs, it is essential that people in daily contact with such individuals become involved in oral care.

As pediatric dentists' it is our job to reach out to and educate the underprivileged children who suffer from visual and hearing impairment. Given our skills, capabilities and resources, reaching out, even on a small scale, will go a long way in making our societies and communities a better place for these children.

*“The purpose of life is not to be happy. It is to be useful, to be honorable, to be compassionate, and to have made some difference that you lived and lived well.”*

**–Ralph Waldo Emerson.**

## ***ABSTRACT***

**Background:** Children with special health care needs have an increased risk for caries and periodontal diseases as well as a higher propensity for poorer oral hygiene than children with no impairments. This study was conducted to assess the oral health status of visually and aurally impaired children and to evaluate effective modes of communication to educate them for maintenance of oral health.

**Aim:** The aim of this study is to assess the oral health status in visually and aurally impaired children and compare the same after using specific modes of communication i.e., ATP (Audio Tactile Performance) technique versus Audio aids and Sign Language versus Video aids.

**Material and Methods:** A total number of 150 subjects belonging to the age group of 6 to 14 years, fulfilling the inclusion and exclusion criteria were randomly selected for the study. A verbal session for the teachers and supervisors was conducted wherein they were educated on the importance and maintenance of oral hygiene. Personal details of children were recorded along with an attempt to establish a good rapport with them. Evaluation was done by a single examiner for plaque and gingival status. The individual study groups were further educated using specific modes of communication for each group. All subjects were provided with a standardized soft bristled toothbrush prior to the study. The caregivers were advised to supervise the children during the study duration for positive reinforcement and motivation. Follow up was done at 3, 6, and 9 months. Records of the indices were maintained throughout the study.

**Results:** Among different modes of communication in the two groups of children included in this study, ATP technique proved to be better than audio aids for visually impaired and sign

language was found better than video aids for aurally impaired children as an effective mode of communication.

**Conclusion:** The present study may help in establishing an effective mode for communicating with visually and aurally impaired children, thus making the dentist and patient comfortable as well as instilling a positive attitude to maintain oral hygiene status among special children.

## ***REVIEW OF LITERATURE***

### **GENERAL OVERVIEW AND HISTORICAL REVIEW OF ORAL HEALTH STATUS IN DIFFERENTLY ABLED CHILDREN**

**Gordon J, et al. (2005)** presented a review on special oral hygiene and preventive care for special needs suggesting that many times the needs of special people are overlooked. They enlisted various methods in which dental issues could be dealt with and prevention of a certain disease was made easy. To best care for patients with these needs, the dental practitioner should be able to identify special oral hygiene needs among the patients, provide them with oral hygiene instruction and implement the specific oral hygiene preventive and treatment procedures suggested.<sup>1</sup>

**Ajami BA, et al. (2007)** conducted a study on 1621 children aged 5 to 16 years assessing the dental treatment needs of children with disabilities. An epidemiological survey followed by the implementation and evaluation of long term public dental health care plan for children and adolescents with disabilities is highly recommended. They concluded that overall oral hygiene in children with disability was poor which lead to other systemic and local factors. The major needs were prophylaxis and oral hygiene advice.<sup>2</sup>

**Shapiro M, et al. (2008)** conducted a study to evaluate the effect of a sensory-adapted dental environment (SADE) on anxiety, relaxation and cooperation of 16 children with developmental disabilities (CDDs). The SADE modifications had multiple components:

visual; auditory, somatosensory; and tactile. The findings indicated the potential importance of considering the sensory adapted environment as a preferable dental environment for this population.<sup>3</sup>

**Oredugba F, et al. (2008)** conducted a study on 54 children and young adults between the age of 3 to 26 years to assess the oral health status and treatment needs, at a day centre for individuals with special needs. An oral health screening program was organized. The study showed high prevalence of dental caries and need for restorative care. Parents needed to be educated on diet modification; improvement of oral hygiene practices and regular dental visits.<sup>4</sup>

**Ceyhan A, et al. (2010)** conducted a study on 136 individuals disabled individuals attending special schools, between the age of 2 to 26 years old to evaluate the oral health status of. They concluded that dmft and DMFT levels did not vary significantly but oral cleanliness did. It is important for the dentist to concentrate on a preventive approach and provide proper dental education to the parents of the disabled individuals. Special attention should be paid to the oral hygiene of the mentally retarded individuals.<sup>5</sup>

**Linda P, et al. (2011)** conducted a study on the unmet dental needs and the barriers to care for the children with significant special health care needs. A 72- item survey was sent across to 3760 families in Massachusetts. The study showed that a high number of children had unmet dental needs who were more at risk for system barriers and internal family barriers to care based on their medical diagnosis.<sup>6</sup>

**Waldman HB, et al. (2011)** conducted a study on dentistry for Mexicans with special needs. The survey found that more than 2 million residents had some disability. There were reports of the general population showing limited use of dental services and the increased need for restorative services was seen. The data showed that there was discrimination

between children and adults in terms with range of disabilities. More facilitates were required creating conscious and positive attitudes among the people. Instituting oral health programs was required.<sup>7</sup>

**Ameer N, et al. (2012)** conducted a study on 750 teenagers between 14 to 17 year old who were visually impaired, deaf and dumb, intellectually disabled and physically challenged; and normal teenagers in the district of Nalgonda, to assess oral hygiene status, oral hygiene practices and periodontal status among. They concluded that the intellectually disabled individuals showed the poorest oral hygiene. More attention was needed to be given to the dental needs of these individuals.<sup>8</sup>

**AAPD (2012)** published a revised update on the guidelines on management of dental patients with special health care needs based on the current dental and medical literature available then. They stated that individuals with SHCN may be at an increased risk of oral diseases throughout their lifetime. These diseases can have a direct and devastating impact on the quality of life of these individuals. SHCN also included disorders or conditions which manifest only in the orofacial complex. They recommended scheduling appointments, forming dental home, assessment of the patient, and communication with the patient, medical consultations, planning of the dental treatment, an informed consent, behavior guidance, preventive strategies and mentioned the barriers that the dentist must be familiarized with. They also outlined the developmental or acquired orofacial conditions and emphasized on referrals as and when required for SHCN individuals.<sup>9</sup>

**Seby J, et al. (2013)** carried out a survey on 402 disabled children between the age of 6 to 12 years to assess the oral health of children in special schools in Chennai, India. They found that majority of the children brushed only once a day and some needed assistance from the caregiver and found a significant difference between the mean of dmft/DMFT of

resident and nonresident children. The oral health of the resident children was comparatively better as they had caregivers to assist and had regular dental check up as well.<sup>10</sup>

**Ventataraam S, et al. (2013)** conducted a study on dental health status among 310 sensory impaired and blind institutionalized children aged 6-20 years. They concluded that blind children experienced more caries than hearing impaired children in permanent dentition, whereas it was opposite in primary dentition. The scores of caries increased with increasing age. They further concluded that the role of dentists was important in improving the dental health of disabled children by early diagnosis and prompt treatment.<sup>11</sup>

**Enrique B, et al. (2014)** conducted study on 120 deaf and blind children out of which 35 were visually impaired and 85 were auditory impaired to describe the demographics and oral characteristics of deaf and blind children and adolescents who received dental treatment at a specialized institute for the deaf and blind. They concluded that under oral health supervision, children and adolescents with or without hearing or visual impairment develop similar dental caries prevalence. Oral hygiene can pose as a higher challenge to those with visually impairment than to hearing impairment.<sup>12</sup>

**Elena G, et al. (2014)** conducted a survey on 154 caregivers of special health care needs children between the ages of 2 to 16 years, on the relationship between patients' level of functioning, their oral health and the caregivers' oral health related responses. This survey assessed parents' and patients' background information as well as the types of conditions of the patients. They found that the patients' level of functioning ranged from the lowest to the highest regarding their ability to listen/understand, talk, relate to others, care for themselves, play with others, and participate in physical activities. They concluded that understanding a patient's level of functioning might predict the degree to which parents

actually engage in oral health promotions efforts and are interested in oral health-related education.<sup>13</sup>

### **VISUALLY IMPAIRED**

**Nandini S *et al.* (2003)** conducted a study on 150 blind school children with the main goal to create adaptations and routines that allow them to be totally independent in oral hygiene care. They concluded that 37.3% of the children examined were affected by dental caries and 71% by gingivitis. Although 85% of them used toothbrush, 15% were found to be using their finger. Tactile sensation was a good method of teaching the children using models. Understanding the abilities and limitations of those suffering from these disabilities will help the dentist to facilitate the provision of quality dental care.<sup>14</sup>

**Serge R, *et al.* (2004)** performed a study to estimate the prevalence of visual impairment and its causes. They estimated prevalence for three age groups: children less than 15 years; adults from 15 to 49 years; and adults aged 50 years and older. The number of people with visual impairment worldwide was in excess of 161 million, of which 37 million were blind and 124 million had low vision. 1.4 million Children of the total who were estimated to be blind were below the age of 15 years.<sup>15</sup>

**Mahoney EK, *et al.* (2008)** presented a review examining literature related to dental aspects of visual impairment, its implications for obtaining dental care and various associated oral conditions and medical complications in the people residing in United



Kingdom. They concluded that the prevalence of visual impairment was increasing globally due to local and systemic diseases, medical advances, and increasing age of population groups. They also concluded that the available data concerning visual impairment and dental care were out of date and provided a conflicting advice.<sup>16</sup>

**Mohammad S, et al. (2009)** conducted a study on oral health knowledge, practice, oral hygiene status and dental caries prevalence among 80 visually impaired students were involved between the ages of 10 to 35 years in a residential institute of Aligarh. They concluded that no difference was seen in the method of prevention of oral diseases and treatment modalities between non-disabled and disabled individuals. As the visually impaired cannot visualize dental plaque, education and motivation to maintain the oral hygiene was necessary.<sup>17</sup>

**Prashant ST, et al. (2011)** conducted a study on 85 visually impaired children between the ages of 8-13 years in the city of Bangalore to assess their oral hygiene status and prevalence of dental caries. They concluded that if dental awareness and diet counseling is given at an early age, probability of dental complications reduces. An effective dental method of education for visually impaired children is required for which more studies have to be done.<sup>18</sup>

**Apiwan S, et al. (2011)** conducted a 6 month study on 60 visually impaired students between the ages of 10-12 years comparing toothbrush efficacy between the horizontal scrub and modified Bass methods. The subjects received verbal and tactile tooth brushing instructions and used their methods twice a day. At the end of 6 months they found a significant reduction in the oral hygiene scores. They also found that there was not much difference between both the methods of brushing techniques used. The length of teaching time in modified Bass group was longer than in the horizontal scrub group.<sup>19</sup>

**Bhandary S, et al. (2012)** conducted a study to assess the awareness of care providers of visually impaired children regarding oral hygiene on 221 subjects. The results that were obtained showed that most of the caregivers were unaware of the difficulties faced by these children. Families of such children were found to be emotionally, physically and financially disturbed to attend to the needs of these children. The caregivers were not aware of changing the children's toothbrush periodically. The results of this study showed an attitude of ignorance and apathy from the caregivers towards these children as well as lack of awareness.<sup>20</sup>

**Jitendra Solanki, et al. (2013)** conducted a study on 704 children between the ages 6-15 years to evaluate prevalence of dental caries and oral hygiene status in blind children. They concluded that visually impaired children had a poor oral hygiene and their oral health was affected by limited understanding of the importance of maintaining oral health. They had difficulty in communicating and had a fear of oral health procedures. Awareness plays an important role in maintenance of oral hygiene and an efficacious dental health method for communication with visually impaired children needs to be inculcated.<sup>21</sup>

**Thanveer K, et al. (2013)** conducted a study on 108 visually impaired school children of Vadodara district to assess their dentition status and treatment needs. After statistical analysis, although, prevalence of caries was high in visually impaired children, it was higher in children with permanent teeth. A poor oral hygiene was seen due to various factors like lack of personal attention of the care takers at school, ignorance of guardians and parents, difficulty to visualize teeth during brushing and also due to lack of facilities for check up and treatment.<sup>22</sup>

**Mohit Bansal. (2014)** conducted a study on 50 caries free blind children between the ages of 8 to 23 years in the city of Chandigarh to investigate the effect of auditory aid in

improving oral hygiene among visually impaired children before and after imparting oral hygiene instructions. They found that the plaque and gingival scores to have reduced since the baseline. Children were seen with a better oral hygiene after education. The concluded that being visually impaired represents a great challenge for these children as it prevents visualizing and rapid learning, dentists have an important role to play when it comes to maintaining and motivating such individuals. However, proper training to these children can help them maintain a healthy oral hygiene.<sup>23</sup>

**Chrishantha J, *et al.* (2015)** conducted a study on 80 visually impaired children between the ages 4 to 15 years to compare two brushing methods- Fone's versus modified Bass method in visually impaired children using audio tactile performance technique (ATP). The found that a statistically significant reduction in plaque in both the groups. There was an increased in the frequency of tooth brushing following training and positive reinforcement.<sup>24</sup>

**Ismail AD, *et al.* (2015)** conducted a study on 92 subjects out of which 33 were with low vision and 59 were totally blind, to evaluate the knowledge and oral health related behavior among visually impaired subjects in Jazan Region, Kingdom of Saudi Arabia. They concluded that blind individuals had a lower knowledge of oral and systemic diseases. Their frequency of brushing was less. They have wide spread gingivitis and limited access to health care provider to maintain their periodontal health. They found that the awareness of blind individuals in that specific region was high but they were present with misconception as well.<sup>25</sup>

**Priyadarshini P, *et al.* (2015)** conducted a study in the city of Bangalore on 43 individuals with the mean age of 15.3 years, to assess the oral health practices, status and caries experience among the visually impaired. Their study revealed that majority of the children

lacked in oral health practices. Proper planning and educating the patients is necessary to achieve positive outcomes. Every child in their study showed at least one tooth that was affected by caries. Special attention and services must be provided to individuals who cannot access the dental facilities.<sup>26</sup>

### **HEARING IMPAIRED**

**Garg S *et al.* (2009)** presented a study highlighting the major components of a program launched by the government of India called the National Programme for Prevention and Control of Deafness, with a focus on manpower development and ear service provision including rehabilitation. They used data recorded by the National Sample Survey (NSS), 2002 which mentioned hearing impairment as the second most common disability after locomotor disability. The NSS enquired about the probable causes of hearing impairment in India. Old age was seen as a common cause in about 25% and #0% for rural and urban areas respectively. Other causes were ear wax which is reversible, middle ear infections such as suppurative otitis media and serous otitis media leading to loss of hearing.<sup>28</sup>

**Rajat KS, *et al.* (2012)** published a review on dental care for the deaf pediatric patient. They stated that knowledge of the etiology and consequences of deafness is invaluable to the dentist administering dental care to the deaf child. The dentist must be aware of the psychological aspects of the child and the child dependence on the parent. Once the dentist can understand this is will be easier for them to bridge the gap of communication and gain the patient's confidence, which in turn is a rewarding experience.<sup>27</sup>

**Malee A, *et al.* (2012)** conducted a study on 66 hearing impaired children between 6 to 10 years of age the effectiveness of oral hygiene instruction media on periodontal health

among hearing impaired children. They concluded that all the modes of education had significant reduction in the overall periodontal health. They also stated that more studies should be conducted for an accurate evaluation and outcome.<sup>29</sup>

**Sandeep V, et al. (2014)** conducted a study on 372 institutionalized children with hearing impairment aged 6-16 years assessing the impact of visual instruction on their oral hygiene status. They concluded that visual instruction was found to be an effective tool in oral health education for CHI and while oral health education is essential, but it alone cannot solve the problems among special health needs children. They also observed that gender and age variations existed in oral hygiene performance. Motivational process should be extended to their parents, caregivers and instructors using different modes of motivation.<sup>30</sup>

**Samnieng P, et al. (2014)** conducted a questionnaire based study on 204 hearing impaired individuals to determine whether there are indications that hearing impaired patients experience difficulties in accessing dental care and/or in receiving dental treatment. It was observed that 87% of the patients had visited a dentist, 77% were reported to have at least one problem in communication while receiving dental care. They concluded that majority of the patients failed to obtain the needed care because of communication difficulties experienced in the treatment situation.<sup>31</sup>

**Liliya D, et al. (2015)** conducted a motivational training program for oral hygiene of 100 children deaf children between 5 to 12 years in Sofia, Bulgaria. They concluded that it took longer time to train these children due to communication and language deficits and the specific training program used in this study helped and provided an opportunity to improve the oral environment and reduced the risk of caries. Visual instructions were easier to learn and remember. Education is the key to prevention of oral diseases.<sup>32</sup>

**Masali KM, et al. (2016)** conducted a cross sectional study on the situation of hearing loss among those people who were below poverty line in Southern India. 128 BPL patients were included in this study. A clinical ENT examination by pure-tone audiometer was done. In their study, the overall preponderance in males was more than for females. They stated that for deaf patients, early diagnosis and treatment was most important. Early management of ear diseases can reduce the deafness. Health education, improvement of socio-economic status and health facilities will be helpful in reducing the prevalence of deafness.<sup>36</sup>

**Guleria T, et al. (2017)** conducted a community based cross sectional observational study on 306 individuals in urban area of Shimla. Information was obtained by a structured questionnaire, clinical ENT examination and audiological tests after obtaining an informed consent. Prevalence of hearing loss was found to be 13.1% and predominantly mild sensorineural or conductive type of hearing loss. An early intervention and quality patient education was necessary for prevention of hearing impairment in majority of cases<sup>37</sup>.

### **TOOTH BRUSHING TECHNIQUES**

**Sten O et al. (1982)** conducted a study on the tooth brushing behavior in children at different ages on 47 children, 22 of them were 7 year olds and 25 were 11 year olds. They concluded that majority of the children of both the age groups used the horizontal scrub technique. The hand motions of the younger children varied from long to short strokes, whereas majority of the older children applied the short stroke technique. The findings suggested age related factor between the development of motor skills and the ability to brush. It is important to give the correct oral instructions adjusted to the child's development stage and motor skill. The same basic knowledge when given to a person with impairment becomes imperative.

**Soraya C, et al. (2002)** conducted a study on the effectiveness of teaching methods for tooth brushing in preschool children. The study was carried out on a total of 40 children and was divided into two groups according to age (Group 1: 3 to 4 years; Group 2: 5 to 6 years). They found that the overall plaque index decreased in both groups after the application of the 2 methods of instruction. But the individual method showed the greatest difference followed by audiovisual and then the child as a model.<sup>38</sup>

**Das UM, et al. (2009)** conducted a study on tooth brushing skills, 45 children aged 3 to 11 years were included to evaluate tooth brushing management and ability of children in relation to age and gender. The manual dexterity of children was evaluated according to Beals *et al*; they found that most of the children brushed their teeth with more than one type of grip. The most preferred grip type was distal oblique followed by power and oblique. Younger children brushed for shorter time compared to older children in the study. They concluded that younger children need tooth brushing instruction according to their manual skills as they required manual dexterity as well, and that intense individual training is essential.

**Srivastava N et al. (2013)** conducted a study to assess the effectiveness of three different methods of teaching tooth brushing in 60 children aged 7 to 9 years. They concluded that there is a significant relationship that exists between the methods of oral hygiene instructions and the reinforcement and the plaque index. They found that teaching using a cast model was better and the children retained it for a longer time. Reinforcement of the brushing instructions on repeated intervals was important in establishing the desired behavior in the children.<sup>39</sup>

**Nikhil S, et al. (2013)** conducted a comparative study on 60 children between the ages of 7 to 9 years to evaluate the efficacy of different modes of teaching tooth brushing in

children. They found that the individual cast instruction group was the most effective method followed by audio visual group and child as a model group for teaching brushing methods. The individual cast method was useful as it helped achieving the desired positive effect positive effect on learning of a child and the inculcation of the desired habit.

**Patil S, *et al.* (2014)** conducted a study on 180 healthy children to evaluate the effectiveness of the horizontal scrub, Fones, and modified Bass methods demonstrated on cast to individual children. The groups were divided into three groups and each group was taught a different method of brushing technique. They concluded by showing that modified Bass technique was the most effective brushing technique followed by horizontal scrub technique. They also mentioned that Fones method was the most easily learnt and retained technique by the school aged children.<sup>40</sup>

### **TACTILE SENSES AND ATP TECHNIQUE**

**Hebble M. *et al.* (2012)** conducted a non-randomized study including 96 visually impaired children between the age of 6 to 18 years to develop a special oral health education technique and compared plaque scores before and after health education. Audio tactile performance technique (ATP technique) a specially designed health education, method was used to educate these children regarding oral hygiene maintenance. It was concluded from the study that visually impaired children could maintain an acceptable level of oral hygiene when taught using special customized methods.<sup>41</sup>

**Joybell C, *et al.* (2015)** conducted a study on 80 visually impaired children aged between 4 to 15 years to evaluate the effectiveness of two brushing techniques - Fone's method Vs Modified Bass method in visually impaired children using the Audio Tactile Performance



(ATP) technique. They concluded that while both the brushing methods were equally effective, the group which was educated using ATP technique showed significant improvement in the oral hygiene of the visually impaired children when taught using an effective communication tool.

**Ganapathi AK, et al. (2015)** conducted a study 200 blind children between the ages 8 to 14 years from two blind schools with similar teaching, to evaluate the effectiveness of various sensory input methods in dental health education among blind children. They divided the children into 5 group of 40 children each based on the mode of communication. Group I- audio group, group II – Braille group, group III – tooth models, group IV – multisensory group, which included all the above three groups and group V was the control group. It was concluded that blind children depended more on other senses like feeling and hearing. And therefore, a modified approach of teaching and educating them on oral health is required through various sensory inputs.<sup>42</sup>

**Bhramanna CP, et al. (2016)** conducted a study to assess the impact of verbal, Braille text, and tactile oral hygiene awareness on the oral health status of 120 visually impaired children between 6-16 years of age. They concluded that a combination of the 3 methods of oral health education were effective in instilling a positive and good attitude in the children. They emphasized that tooth brushing technique is an important factor for effectively maintaining oral hygiene and they used the horizontal scrub method of brushing as it is a technically sound method which can be easily practiced.

**Krishnakumar R, et al. (2016)** conducted a comparative study on 48 visually impaired children to evaluate audio and audio-tactile method of communication to improve oral hygiene status of visually impaired school children. A specially designed technique, ‘ATP technique’ was used to educate the children regarding oral hygiene maintenance. This

technique showed positive results from a poor to fair result in the oral hygiene scores of the children. Patient motivation is very necessary to bring about results in any individual with visual impairment.<sup>44</sup>

### **SIGN LANGUAGE AND VIDEO AIDS**

**Campbell R, et al. (2007)** conducted a study on sign language and the processing done by the brain. They studied various aspects of the functioning and processing of brain and compared the deaf and hearing brain. Much research is needed in this aspect. They found only two studies suggesting that the brain of deaf and hearing people are the same in terms of functioning. They compared basic sign language and audiovisual (natural) English speech and found that the perception of both recruited similar neural system responses.<sup>45</sup>

**Dasgupta T, et al. (2008)** conducted a on the Indian Sign Language revealing that the ISL is a complete natural language having its own morphology, phonology, syntax and grammar. The ISL phonology is a visual-spatial language which provides linguistic information using hands, arms, face, and head/body postures. They said an approach towards building a multimedia SL dictionary that can take any Indian language text and store signs in any SL. At present the system can take Hindi, English and Bengali languages and can only store ISL.

**Shah N, et al, (2016)** conducted a study on the effectiveness of an educational video in improving oral health knowledge at AIIMS, New Delhi on 126 subjects visiting the dental facility. An oral health education film was screened which was found to be effective in increasing oral health related knowledge of the subjects; and it was a positive tool for imparting oral health education and awareness. The concluded that a videotape can be a

useful adjunct and can enhance, dramatize and bring a sense of realism leading to a great impact on the population especially in India.<sup>48</sup>

### ***AIMS AND OBJECTIVES***

- **AIM:**

The aim of this study is to assess the oral health status in visually and aurally impaired children and compare the same after using specific modes of communication i.e., ATP (Audio Tactile Performance) technique versus Audio aids and Sign Language versus Video aids.

- **OBJECTIVES:**

1. To assess and compare oral health status of visually and aurally impaired children with healthy children.
2. To compare and evaluate the efficacy of ATP (Audio Tactile Performance) and Audio aids as a mode of communication for visually impaired children.
3. To compare and evaluate the efficacy of Sign Language and Visual aids for aurally impaired children.

The present study was conducted in collaboration with approval of various schools including those for visually impaired, aurally impaired and regular schools from the district of Bahraich, Uttar Pradesh, after obtaining clearance from the Institutional Ethical Committee of BBDCODS, Lucknow (**Annexure- I & 11**). The study was done with an aim to assess the oral health status in visually and aurally impaired children and to compare the same after using different modes of communication i.e., ATP (Audio Tactile Performance) technique versus Audio aids and Sign Language versus Visual aids in children of age 6 to 14 years.

## ***MATERIALS AND METHODS***

### **MATERIALS AND EQUIPMENTS USED:**

#### **For examination of the patient-**

- Mouth mask and diagnostic gloves (Medishield Health Care)
- Stainless steel kidney tray, single sided mouth mirror, probe and tweezers (GDC)
- Toothbrushes (for subjects- AquaWhite)

#### **For recording data-**

- Case record sheet
- Pen, pencil and eraser

**For demonstration and instructions:**

- Complete set of dental model (Colgate)
- Toothbrush (AquaWhite)
- Speakers for audio aids (iBall)
- Laptop for visual aids (Acer)

**Inclusion Criteria-**

- Subjects belonging to age group of 6-14 years
- Children with no impairment
- Visually impaired children
- Auditory impaired children

**-Exclusion Criteria-**

- Patients whose parental consent was not obtained

**Sample size-**

The sample size was calculated using the following formula (Charan and Biswas, 2013):

$$n=2X(Z_{\alpha/2}+Z_{\beta})^2 SD^2/d^2$$

where,

n: Sample size per group

SD: Assumed standard deviation being 0.3

d: Difference in the means (effect size)

$Z_{\alpha/2}$ : Significance level,  $Z_{\beta}$  : Power of the study

Assuming 80% power , 5% significance level with 95% confidence interval, as well as assuming standard 0.3, the required sample size per group is 32 patients in each group.

Considering 20% loss to follow-up, the final sample size would be 38 in each group.

## **METHODOLOGY**

The present study was a comparative study where study subjects aged between 4 to 16 years were randomly selected from different residential institutions for visually impaired and aurally impaired along with various day schools. 150 subjects satisfying the inclusion criteria were part of this study. They were evaluated, divided and subdivided as mentioned below:

1. **Group I** - 50 Control Group
2. **Group II** - 50 Visually Impaired (Completely blind)
3. **Group III** - 50 Aurally Impaired (Completely deaf and dumb)

The groups II & III were further subdivided based on the modes of communication for each group as follows:

- i. **Group II (a)** - ATP Technique
- ii. **Group II (b)** - Audio Aids
- iii. **Group III (a)** - Sign Language
- iv. **Group III (b)** - Video Aids

The schools in concern were informed and a prior notice was given to each school before commencement of the study. An informed consent/assent was obtained from each institution (**Annexure- III, IV, V, VI & VII**). A verbal interactive session for the teachers, supervisors and caregivers was conducted wherein they were educated on the importance and maintenance of oral hygiene. It was further ensured that instructors and care givers at the residential schools were able to carry out specific oral hygiene maintenance instructions themselves, in order to reinforce it to the participants.

#### **Examination of participants:**

On the first visit, each participant was made to sit comfortably on a chair facing the examiner. Primary details of the children were recorded along with an attempt to establish a good rapport with them. An informed consent/assent was obtained prior to the start of the procedure and appropriate instructions were given to each one. Participants were examined then under natural day light using a single sided mirror and probe. Evaluation at baseline was done by a single examiner for oral hygiene status using selected indices (**Figure- 3 & 4**).

#### **Procedure:**

On completion of oral hygiene evaluation, individual study groups were educated using specific modes of communication i.e., Audio aids and ATP technique for the visually

impaired and Video aids and Sign language for the aurally impaired respectively. The groups were educated with the help of their instructors and care givers. In control group instructions were verbally communicated and demonstrated by the examiner with the help of a dental model and toothbrush (**Figure- 3**).

In the subgroup instructed using ATP technique, each participant was individually explained the brushing technique with the help of a model and toothbrush to understand better through their tactile senses. They were made to feel the model and tooth brush, then asked to feel their teeth with the tongue and correlate to the technique being used on the model. For the subgroup with audio aids, a pre-recorded audio clip was played in the local language (Hindi) for participants to listen to and understand. The audio clip contained instructions on brushing technique to be used and importance of maintaining oral health and hygiene. The clip was repeated and shown to all participants for good understanding. No specific time duration was set for the amount of time spent on each participant. Every individual was given time until they themselves understood the technique and could perform it (**Figure- 7**).

In subgroup using sign language, participants were made to sit and their instructor who was taught the brushing technique and the importance of oral hygiene maintenance prior to the commencement of the program, communicated to them using sign language. The instructions were repeated as required or when asked by any of the participant. For subgroup with video aids, a pre-recorded video clip was played and repeated to the children using a laptop. The video clip was shown to small groups of children at a time. They were asked to demonstrate same brushing technique after viewing the video clip (**Figure- 8**).

At the end of the session, every participant was given a standardized soft bristle tooth brush to use throughout the duration of the study. This tooth brush was replaced by a new



one on each follow up. No tooth brush was given to participants of control group instead they were asked to purchase a new one before each follow up i.e., at the end of three months.

Follow up was done at 3, 6, and 9 months. The same set of instructions was given out to all participants according to the group they belonged to including the control group.

All records including primary personal details, brushing habits and oral hygiene scores were recorded and maintained on the first visit. Each participant had a case sheet record.

The participants were educated on maintaining cleanliness and emphasis was laid on hygienic maintenance of tooth brush. Caregivers were advised to supervise the children during the course of the study duration for timely positive reinforcement and motivation.

Records of indices were maintained throughout the study. Plaque, calculus and gingival scores were calculated according to the given set of guidelines. The data collected was subjected to statistical analysis (**Figure- 6, Annexure- 8**).

### **1. Silness-Loe Plaque Index (1964)**

<b>SCORES</b>	<b>CRITERIA</b>
0	No plaque
1	A film of plaque adhering to the free gingival margin and adjacent area of the tooth  The plaque may be seen in situ only after application of disclosing solution or by using the probe on the tooth surface
2	Moderate accumulation of soft deposits within the gingival pocket, or the tooth and gingival margin which can be seen with the naked eye
3	Abundance of soft matter within the gingival pocket and/or on the tooth and gingival margin

## 2. Calculus index

Calculus	Score
0	No Calculus present
1	Supragingival calculus covering not more than 1/3 <sup>rd</sup> of the exposed tooth surface.
2	Supragingival covering more than 1/3 <sup>rd</sup> , but not more than 2/3 <sup>rds</sup> of the exposed tooth surface or the presence of individual flecks of subgingival calculus around the cervical portion of the tooth or both
3	Supragingival calculus covering more than 2/3 <sup>rd</sup> of the exposed tooth surface or a continuation of heavy band of supragingival calculus around the cervical portion of the tooth.

## 3. Loe-Silnes Gingival Index (1963)

SCORES	APPEARANCE	BLEEDING	INFLAMMATION
0	Normal	No bleeding	None

1	Slight change in colour and mild oedema with slight change in texture	No bleeding	Mild
2	Redness, hypertrophy, oedema and glazing	Bleeding on probing or pressure	Moderate
3	Marked redness, hypertrophy, oedema, ulceration	Spontaneous bleeding	Severe

## ***RESULTS***

### **STATISTICAL TOOLS**

The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 21.0 statistical Analysis Software. The values were represented in Number (%) and Mean $\pm$ SD.

The following Statistical formulas were used:

**1. Mean:** To obtain the mean, the individual observations were first added together and then divided by the number of observation. The operation of adding together or summation is denoted by the sign  $\Sigma$ .

The individual observation is denoted by the sign X, number of observation denoted by n, and the mean by  $\bar{X}$ .

$$\bar{X} = \frac{\Sigma X}{\text{No. of observations (n)}}$$

2. **Standard Deviation:** It is denoted by the Greek letter  $\sigma$ .

$$\sigma = \sqrt{\frac{\Sigma(X - \bar{X})^2}{n}}$$

3. **Chi square test:**

$$\chi^2 = \sum \frac{(O - E)^2}{E}$$

Where O = Observed frequency

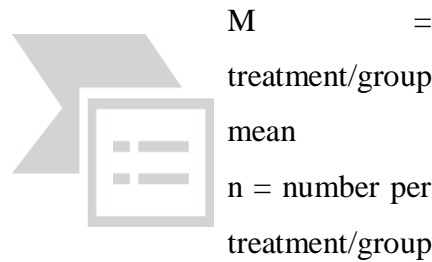
E = Expected frequency

4. **Analysis of Variance: Analysis of Variance (ANOVA):** The ANOVA test was used to compare the within group and between group variances amongst the study groups. Analysis of variance of different study groups at a particular time interval revealed the differences amongst them. ANOVA provided "F" ratio, where a higher "F" value depicted a higher inter-group difference.

$$: F = \frac{\text{Mean of Sum of Between Group Differences}}{\text{Mean of Sum of within Group Differences}}$$

Differences	Sum of Squares	df	Mean Square	F
Between Groups	A	N <sub>1</sub>	X=A/N <sub>1</sub>	X/Y
Within Groups	B	N <sub>2</sub>	Y=B/N <sub>2</sub>	

5. **Post-Hoc Tests (Tukey-HSD)**



M =  
treatment/group  
mean  
n = number per  
treatment/group

1. Calculate an analysis of variance (e.g., One-way between-subjects ANOVA).
2. Select two means and note the relevant variables (Means, Mean Square Within, and number per condition/group)
3. Calculate Tukey's test for each mean comparison
4. Check to see if Tukey's score is statistically significant with Tukey's probability/critical value table taking into account appropriate  $df_{\text{within}}$  and number of treatments.
6. **Paired "t" test:** To compare the change in a parameter at two different time intervals paired "t" test was used.



where:

$d_{\text{av}}$  is the mean difference, i.e. the sum of the differences of all the datapoints (set 1 point 1 - set 2 point 2, ...)

$SD$  is the standard deviation of the differences between all the pairs

$N$  is the number of pairs.

7. **Student 't' test:** To test the significance of two means the student 't' test was used

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$\text{where } S^2 = \frac{(N_1 - 1)SD_1^2 + (N_2 - 1)SD_2^2}{N_1 + N_2 - 2}$$

where  $\bar{X}_1, \bar{X}_2$  are means of group 1 and group 2

$N_1, N_2$  are number of observation group1 and group 2  
 $SD_1, SD_2$  are standard deviation in group1 and group 2

**8. Level of significance:** "p" is level of significance

$p > 0.05$	Not significant
$p < 0.05$	Significant
$p < 0.01$	Highly significant
$p < 0.001$	Very highly significant

The present study was carried out with an aim to assess oral hygiene status in visually and aurally impaired children to compare and evaluate the efficacy after using specific modes of communication i.e., ATP (Audio Tactile Performance) technique versus Audio aids and Sign Language versus Video aids. The interventional study was carried out on a total of 150 children. The group wise distribution of children is shown [Table- 1].

The children aged between 6 to 14 years were divided randomly into three groups of 50 participants each (33.3%) comprising of healthy participants that constituted the Group I - Control Group. 50 participants (33.3%) comprised of visually impaired children that constituted Group II and Group III consisted of 50 participants that were aurally impaired children (33.3%) [Table -1, Figure-1]

The mean age of the participants ranged from  $9.18 \pm 1.86$  years in Group I,  $10.04 \pm 2.44$  years in Group II and  $9.96 \pm 2.27$  years in Group III. The mean age of the participants in Groups II and III was observed to be higher as compared to that in Group I. This difference, however, was not statistically significant ( $p=0.101$ ). In Group I, proportion of males was lower (46%)

compared to Groups II and III (60% and 54% respectively); the proportion of females was higher in Group I (54%) with minimal difference between groups II and III i.e., (40%), (46%) the data was not statistically significant ( $p=0.371$ ) [**Table- 2, Graph 2 (a) & (b)**].

#### **THE STUDY WAS CARRIED OUT IN TWO PHASES:**

**Phase I:** Assessment of Oral Hygiene Status of Children on First Visit

**Phase II:** Instructing participants by using different modes of communication to evaluate the impact on the oral hygiene status at different intervals.

#### **PHASE I: ASSESSMENT OF ORAL HYGIENE STATUS OF PARTICIPANTS**

##### **FIRST VISIT**

On the first visit, an assessment of the oral hygiene status was done by recording three indices- Plaque Index, Calculus Index and Gingival Index. Comparing the above mentioned indices, it was observed that Group I showed minimum mean calculus index value (0.35) and gingival index value (0.25) whereas Group II showed minimum mean plaque index (1.48) and higher mean gingival index value (0.63) as compared to Group III. Group III showed maximum mean plaque index (2.19) and calculus index values (0.95). [Table-3 & Graph-3]. On the basis of above evaluation the order of different groups for different oral hygiene indices was:

**Plaque Index:** Controls > Visually impaired < Aurally impaired

**Calculus Index:** Controls < Visually impaired < Aurally impaired

**Gingival Index:** Controls < Aurally impaired < Visually impaired

A significant difference among groups was observed for all the three parameters. Statistically, a very high significant difference was observed between Groups II and III. [Table-4].

Routine dental hygiene practices were observed by evaluating the frequency, duration, method and material used for tooth brushing. It was found that in Groups I and II 72% and 48% participants brushed their teeth twice a day while all the participants in Group III brushed their teeth once a day, thus showing a statistically high significant intergroup difference ( $p < 0.001$ ).

In respect to the duration of tooth brushing, the proportion of those spending 30-60 seconds was observed to be higher in Groups II and III (40% and 44%) respectively as compared to that in Group I (28%), however, the proportion of those spending 2-5 minutes was much higher in Group I (16%) as compared to that in Groups II and III. On statistically evaluating the data, the difference was found to be significant ( $p = 0.033$ ) [Table-5, Graph-5 (a)].



In Group I and Group II, 22% of participants brushed their teeth using vertical motion of tooth brushing as compared to only 12% in Group III. In Group I 52% used horizontal motion as compared to Groups II and III where proportion of those brushing their teeth using horizontal motion was higher i.e., 78% and 88% respectively. In Group I, 26% of the participants used horizontal and vertical motion in combination for tooth brushing as compared to none of the children using a combination in Group III. Statistically, a significant difference in the method of tooth brushing among each group was observed ( $p < 0.001$ ).

Apart from one child in Group I (2%), all the other participants in each group used toothbrush and toothpaste for oral hygiene maintenance. On statistical evaluation, no significant difference was seen among each group with respect to the material used for tooth brushing [**Table-5, Graph-5 (b)**].

**PHASE II: INSTRUCTING PARTICIPANTS USING DIFFERENT MODES OF COMMUNICATION AND THEN EVALUATING THEIR IMPACT ON THE ORAL HYGIENE STATUS**

**A. ASSESSMENT OF GROUP I – ROUTINE INSTRUCTIONS**

In Group I, oral hygiene maintenance was emphasised on by demonstrating brushing techniques to the participants. Verbal oral hygiene instructions were given to each participant. **Table-6** shows the evaluation of change in oral hygiene status at different follow up intervals compared to baseline record.

In the control group, at follow up intervals, a gradual reduction of plaque index ( $1.50 \pm 1.02$  to  $0.21 \pm 0.24$ ) was observed which was statistically significant ( $p < 0.001$ ) as compared to baseline record. The percentage change in plaque index was observed to be ( $-87.36 \pm 16.20\%$ ) at third follow up interval. [**Table-6**].

For calculus index, the percentage reduction at the first follow up interval was statistically non significant but a significant reduction was observed from second follow up onwards, where the percentage change was  $-90.60 \pm 28.02\%$  ( $p = 0.002$ ), followed by the third follow up interval which was statistically less significant ( $p = 0.001$ ). [**Table-6**].

For gingival index, percentage reduction from baseline record to first follow up interval was significant statistically ( $p = 0.008$ ). At second follow up interval the percentage change was  $-96.00 \pm 17.02\%$  and at third follow up interval there was an absolute resolution of the gingival indices which was statistically highly significant ( $p < 0.001$ ) [**Table-6, Graph-6 (a) & (b)**].

## **B. ASSESSMENT IN GROUP II (VISUALLY IMPAIRED) – AUDIO TACTILE**

### **PERFORMANCE (ATP) TECHNIQUE VS AUDIO AIDS**

In the study Group II (Visually impaired), the participants were divided into two subgroups of 25 each with a specific mode of communication in each subgroup..

### **CLINICAL PARAMETERS OF TWO INTERVENTION SUBGROUPS**

Participants of the group were randomly distributed into two subgroups. Subgroup II (a) comprised of 25 participants instructed using audio tactile performance (ATP) technique and Subgroup II (b) comprised of 25 children instructed using audio aids.

At baseline the two subgroups did not show a significant difference for the oral hygiene maintenance parameters. However, in Subgroup II (a) mean plaque index and calculus index were lower as compared to Subgroup II (b) whereas mean gingival index in Subgroup II (a) was higher as compared to that in Subgroup II (b). This difference was not significant statistically ( $p>0.05$ ) [**Table-7**].

For the plaque index values, a reduction in mean values was observed in subgroups II (a) and II (b) from the first follow up interval  $1.42\pm 0.59$  and  $1.53\pm 0.77$ , which gradually decreased till the third follow up interval  $0.46\pm 0.41$  and  $0.80\pm 0.55$  [**Table-7**]. In Subgroup II (a) a reduction of 64%, while in Subgroup II (b) 52.86% in the mean plaque index was observed from the baseline record to the final follow up interval. On evaluating the data, the difference between two groups was not significant statistically, except at third follow up in Subgroup II (b) it was significantly higher as compared to that in Subgroup II (a) ( $p=0.016$ ) [**Graph-7**].

For calculus index, a reduction in mean values was observed in both the subgroups II (a) & (b) from first follow up  $0.50\pm 0.65$  and  $0.76\pm 0.68$  interval which decreased at third follow up interval  $0.38\pm 0.46$  and  $0.64\pm 0.59$ . Calculus index showed a reduction of 69% in Subgroup II (a) and 49.33% in Subgroup II (b) from the baseline record and the final follow up interval. However, on statistically evaluating the data, the difference between two subgroups was not significant at any of the follow up intervals ( $p>0.05$ ) [**Table-8 & Graph-8**].

For gingival index, a reduction in mean values was observed in both the subgroups II (a) & (b) from the first follow up interval  $0.80\pm 0.69$ , (88%) and  $0.59\pm 0.61$ , (78%) which

decreased at the third follow up interval  $0.12\pm 0.26$  and  $0.24\pm 0.44$ . However, on evaluating the data, the difference between two groups was found to be statistically non significant at any follow up intervals ( $p>0.05$ ) [**Table-9 & Graph-9**].

**Inference:** Both the modes of communication had an equivalent efficacy. Except for plaque index in Group II (a) which had a statistically significant outcome as compared to Group II (b) at final follow up interval, showing that the ATP technique had better impact on the participants as compared to the participants instructed using audio aids.

### **C. ASSESSMENT IN GROUP III (AURALLY IMPAIRED) – SIGN LANGUAGE VS**

#### **VIDEO AIDS**

In the study Group III (Aurally impaired), the participants were randomly and equally distributed into two subgroups of 25 each. The subgroup III (a) comprised of 25 participants

who were instructed using sign language whereas Subgroup III (b) comprised of 25 participants who were instructed using video aids.

On statistical evaluation of the data, at baseline record, both the subgroups did not show a significant difference for oral hygiene parameters. In Subgroup III (a) mean plaque index and calculus index was observed to be lower as compared to that in Subgroup III (b) and in Subgroup III (a) whereas mean gingival index values was observed to be higher as compared to that in Subgroup III (b) yet this difference was not statistically significant ( $p>0.05$ ) [**Table-10 & Graph-10**].

For plaque index, in the two subgroups III (a) and (b), a reduction in mean values was observed from the first follow up interval ( $2.38\pm 0.76$ ) and ( $1.99\pm 0.68$ ) respectively to the third follow up interval ( $1.07\pm 0.41$ ) and ( $1.40\pm 0.50$ ) respectively. Observations between the baseline record and final follow up interval showed a reduction in the mean plaque index i.e., subgroup III (a) in 50.9% and in subgroup III (b) 25.96%. On evaluating the data statistically, the difference among the two subgroups was not significant at any of the follow up intervals except for the third follow up values.

For calculus index, a reduction in mean values was observed in the two subgroups from the first follow up interval  $0.50 \pm 0.65$  and  $0.76 \pm 0.68$  to the third follow up interval  $0.38 \pm 0.46$  and  $0.64 \pm 0.59$ . Between the baseline record and final follow up interval, the mean calculus index showed a reduction of 29% in Subgroup III (a) and 20% in Subgroup III (b) respectively. On evaluating the data, difference between two groups was not statistically significant at any of the follow up intervals ( $p>0.05$ ) [**Table-11 & Graph-11**].

For the gingival index, a reduction in the mean values was observed in the two subgroups from the first follow up  $0.60\pm 0.65$  and  $0.61$  to third follow up interval  $0.23\pm 0.38$  and  $0.42\pm 0.47$ . Between the baseline record and final follow up interval, the mean gingival

index showed a reduction of 82% in Subgroup III (a) and 61% in Subgroup III (b). On evaluating the data, the difference between two groups was not statistically significant at any of the follow up intervals ( $p>0.05$ ) [Table-12 & Graph-12].

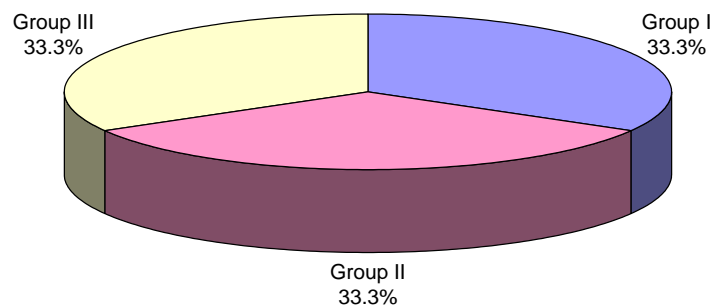
**Inference:** Both the interventions had an equivalent efficacy. However, a reduction in the plaque index of Group III (a) was observed as compared to Group III (b) at final follow up interval, showing that participants instructed using sign language had a better outcome as compared to participants instructed using video aids.

### DISTRIBUTION OF PARTICIPANTS

S.NO.	GROUP & NO. OF PARTICIPANTS	DESCRIPTION	SUBGROUPS (TECHNIQUE BASED) & NO. OF PARTICIPANTS	PERCENTAGE (%)
1.	I (50)	Normal Hygiene Children without	Verbal instructions and demonstration using models	33.3

		any disability (Control Group)		
2.	II (50)	Visually Impaired Children (Study Group I)	II (a) : (25) Participants instructed using audio tactile performance (ATP) technique	50.0
			II (b) : (25) Participants instructed using audio aids	50.0
3.	III (50)	Aurally Impaired Children (Study Group II)	III (a) : (25) Participants instructed using sign language	50.0
			III (b) : (25) Participants instructed using video aids	50.0

**Table 1: Group Wise Distribution of Participants (N=150)**



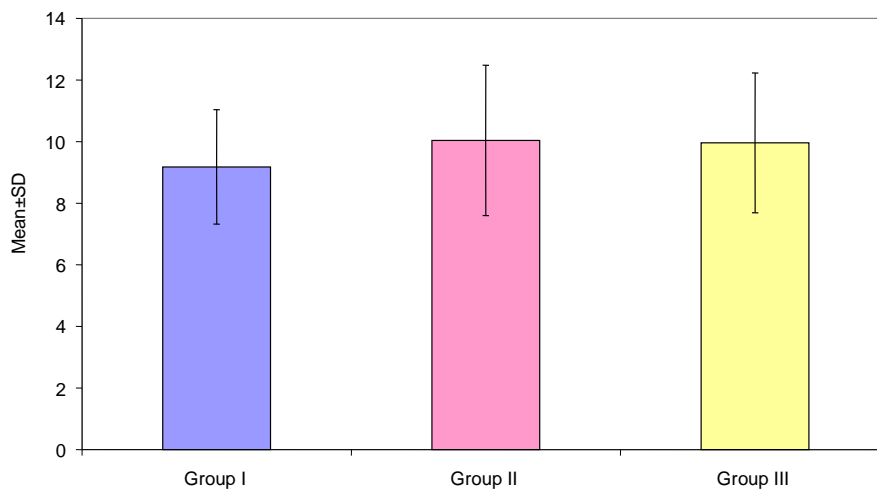
**FIGURE 1- GROUP WISE DISTRIBUTION OF PARTICIPANTS IN EACH GROUP**

### **AGE AND GENDER COMPARISON OF PARTICIPANTS**

S.No.	PARAMETERS	GROUP I (50)	GROUP II (50)	GROUP III (50)	STATISTICAL SIGNIFICANCE

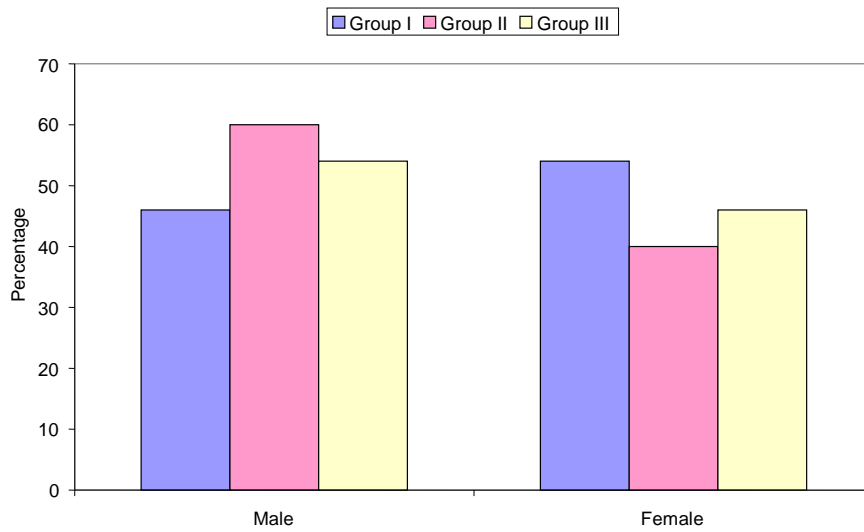
		Mean	SD	Mean	SD	Mean	SD	'F'	'p'
1.	Age (years)	9.18	1.86	10.04	2.44	9.96	2.27	2.326	0.101
2.	Gender	No.	%	No.	%	No.	%	$\chi^2$	'p'
	Male	23	46	30	60	27	54		
	Female	27	54	20	40	23	46		
								1.982	0.371

**Table 2: Age and Gender Comparison of Participants Enrolled in the Three Study Groups**



**GRAPH 2 (a) - COMPARISON OF MEAN AGE IN THE THREE GROUPS**





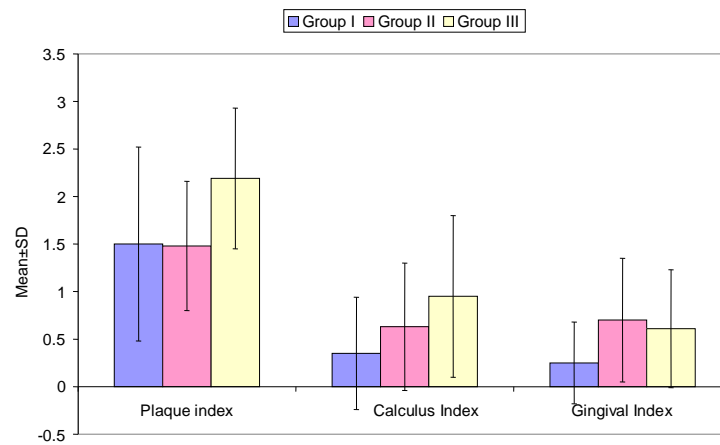
GRAPH 2 (b): COMPARISON OF GENDER PROFILE OF PARTICIPANTS IN THE THREE GROUPS

## PHASE I: ASSESSMENT OF ORAL HYGIENE STATUS OF PARTICIPANTS

### FIRST VISIT

S.No	PARAMETERS	GROUP I (CONTROL)		GROUP II (VISUALLY IMPAIRED)		GROUP III (AURALLY IMPAIRED)		STATISTICAL SIGNIFICANCE	
		Mean	SD	Mean	SD	Mean	SD	'F'	'p'
<b>ORAL HYGIENE/HYGIENE</b>									
1.	Plaque index	1.50	1.02	1.48	0.68	2.19	0.74	11.62	<0.001
2.	Calculus Index	0.35	0.59	0.63	0.67	0.95	0.85	8.925	<0.001
3.	Gingival Index	0.25	0.43	0.70	0.65	0.61	0.62	8.317	<0.001

**Table 3: Assessment of Mean Oral Hygiene Status of Participants in Each Group on First Visit**



**GRAPH 3- ASSESSMENT OF MEAN ORAL HYGIENE STATUS OF PARTICIPANTS IN EACH GROUP ON FIRST VISIT**

**COMPARISON OF MEAN DIFFERENCES OF ORAL HYGIENE STATUS PARAMETERS**

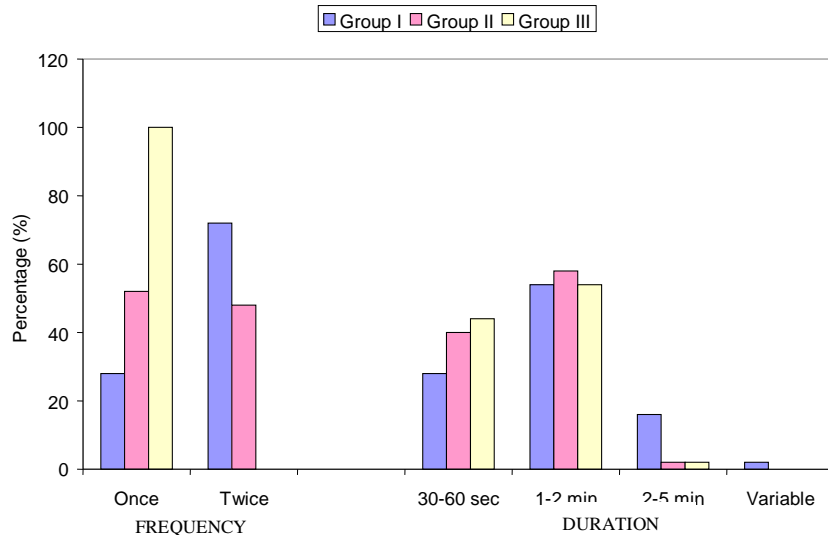
S.No.	PARAMETERS	GROUP I VS II			GROUP I VS III			GROUP II VS III		
		Mean Diff.	SE	'p'	Mean Diff.	SE	'p'	Mean Diff.	SE	'p'
1.	Plaque Index	0.02	0.17	0.988	-0.68	0.17	<0.001	-0.71	0.17	<0.001
2.	Calculus Index	-0.29	0.14	0.114	-0.60	0.14	<0.001	-0.32	0.14	0.072
3.	Gingival Index	-0.45	0.12	0.001	-0.36	0.12	0.007	0.09	0.12	0.716

**Table 4 Comparison of Mean Differences of Oral Hygiene Status Parameters of Participants in Each Group (Tukey's HSD Test)**

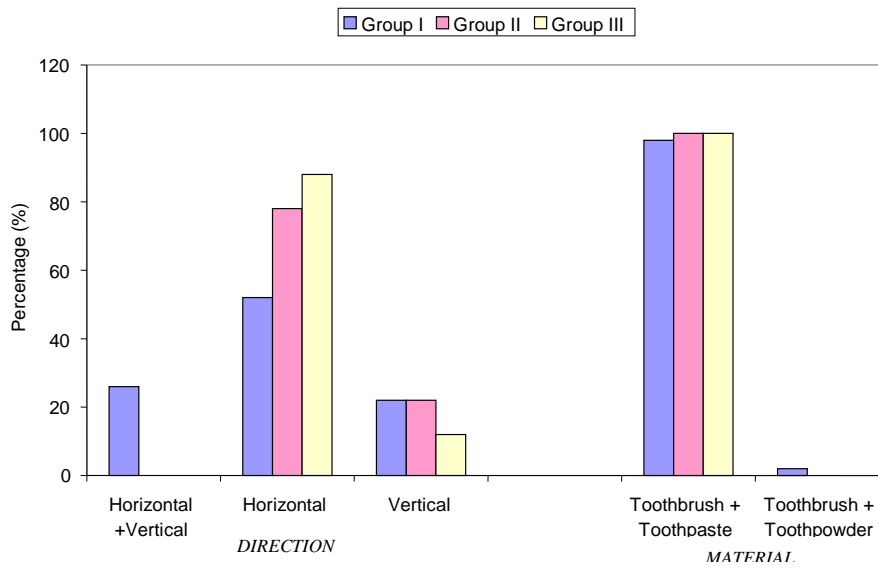
**ASSESSMENT OF TOOTH BRUSHING FREQUENCY, DURATION, METHOD  
AND MATERIAL USED**

S.NO.	PARAMETERS	GROUP I		GROUP II		GROUP III		STATISTICAL SIGNIFICANCE	
		No.	%	No.	%	No.	%	$\chi^2$	'p'
1.	<b>FREQUENCY</b>								
	Once	14	28.0	26	52.0	50	100.0	56.00	<0.001
	Twice	36	72.0	24	48.0	0	0.0		
<b>DURATION</b>									
2.	30-60 sec	14	28.0	20	40.0	22	44.0	13.75	0.033
	1-2 min	27	54.0	29	58.0	27	54.0		
	2-5 min	8	16.0	1	2.0	1	2.0		
	Variable	1	2.0	0	0.0	0	0.0		
	<b>METHOD</b>								
3.	Horizontal +Vertical	13	26.0	0	0.0	0	0.0	32.54	<0.001
	Horizontal	26	52.0	39	78.0	44	88.0		
	Vertical	11	22.0	11	22.0	6	12.0		
4.	<b>MATERIAL</b>								
	Toothbrush + Toothpaste	49	98.0	50	100.0	50	100.0	2.013	0.365
	Toothbrush + Toothpowder	1	2.0	0	0.0	0	0.0		

**Table 5: Comparison of Oral Hygiene Practices among Three Study Group**



GRAPH 5 (a): COMPARISON OF FREQUENCY AND TIME SPENT ON TOOTH BRUSHING IN EACH GROUP



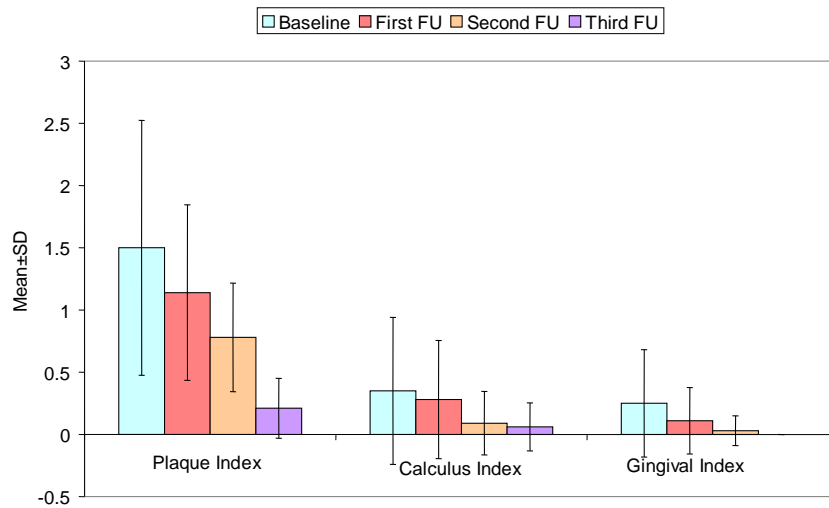
GRAPH 5 (b): COMPARISON OF METHOD AND MATERIAL USED FOR TOOTH BRUSHING IN EACH GROUP

**COMPARISION OF ORAL HYGIENE STATUS AT DIFFERENT FOLLOW**

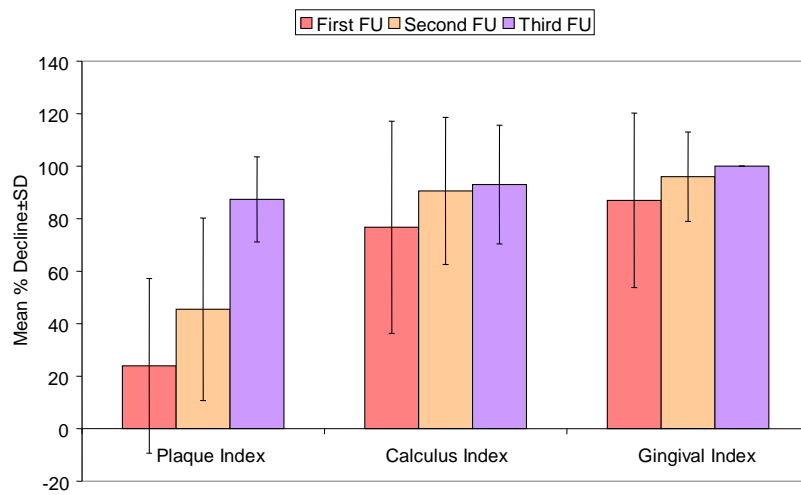
**UP INTERVALS IN CONTROL GROUP**

S.No	TIME INTERVAL (3 MONTHS)	MEAN	SD	CHANGE FROM BASELINE		% CHANGE		SIGNIFICANCE OF CHANGE (PAIRED 't'-TEST)	
				Mean	SD	Mean	SD	't'	'p'
<b>PLAQUE INDEX</b>									
1.	Baseline Record	1.50	1.02						
2.	First Follow Up	1.14	0.71	0.36	0.67	-23.94	33.28	3.87	<0.001
3.	Second Follow Up	0.78	0.44	0.72	0.93	-45.47	34.76	5.50	<0.001
4.	Third Follow Up	0.21	0.24	1.30	0.96	-87.36	16.20	9.57	<0.001
<b>CALCULUS INDEX</b>									
1.	Baseline Record	0.35	0.59						
2.	First Follow Up	0.28	0.47	0.07	0.26	-76.70	40.43	1.88	0.065
3.	Second Follow Up	0.09	0.26	0.26	0.56	-90.60	28.02	3.31	0.002
4.	Third Follow Up	0.06	0.19	0.29	0.56	-93.00	22.61	3.58	0.001
<b>GINGIVAL INDEX</b>									
1.	Baseline Record	0.25	0.43						
2.	First Follow Up	0.11	0.27	0.15	0.37	-87.00	33.21	2.76	0.008
3.	Second Follow Up	0.03	0.12	0.22	0.41	-96.00	17.02	3.83	<0.001
4.	Third Follow Up	0.00	0.00	0.25	0.43	-100.00	0.00	4.10	<0.001

**Table 6: Evaluation of Change in Oral Hygiene Status of Control Group at Different Follow Up Intervals as Compared to Baseline Record (N=50)**



**GRAPH 6 (a): ORAL HYGIENE STATUS IN CONTROL GROUP AT DIFFERENT FOLLOW UP INTERVALS**



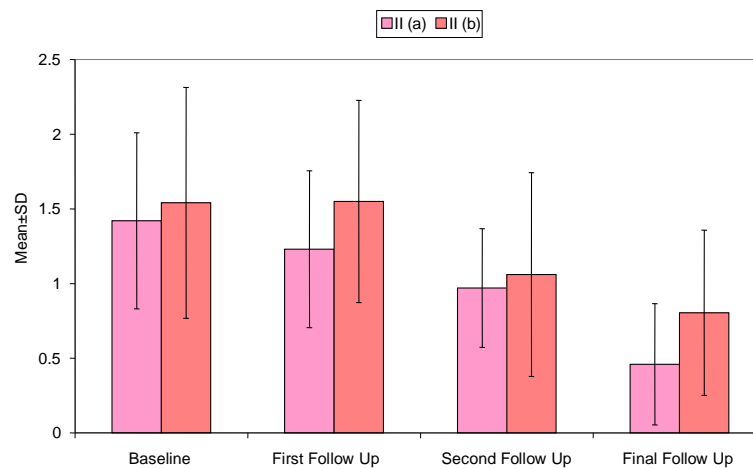
**GRAPH 6 (b): MEAN PERCENTAGE (%) REDUCTION IN EACH ORAL HYGIENE PARAMETER OF CONTROL GROUP AS COMPARED TO BASELINE RECORD**

**COMPARISON OF ORAL HYGIENE STATUS PARAMETERS AMONG  
SUBGROUPS OF GROUP II (VISUALLY IMPAIRED) AT EACH FOLLOW UP  
INTERVALS BASED ON MODE OF COMMUNICATION USED**

**PLAQUE INDEX**

S.No	PARAMETERS	II (a) (n=25) ATP Technique			II (b) (n=25) Audio Aids			STATISTICAL SIGNIFICANCE	
		Mean	SD	Percentage % reduction from baseline	Mean	SD	Percentage % reduction from baseline	't'	'p'
1.	Baseline Record	1.42	0.59		1.54	0.77		-0.617	0.540
2.	First Follow Up	1.23	0.53	13.97	1.55	0.68	13.09	-1.868	0.068
3.	Second Follow Up	0.97	0.40	30.27	1.06	0.68	40.07	-0.570	0.571
4.	Third Follow Up	0.46	0.41	64.00	0.80	0.55	52.86	-2.506	0.016

**Table 7: Comparison of Mean Plaque Index Values among Subgroups at Each Follow Up-Intervals**

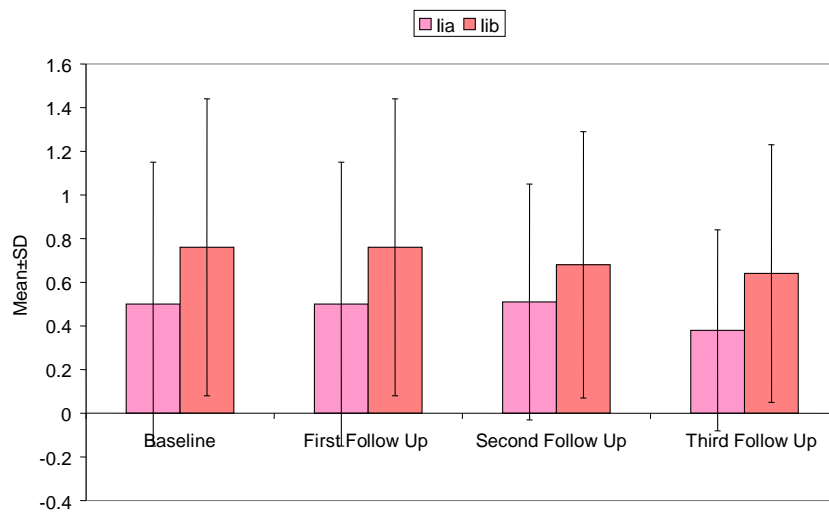


**Graph 7: Comparison of Mean Plaque Index Values among Subgroups at Each Follow Up Intervals**

**CALCULUS INDEX**

S.No	PARAMETERS	II (a) (n=25) ATP Technique			II (b) (n=25) Audio Aids			STATISTICAL SIGNIFICANCE	
		Mean	SD	Percentage % reduction from baseline	Mean	SD	Percentage % reduction from baseline	't'	'p'
1.	Baseline Record	0.50	0.65		0.76	0.68		-1.388	0.172
2.	First Follow Up	0.50	0.65	56.00	0.76	0.68	36.00	-1.388	0.172
3.	Second Follow Up	0.51	0.54	58.50	0.68	0.61	45.33	-1.041	0.303
4.	Third Follow Up	0.38	0.46	69.00	0.64	0.59	49.33	-1.740	0.088

**Table 8: Comparison of Mean Calculus Index Values among Subgroups at Each Follow Up Intervals**



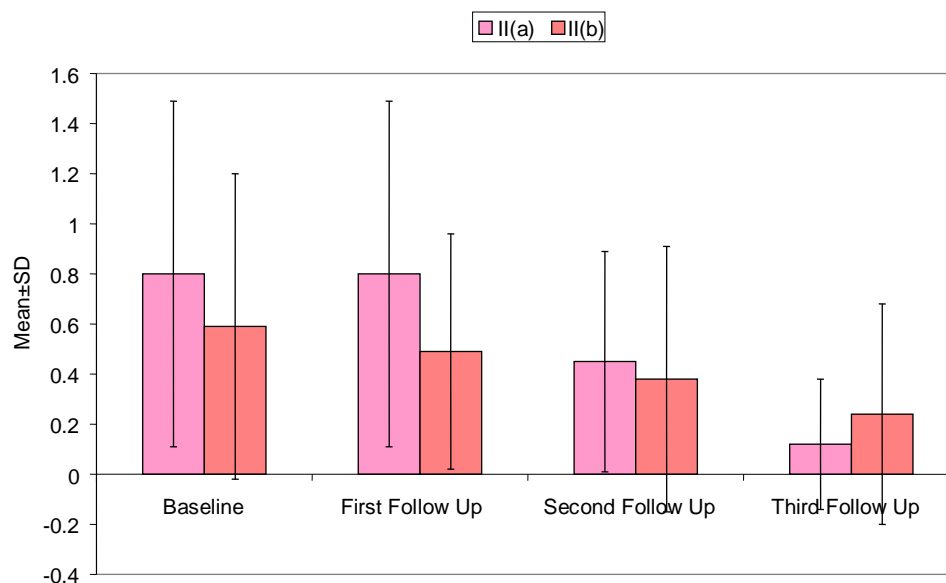
**Graph 8: Comparison of Mean Calculus Index Values among Subgroups at Each Follow Up Intervals**



**GINGIVAL INDEX**

S.No	PARAMETERS	II (a) (n=25) ATP Technique			II (b) (n=25) Audio Aids			STATISTICAL SIGNIFICANCE	
		Mean	SD	Percentage % reduction from baseline	Mean	SD	Percentage % reduction from baseline	't'	'p'
<b>GINGIVAL INDEX</b>									
1.	Baseline Record	0.80	0.69		0.59	0.61		1.144	0.258
2.	First Follow Up	0.80	0.69	32.00	0.49	0.47	55.33	1.859	0.069
3.	Second Follow Up	0.45	0.44	61.78	0.38	0.53	65.67	0.508	0.614
4.	Third Follow Up	0.12	0.26	88.00	0.24	0.44	78.00	-1.180	0.244

**Table 9: Comparison of Mean Gingival Index Values among Subgroups at Each Follow Up Intervals**



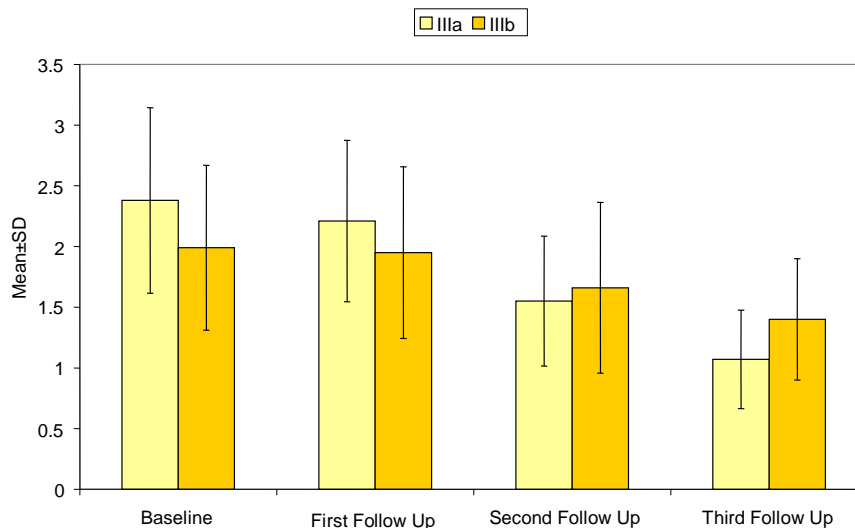
**Graph 9: Comparison of Mean Gingival Index Values among Subgroups at Each Follow Up Intervals**

**COMPARISON OF ORAL HYGIENE PARAMETER AMONG SUBGROUPS OF GROUP III (AURALLY IMPAIRED AT EACH FOLLOW UP INTERVALS) BASED ON THE MODE OF COMMUNICATION USED**

**PLAQUE INDEX:**

S.No	PARAMETERS	III (a) (n=25) Sign Language			III (b) (n=25) Video Aids			STATISTICAL SIGNIFICANCE	
		Mean	SD	Percentage % reduction from baseline	Mean	SD	Percentage % reduction from baseline	't'	'p'
<b>PLAQUE INDEX</b>									
1.	Baseline Record	2.38	0.76		1.99	0.68		1.908	0.062
2.	First Follow Up	2.21	0.66	3.84	1.95	0.71	2.00	1.340	0.187
3.	Second Follow Up	1.55	0.54	29.80	1.66	0.70	14.87	-0.623	0.537
4.	Third Follow Up	1.07	0.41	50.90	1.40	0.50	25.96	-2.564	0.014

**Table 10: Comparison of Mean Plaque Index Values among the Two Subgroups at Each Follow Up Intervals**

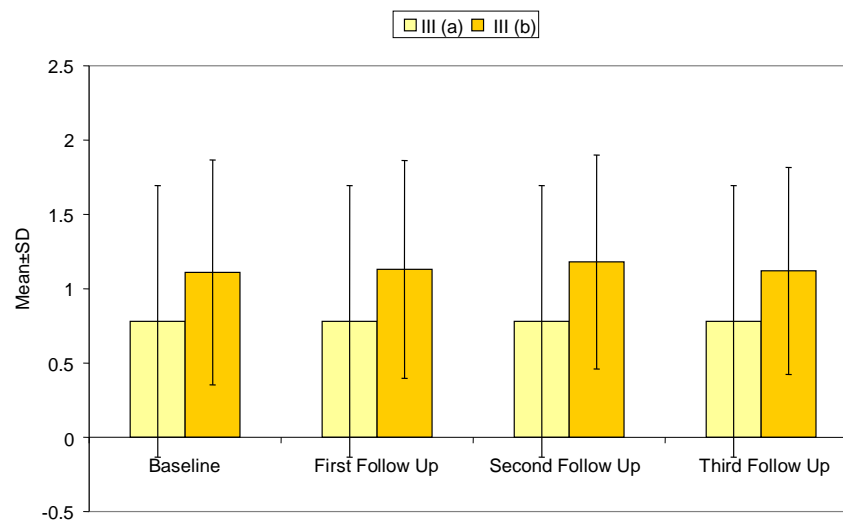


**Graph 10: Comparison of Mean Plaque Index Values among the Two Subgroups at Each Follow Up Intervals**

**CALCULUS INDEX:**

S.No.	PARAMETERS	III (a) (n=25) Sign Language			III (b) (n=25) Video Aids			STATISTICAL SIGNIFICANCE	
		Mean	SD	Percentage % reduction from baseline	Mean	SD	Percentage % reduction from baseline	't'	'p'
1.	Baseline Record	0.50	0.65		1.11	0.76		-1.390	0.171
2.	First Follow Up	0.50	0.65	0.00	1.13	0.73	0.00	-1.494	0.142
3.	Second Follow Up	0.51	0.54	5.68	1.18	0.72	14.58	-1.719	0.092
4.	Third Follow Up	0.38	0.46	29.55	1.12	0.70	20.83	-1.480	0.145

**Table 11: Comparison of Mean Calculus Index Values between Two Subgroups at Different Follow Up-Intervals**

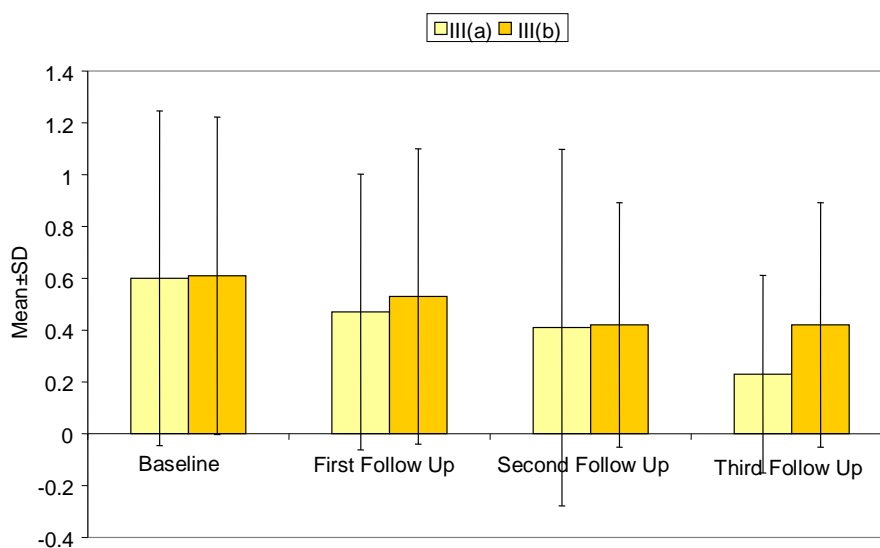


**Graph 11: Comparison of Mean Calculus Index Values between Two Subgroups at Different Follow Up-Intervals**

**GINGIVAL INDEX:**

S.No	PARAMETERS	III (a) (n=25) Sign Language			III (b) (n=25) Video Aids			STATISTICAL SIGNIFICANCE	
		Mean	SD	Percentage % reduction from baseline	Mean	SD	Percentage % reduction from baseline	't'	'p'
1.	Baseline Record	0.60	0.65		0.61	0.61		-0.056	0.955
2.	First Follow Up	0.47	0.53	57.33	0.53	0.57	44.13	-0.385	0.702
3.	Second Follow Up	0.41	0.69	50.00	0.42	0.47	55.73	-0.060	0.952
4.	Third Follow Up	0.23	0.38	76.00	0.42	0.47	55.73	-1.566	0.124

**Table 12 Comparison of Mean Gingival Index Values among Two Subgroups at Each Follow up Intervals**



**Graph 12: Comparison of Mean Gingival Index Values among Two Subgroups at Each Follow Up Intervals**

**SUMMARY TABLE**

S NO	VARIABLES	CONTROL (n=50) (Group I)		CHILDREN UNDERGOING AUDIOTACTILE PERFORMANCE INTERVENTION (n=25) Group II(a)		CHILDREN UNDERGOING INTERVENTION USING AUDIO AIDS (n=25) Group II(b)		CHILDREN UNDERGOING INTERVENTIO N USING SIGN LANGUAGE (n=25) Group III(a)		CHILDREN UNDERGOING INTERVENTION USING VIDEO AIDS (n=25) Group III(b)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
<b>BASELINE</b>											
1.	PLAQUE INDEX	1.50	1.02	1.99	0.68	1.42	0.59	1.50	1.02	2.38	0.76
2.	CALCULUS INDEX	0.35	0.59	1.11	0.76	0.50	0.65	0.55	0.54	0.78	0.91
3.	GINGIVAL INDEX	0.25	0.43	0.61	0.61	0.80	0.69	0.25	0.43	0.60	0.65
<b>FIRST FOLLOW UP</b>											
1.	PLAQUE INDEX	1.14	0.71	1.23	0.53	1.55	0.68	2.21	0.66	1.95	0.71
2.	CALCULUS INDEX	0.28	0.47	0.50	0.65	0.76	0.68	0.50	0.65	1.13	0.73
3.	GINGIVAL INDEX	0.11	0.27	0.80	0.69	0.49	0.47	0.47	0.53	0.53	0.57
<b>SECOND FOLLOW UP</b>											
1.	PLAQUE INDEX	0.78	0.44	0.97	0.40	1.06	0.68	1.55	0.54	1.66	0.70
2.	CALCULUS INDEX	0.09	0.26	0.51	0.54	0.68	0.61	0.51	0.54	1.18	0.72
3.	GINGIVAL INDEX	0.03	0.22	0.45	0.44	0.38	0.53	0.41	0.69	0.42	0.47
<b>THIRD FOLLOW UP</b>											
1.	PLAQUE INDEX	0.21	0.24	0.46	0.41	0.80	0.55	1.07	0.41	1.40	0.50
2.	CALCULUS INDEX	0.06	0.19	0.38	0.46	0.64	0.59	0.38	0.46	1.12	0.70

3.	GINGIVAL INDEX	0.0									
		0.00	0	0.12	0.26	0.24	0.44	0.23	0.38	0.42	0.47

**Table 13 Summary Showing Each Index and Different Follow Up Intervals Based on the Mode of Technique Used**

### *DISCUSSION*

The general health condition of individuals with special health care needs (SHCN) has been reported to be influenced by various sociodemographic factors including living conditions and severity of impairment.<sup>5</sup> Health care for individuals with special needs requires specialized knowledge acquired by additional training, as well as increased awareness and attention, adaptation, and accommodative measures which are beyond what are considered routine<sup>10</sup>. Medically compromised and SHCN individuals present a unique population that challenges the dentist's skills and knowledge. Hence, the dental needs of these individuals should be attended through accurate and appropriate prevention, detection and treatment.

The effects of disabling conditions are many and varied, but one of the most common effects is inability to maintain oral health. The three principal components – impairment, disability and handicap – would operate independently, with impairment addressing impact on the body; disability to impact on the person; and handicap to impact on the person interacting with the environment.<sup>50</sup>

Dental treatment is the greatest unmet health need of the handicapped child. This statement by Nowak was substantiated by various studies done globally on special children.<sup>11, 12, 34</sup> The situation becomes more complex when dealing with physically or mentally compromised people. Visually and aurally impaired individuals have oral health problems similar to those seen in the general population so it is necessary to emphasise the

importance of oral care for them. They should be guided in reduction or elimination of dental plaque and health promotion. Knowledge should also be imparted regarding functionality and the conservation of dental elements and aesthetics. Motivating individuals with any impairment to have good oral hygiene is a major challenge for dental surgeons.

SHCN children are generally incapable of obtaining an adequate oral hygiene level because of their limited motor skills, understanding and lack of knowledge of oral hygiene measures and effective tooth brushing technique, this results in poor periodontal conditions.<sup>5</sup> Thus, we aimed at training children with appropriate brushing technique for plaque removal that plays a major role in the etiology of dental caries, gingivitis and its progression to periodontitis.

The present was undertaken by the department of Pedodontics and Preventive Dentistry, Babu Banarasi Das College of Dental Sciences, Lucknow including various residential institutions for special children and regular day schools for control group children. The study was conducted to assess oral health status of visually and aurally impaired children and to evaluate effective modes of communication i.e., ATP Technique versus Audio aids and Sign Language versus Video aids, in each group respectively for visually and aurally impaired children, thus, to educate them in maintaining good oral health. The study aided in assessing their ability to retain methods taught to them. An interventional comparative study was carried out on a total of 150 children aged between 4-16 years who were randomly selected from various schools after a prior written consent and approval from the Institutional Ethical Committee [**Annexure 1, 2**].

On the first visit, an interactive session was held with teachers and caretakers in each school. They were explained the purpose of this study and were taught tooth brushing technique (Fone's method of tooth brushing) which was instructed to participants of each

subgroup by their teachers since children were familiar and comfortable communicating with them. The participants were then made to practice and demonstrate the techniques to ensure that correct method was being followed. Furthermore, the demographic data (name, age, sex) of participants was recorded with their oral hygiene practices (tooth brushing method, material, duration and frequency) in an attempt to establish a rapport with them. The evaluation was done by a single examiner throughout the study to maintain an unbiased examination and result. The subsequent study was carried out in two phases: assessment of oral health status of children and thereafter, providing preventive instructions using different modalities and evaluating their impact.

Study groups were distributed under three heads i.e., Group I (control group) healthy children without any disability/impairment, Group II (visually impaired children) and Group III (aurally impaired children). Children fulfilling the inclusion criteria were enrolled in the study with 50 children in each group out of the total 150 children. The study was conducted over a period of one year with three subsequent follow ups after the base line record with an interval of three months. At each follow up, oral hygiene indices were recorded, instruction for oral hygiene maintenance and tooth brushing technique was demonstrated. A significant reduction in the overall oral hygiene status was observed at each follow up as compared to the baseline. [Table 1, Figure 1]

The comparison of age and gender of all the children enrolled showed that the mean age in Group II ( $10.04 \pm 2.44$ ) and Group III ( $9.96 \pm 2.27$ ) was higher than Group I ( $9.18 \pm 1.86$ ), the difference was not statistically significant however, in similar studies conducted by **Yee R (2002)** and **Basil FM (1989)** oral health status scores showed a significant increase with advancing age in both the visually and aurally impaired groups.<sup>12, 17, 18</sup> In another study conducted by **Al-Qahtani (2014)** on oral health status of blind children between 6-7 and 11-12 year olds, mean oral health status scores of were higher in the younger children than older



children.<sup>12</sup> The result was different to the findings of the present study which indicated that age was not a major factor in oral health status of visually or aurally impaired individuals [Table-2].

In Group II and Group III proportion of males (60% and 54%) was higher than Group I (46%), the data was statistically non significant [Figure-2]. In a study carried out by **Sanjay V (2014)** on the dental health status among sensory and blind institutionalized children, oral health status score was higher among male children than females indicating that males had poor oral health status, similarly **Thanveer K (2013)** observed higher prevalence of dental caries and poor oral hygiene status in males than females. In the present study, gender did not show a significant impact on the overall oral health status of visually and aurally impaired children<sup>12, 23</sup>. This perhaps was due to the fact that all children of the residential institutions were regularly monitored and motivated on tooth brushing.

On assessing the oral hygiene status and comparing the oral hygiene indices (Plaque index, Calculus index and gingival index), Group I showed lower CI and GI, Group II showed lower PI and higher GI. Group III showed highest PI and CI. Thus, oral hygiene indices observed in Group I was significantly lower compared to Group II and III. The study was further subdivided based on the mode of communication [Table-3 & Graph-3].

Routine dental hygiene practices were observed by evaluating the frequency, duration, method and material used for tooth brushing. It was seen in Groups I and II, 72% and 48% participants brushed their teeth twice a day while all the participants in Group III brushed their teeth once a day, showing a statistically high significant intergroup difference ( $p < 0.001$ ). The duration of tooth brushing, the proportion of those spending 30-60 seconds was observed to be higher in Groups II and III (40% and 44%) respectively as compared to that in Group I (28%), however, the proportion of those spending 2-5 minutes was much higher in Group I (16%) as

compared to that in Groups II and III. On statistically evaluating the data, the difference was found to be significant ( $p=0.033$ ) [**Table-5, Graph-5 (a)**].

In Group I and Group II, 22% of participants brushed their teeth using vertical motion of tooth brushing as compared to only 12% in Group III. In Group I, 52% used horizontal motion as compared to Groups II and III and proportion of those brushing their teeth using horizontal motion was 78% and 88% respectively. In Group I, 26% of the participants used horizontal and vertical motion in combination for tooth brushing as compared to none of the children using a combination in Group III. Statistically, a significant difference in the method of tooth brushing among each group was observed ( $p<0.001$ ).

Apart from one child in Group I (2%), all the other participants in each group used toothbrush and toothpaste for oral hygiene maintenance. On statistical evaluation, no significant difference was seen among each group with respect to the material and method used for tooth brushing [**Table-5, Graph-5 (b)**]. In a similar study conducted by **Ahmad MS (2009)** on 80 visually impaired students, no significant relationship between oral health status and oral hygiene practice existed (type of cleaning tools, use of dentifrices, frequency of cleaning), likewise **Nandani S (2003)** concluded that irrespective of the duration of cleaning, material or method used, oral hygiene of blind children was poor and required correct teaching and motivation as oral hygiene status.

For Control Group, same method was followed and each child had an individual record maintained. Participants were verbally instructed on importance of oral hygiene maintenance and brushing technique was demonstrated. At each follow up intervals, a gradual reduction of PI and GI ( $p=0.008$ ) was observed which was statistically significant compared to baseline record. The CI percentage reduction at the first follow up interval was significant from second follow up onwards, and by third follow up interval it showed statistically high significance

( $p=0.001$ ). An absolute resolution of the gingival indices was observed ( $p=0.008$ ). The results of the present study were in accordance to a similar study reported by **Solanki J (2013)** where prevalence of oral health status was higher in visually impaired children compared to healthy children.[**Table-6, Graph-6 (a) & (b)**].

In Group II (Visually impaired), participants were distributed into two subgroups of 25 children each- Children undergoing audio tactile performance intervention and audio aids. Audio tactile performance technique (ATP) is a specially designed that is reported by **Mescher (2001)** to be a very effective communication tool to educate these children regarding oral hygiene maintenance, furthermore, **Sumtkeere A (2011)** stated that visually impaired children have poor oral hygiene than sighted ones.<sup>20</sup> Fone's method of tooth brushing technique was used. A comparative study conducted by **Chrishantha J (2015)** on visually impaired children comparing two brushing methods- Fone's versus modified Bass method in visually impaired children using audio tactile performance technique (ATP) and found a statistically significant reduction in plaque index.<sup>25</sup> The results of their study were closely related to the present study in which ATP technique showed a good outcome. A similar study was conducted by **Apiwan S (2011)** comparing toothbrush efficacy between the horizontal scrub and modified Bass methods in blind children, using verbal and tactile tooth brushing instructions twice a day, they observed a significant reduction in the oral hygiene scores but no significant difference between both the methods of brushing techniques used indicating that tactile sensation helps visually impaired children to bring out a positive outcome.<sup>22</sup>

A study carried out by **Sumtkeere A (2011)** on 60 blind children to compare tooth brushing efficacy between horizontal scrub and modified bass method, reported a significant reduction on PI over the course of their study. In this study, Fone's method of tooth brushing

showed that it was easy to grasp and majority of the children retained this technique and followed it with ease. At baseline the two subgroups, did not show a significant difference for the oral hygiene parameters. However, in Subgroup II (a) mean PI and CI was lower compared to Subgroup II (b) and mean GI in Subgroup II (a) was higher compared to Subgroup II (b). This difference was not significant statistically ( $p>0.01$ ). Our results supported **Ivanovic and Lekic's (1999)** findings that short term preventive programme without professional instrumentation induces a transient improvement of oral health.<sup>20 (27)</sup> In addition, various other authors including **Mann (1984)** have reported that the oral hygiene of blind population is significantly worse than in an equivalently sighted one and visualizing the plaque becomes difficult so even understanding the importance of oral hygiene is difficult for them, this was observed in the present study also.

In a study conducted by **Bansal M (2014)**, it was found that most of the children had moderate to fair oral hygiene at baseline which significantly improved after imparting auditory instructions and regular supervision. This was in contrast to the results in our study where ATP technique was found to be better than audio aids as a part of instructing the visually impaired children.

For PI values, a reduction in mean was observed in the two subgroups from first follow up interval, which gradually decreased till the third follow up interval. On evaluating the data, the difference between two groups was not significant statistically ( $p=0.016$ ) [**Table-7, Graph-7**]. For CI, a reduction in mean values was observed in both the subgroups from first follow up. On statistical evaluation, the difference between two subgroups was not significant at any of the follow up intervals ( $p>0.05$ ) [**Table-9 & Graph-11**]. A reduction in mean GI values was observed in both subgroups from the first follow up interval, the difference between two groups was statistically non significant at any follow up intervals

( $p > 0.05$ ) [Table-9 & Graph-9]. The main reason for a higher prevalence of dental caries and gingivitis in disabled individuals is the inadequate removal of plaque. In a study conducted by **Ahmad S (1999)**, most of the blind students examined had poor oral hygiene which declined over a given period of time, similarly **Bansal M (2014)** reported a reduction in oral hygiene index values in blind children over a three month study and **Nandini S (2003)** concluded from their study on 150 blind school children that tactile sensation was a good method of teaching children using models and children showed reduced GI scores.<sup>15, 18, 24</sup> This was in accordance with the results seen by **Jitendra S (2013)** who carried out a study on 704 blind children of 6-15 years on oral hygiene status and found that oral health in visually impaired children was affected by limited understanding of the importance of maintaining oral health, difficulty in communicating and had a fear of undergoing oral health procedures. It can be concluded that awareness plays an important role in maintenance of oral hygiene and an efficacious dental health method for communication with visually impaired children needs to be inculcated.<sup>22</sup>

In our study, ATP technique showed better outcome with eventual follow ups compared to audio aids for the visually impaired children. Since these children are unable to self-monitor the effectiveness or maintain regularity, care takers of the residential schools were instructed to reinforce the brushing techniques and motivate the children to maintain a health this was also observed by **Hebble A (2012)** and **Prashant ST (2011)** who conducted studies and concluded that visually impaired children could maintain an acceptable level of oral hygiene when taught using special customized methods, laying emphasis on dental awareness and diet counseling to be started at an early age, thereby reducing probability of dental diseases and complications. The oral health status of visually impaired children as stated by **Cohen S (1991)** declined from the beginning of their study after a no

reinforcement period whereas in the present study, oral hygiene status improved with constant reinforcement, thus showing the importance of constant reinforcement and motivation.<sup>19, 20</sup> **Ganapathi AK (2015)** observed that blind children depended more on senses like feeling and hearing. In the present study also, blind children depended on the senses of touch and feeling which aided in an overall good outcome. Therefore, a modified approach of teaching and educating them on oral health is required through various sensory inputs.

In second part of the study in Group III (Aurally impaired), the children were distributed into two subgroups of 25 children each- children undergoing intervention using sign language and video aids. At baseline the two groups were matched statistically. Plaque index in the subgroup using sign language had a better outcome as compared to the subgroup using video aids at final follow up which was similar to the results of studies conducted by **Sandeep (2014)** and **Malee A (2012)**, they observed significant reduction in the levels of plaque and gingival index in hearing impaired children and concluded that specific mode of education used like sign language brought significant reduction in the overall periodontal health. In a motivational training program conducted by **Liliya D (2015)** for oral hygiene of 100 deaf children between 5 to 12 years, Bulgaria, concluded that time to train these children taken was longer due to communication and language deficits however specific training programs can help, this was not in accordance with the present study where children trained by using sign language took lesser time than those trained using video aids as the children were familiar with the sign language used by their teachers.

In a study conducted by **Campbell R (2007)** on sign language and the processing done by the brain they found that the brain of deaf and hearing people are the same in terms of functioning. They compared basic sign language and audiovisual English speech and found

that the perception of both recruited similar neural system responses. Most of the children did not receive dental treatment due to communication barriers which was noted by **Samnieng P (2014)** in a study on 204 hearing impaired individuals, observing that majority of the patients failed to obtain the needed care because of communication difficulties experienced in the treatment situation.

A study carried out by **Sten O (1982)** on tooth brushing behavior in children at different ages out of 47 children, showed that majority of the children used horizontal scrub technique. The findings suggested age related factor between the development of motor skills and the ability to brush whereas in the present study, age did not show a significant difference in the general oral health of the children.

In the present study, the subgroups did not show a significant difference for oral hygiene parameters at baseline. However, in Subgroup III (a) mean PI and CI was observed to be lower as compared to Subgroup III (b) whereas mean gingival index was observed to be higher as compared to that in Subgroup III (b) than Subgroup III (a) yet this difference was not statistically significant ( $p>0.05$ ) [**Table-10 & Graph-10**]. For PI a reduction in mean values was observed from the first follow up interval. On evaluating the data statistically, the difference among the two subgroups was significant for the subgroup instructed using sign language at the third follow up interval. When indexes were examined in regard to sex, irrespective of the ratio of males and females in each group the data statistically, was not found significant ( $p=0.371$ ).

In a similar study conducted by **Srivastava N (2013)** to assess the effectiveness of three different methods of teaching tooth brushing in 60 children aged 7 to 9 years and observed a significant relationship that exists between the methods of oral hygiene instructions, the reinforcement and the PI. They found that teaching using a cast model was better and the

children retained it for a longer time this was in accordance with the result of the present study. They also observed that reinforcement of the brushing instructions on repeated intervals was important in establishing the desired behavior in the children likewise reinforcement laid a lasting impact on the children in this study. For CI, a reduction in mean values was observed in the two groups from the first follow up interval, showing a reduction of 48% in Subgroup III (a) and 24.57% in Subgroup III (b) respectively. On evaluating the data, difference between two groups was not statistically significant at any of the follow up intervals ( $p>0.05$ ) [Table-13 & Graph-15]. For the GI, a reduction in the mean values was observed in the two subgroups from the first follow up with a reduction of 76% in Subgroup III (a) and 55.73% in Subgroup III (b). On evaluating the data, the difference between two groups was not statistically significant at any of the follow up intervals ( $p>0.05$ ) [Table-12 & Graph-12].

**Shah N, et al, (2016)** conducted a study on the effectiveness of an educational video in improving oral health knowledge on 126 subjects. The oral health education film was found to be effective in increasing oral health related knowledge of the subjects; and it was a positive tool for imparting oral health education and awareness concluding that a videotape can be a useful adjunct and can bring a sense of realism leading to a great impact on the population.

In a review published by **Rajat KS (2012)** on dental care for the deaf pediatric patient, they stated that knowledge of the etiology and consequences of deafness is invaluable to the dentist administering dental care to the deaf child. The dentist must be aware of the psychological aspects of the child and the child dependence on the parent. Once the dentist can understand this it will be easier for them to bridge the gap of communication and gain the patient's confidence, which in turn is a rewarding experience.



Comparison of oral hygiene indices (PI, CI and GI) revealed that plaque index and calculus values were maximum in aurally impaired children while gingival indices were maximum in visually impaired children. Plaque index was minimum in visually impaired while calculus and gingival indices were minimum in the control group. On evaluating the data further, it was observed that children with no impairment had significantly lower mean PI, CI and GI as compared to those with impairment.

Special children face difficulties during the process of tooth brushing including putting toothpaste on the tooth brush and using brushing technique. These difficulties can only be demonstrated by oral hygiene instruction. Various studies recommend different techniques of tooth brushing like simple scrubbing, bass method etc. The Fone's tooth brushing method was emphasized on in the present study as it is considered technically sound method that could be easily practiced and can be taught in a fun-filled way while interacting with any child. A considerable amount of information is already known to educate persons about the prevention of dental caries. If this information is put into practice, it could affect their prevalence or slow down the rate at which they progress as reported by **Murry (1983)**, **Azriana (2007)**. Motivation can increase the children's awareness of the importance of oral hygiene practice. In this study a follow up was done for every 3 months for one year until it was noticed that they could practice and were responsible for themselves. Each child was given a tooth brush at the start of the study and at each follow up as well to maintain a standard. A lack of motivation and facilities for regular oral health check-up & treatment also poor socioeconomic status of the parents and cost of treatment are the main factors for the accumulated treatment needs as stated by **Sanjay V (2014)**. Many studies (**Sutton; Tsamtsouris; Ivanovic and Lekic 1999**) have shown supervision of tooth brushing in children results in significant reduction of plaque and gingival indexes. Oral hygiene

instructional media as concluded by **Arnakul (2012)**, can not only improve a children's health, but close attention by teachers or parents or care givers can improve oral hygiene in children.

When the dentist understands these aspects, he will be attuned to the situation facing him, and will more readily be able to close the communication gap between him and the patient. Once this occurs and complete confidence is gained by the patient, the dentist will discover that performing dental care for the special child is the most satisfying and rewarding experience.

### ***CONCLUSION***

The present study was conducted in collaboration with various residential and day schools that included institutions for visually impaired, aurally impaired and regular schools in the district of Bahraich, Uttar Pradesh. The study was done with an aim to assess oral health status in visually and aurally impaired children and to compare the same after using different modes of communication i.e., ATP (Audio Tactile Performance) technique versus Audio aids and Sign Language versus Visual aids in children of age 6 to 14 years.

On the basis of observations made during the course of the study and their analyses, the following conclusions have been drawn:

- In Group I (Control- no impairment) verbal communication and demonstration was used to educate the children. They showed minimum oral hygiene scores among each group at base line record. A reduction in the existing oral hygiene scores was observed showing that healthy children have a good level of perception and understanding; they retain instructions and do not

always require constant reinforcement, thus, they can be relied on and can take responsibility for themselves.

- In Group II (Visually Impaired) two modes of communication i.e., ATP technique and audio aids were used. On evaluating oral hygiene index values, the subgroup instructed by using ATP technique had a better outcome as the children understood instructions with ease and related to demonstrations effectively as compared to the children instructed using audio aids.
- In Group III (Aurally Impaired) two modes of communication were used i.e., Sign language and video aids. It was observed that participants instructed by using Sign language understood instructions without difficulty and could relate to instructions demonstrated to them as compared to the participants instructed using video aids indicating that sign language was more effective for the aurally impaired compared video aids.

The differentially-abled form a substantial section of the community. Disabling conditions have varied effects, but one of the most common is the inability to maintain oral health. The present study may help in establishing a guide for oral hygiene status evaluation in visually and aurally impaired children.

Individual instruction is effective for teaching brushing methods and oral hygiene maintenance in children with impairments. A greater reliance must be placed on tactile stimuli used for teaching the visually impaired, clear verbal instructions acted out by touching should be used. The hearing impaired showed a lack of communication as a major hindrance for their access to oral health and they relied primarily on their teachers for special education through sign language. It was further concluded from this study that reinforcement of desired behaviour had a positive effect on learning of child and the inculcation of the preferred habit. The true measure of a society lies in the way it treats its impaired and underprivileged children.

If good oral health is to become a reality, it is paramount that people in constant association with such individuals become involved in oral care. The oral health care fraternity at large, must actively engage and participate with other sections of the community; as a result of which there will be general and social wellbeing and the affected may enjoy sustained and long-term oral health benefits.

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