# COMPARISON OF SALIVARY PARAMETERS WITH ORAL HYGIENE STATUS AMONG 12-15 YEARS OLD VISUALLY IMPAIRED AND NORMAL CHILDREN BEFORE AND AFTER ORAL HEALTH EDUCATION IN BELAGAVI, KARNATAKA - AN INTERVENTIONAL STUDY


**By**

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# Dissertation

*Submitted to KLE Academy of Higher Education and Research (KAHER), Belagavi*

*In Partial Fulfillment of the Requirements for the Degree Of*

**MASTER OF DENTAL SURGERY**

**IN**

**PUBLIC HEALTH DENTISTRY**

**(BRANCH –VII)**

**Under the Guidance of**

**DR. ANIL V ANKOLA** M.D.S


**DEPARTMENT OF PUBLIC HEALTH DENTISTRY**

**KLE VISHWANATH KATTI INSTITUTE OF DENTAL SCIENCES, BELAGAVI, KARNATAKA.**


**2019 – 2022**

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**This Dissertation is**

**dedicated to**

**The Almighty God,**

**My Parents,**

**&**

**My Family Members**

## *ACKNOWLEDGEMENT*

*No endeavour can start, continue and complete without the blessings of the* ***Almighty.*** *At the outset, I thank the almighty for always being by my side by bestowing strength and patience to complete the task entrusted.*

*I am privileged to express my extreme gratefulness, deepest regards and indebtedness to my respected teacher and guide* ***Dr Anil V Ankola*** ***M.D.S.,*** *Professor& HOD, Department of Public Health Dentistry, K.L.E. VK Institute of Dental Sciences, Belagavi, for providing continuous guidance. I had a great opportunity to learn from a person with such calibre and research expertise. His guidance, everlasting inspiration, incessant encouragement and constructive criticism, with valuable suggestions for improvement without whom the completion of this dissertation would not have been possible.*

*It is an honour for me to express my deep sense of gratitude to my respected teachers* ***Dr.Roopali Sankeshwari*** ***MDS, PhD,*** ***Dr. Sagar Jalihal*** ***MDS,*** *Department of Public Health Dentistry, KLE VK Institute of Dental Sciences, Belagavi for their ceaseless encouragement, support and guidance during the study. Their never ending willingness to render generous help to me in carrying out this work from its inception to its consummation is noteworthy.*

*My heartfelt thanks to* ***Dr Vinuta Hampiholi*** ***MDS*** *and* ***Dr Mahantesh Siddibhavi*** ***MDS*** *for their sincere help and support given to me throughout my course.*

*I am highly beholden to* ***Dr. Alka Kale*** ***M.D.S.*** *Principal, KLE VK Institute of Dental Sciences, Belagavi, for providing me the required facilities and infrastructure.*

*I would also like to extend my thanks to **Dr J B Prasad** and **Dr S B Javali** for guiding and helping me with their valuable inputs on the statistical part of this dissertation.*

*I take this opportunity to thank my batch mates and good friends **Dr. Deepika V Bhat and Dr Abhra Roy Choudhury** for their ceaseless support, kindness and constant help all throughout. I am thankful to my juniors **Dr Ram Surat Kumar, Dr. Atrey Pai Khot, Dr Mehul shah, Dr Anu Sara Varghese, Dr Varkey N. S** and **Dr Prajakta Chavan** for always letting me stay focused and for their help and co-operation.*

*I would also like to thank my seniors **Dr. Laxmi Kabra, Dr Barkha Tiwari, Dr Shefalika Priyam and Dr Supriya Vyavahare** for their guidance, moral support and timely help throughout my course.*

*I would sincerely like to thank my sister and best friend, **Dr. Shefali Pednecar** for giving me immense strength, inspiration and always standing by my side throughout.*

*I would also like to convey my heartfelt gratitude to my brother **Atharva Deshpande** and my dear friends **Dr Shrutika Salkar, Dr Nivedita Saxena, Keshav Dukle, Apoorva Barve, Prathmesh swar, Dr. Muktai Deshpande** for their eagerness and willingness to help me during the course. They have given me immense strength, inspired me and stood by me through thick and thin.*

*I am very much indebted to this department and extend my appreciation to all the **non-teaching staff** of the department for their able assistance.*

*I sincerely acknowledge the help from **Mr. Arun** and **Mr. Anand**, all the staff at Sri Vighneshwara Xerox centre, KLE Academy of Higher Education and Research without whom the task would have been left unaccomplished.*

*Last but not the least I would like to thank my parents, my father **Mr. Prashant M Deshpande**, for his inspiration, blessings and courage without whom this wouldn't be possible and I wouldn't be what I am today. My mother, **Mrs Anuradha P Deshpande** whose unconditional love, immeasurable support, understanding, innumerable sacrifices and prayers which they constantly shower on me and all my family members for their love, unstinted help and support.*

***Dr Apurva P Deshpande***

# LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| SHCN | : | Special health care needs |
| ATP | : | Audio Tactile Performance |
| VP | : | Visual Performance |
| WHO | : | World health organization |
| OHE | : | oral health education |
| DMFT | : | Decayed Missing Filled Teeth |
| def | : | decayed missing filled |
| OHI-S | : | Oral Hygiene Index - Simplified |
| GI | : | Gingival Index |
| PI | : | Plaque Index |
| TDI | : | Traumatic dental injuries |
| OHT | : | Oral health talk |
| PHP | : | Patient hygiene performance |
| *S. mutans* | : | *Streptococcus mutans* |
| DDPI | : | Deputy Director of Public Instructions |
| ANOVA | : | Analysis of Variance |
| SD | : | Standard Deviation |

| | | |
|---|---|---|
| RTF | : | Reduced transport fluid |
| MSA | : | Mitis Salivarius Agar |
| CFU | : | Colony Forming Units |
| HCL | : | Hydrochloric acid |
| DI-S | : | Debris Index – Simplified |
| CI-S | : | Calculus Index – Simplified |
| Min | : | Minute |
| mL | : | Millilitre |
| SES | : | Socio Economic Status |
| SPSS | : | Statistical Package for Social Sciences |
| µl | : | Microlitre |

# ABSTRACT

**Background:** One of the key factors for having good "oral health" is knowledge regarding oral hygiene practices. Lately, throughout the world, the emphasis on the educational approach in the prevention of dental diseases has increased. However, major challenge lies in educating and treating "Special Health Care Needs" (SHCNs) children, especially "visually impaired children". Assessment of multiple factors in development of oral diseases is also equally important. One such host factor of clinical significance is "saliva". The effect of specially designed "oral health education (OHE)" on the salivary parameters with "oral hygiene status" of SHCNs children and normal children has not been evaluated extensively.

**Aim:** To assess and compare salivary parameters with "oral hygiene status" among 12-15 year old "visually impaired" and "normal children" before and after oral health education in Belagavi, Karnataka.

**Methodology:** The current study was an interventional study conducted among "visually impaired school children (Group A)" and "normal school children (Group B)". Twenty-five children were selected from each group randomly based upon inclusion and exclusion criteria using computer generated table of random numbers. Socio-demographic details, oral hygiene practices and diet history were recorded. Oral education was delivered using Audio Tactile Performance (ATP) technique for visually impaired children and novel Visual Performance (VP) technique was used to impart oral health education to normal children. The "oral hygiene status" was assessed and compared using "Oral Hygiene Index – Simplified", "Plaque and Gingival Index" at baseline, 1 week and 1 month time interval in both the groups. Salivary physicochemical (pH, buffering capacity and flow-rate) and microbiological

parameters (*Streptococcus mutans* and *Lactobacillus acidophilus*) were also recorded and compared at baseline, 1 week and 1 month time interval in both the groups. Chi-square test, Mann-Whitney U test and Wilcoxon matched pairs test were applied.

**Results:** At baseline, debris scores, calculus scores, oral hygiene scores, gingival scores and plaque scores were on higher side in Group A than Group B. “Salivary pH”, “buffering capacity” and “flow-rate” in Group B were more than Group A at baseline. Microbiological parameters were more in visually impaired children when compared to normal children at baseline. Statistically significant improvement in oral hygiene status and salivary parameters were seen in both the groups after oral health education.

**Conclusion:** ATP technique for visually impaired children and VP technique for normal children to impart education in oral health are effective ways to improve oral hygiene status and salivary parameters. In the present study, the overall improvement in clinical parameters and reduction in *Lactobacillus acidophilus* count was more in normal children while improvement in “salivary pH”, “buffering capacity”, and “flow-rate” and reduction in *Streptococcus mutans* count was more in “visually impaired children”.

**Keywords:** visually impaired, ATP, oral health education, oral hygiene status, salivary parameters, *Streptococcus mutans, Lactobacillus acidophilus,* children

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# INTRODUCTION

**"Some of the most wonderful people are the ones who don't fit into boxes." ~ Tori Amos**

"Oral health" is a main indicator of overall health and it is rightly said that one is not healthy without good oral hygiene. World health organization (WHO) has conceptualized that oral health plays a vital role in the better and improved performance of individuals. It is responsible for sustaining enhanced quality of life and general wellbeing. One of the crucial factors for having good oral health is knowledge about oral hygiene practices.[1-4]

The health of children is governed by multiple interactions with the environment which are divided into the biological, behavioral, physical, social, and educational environment. However, such interactions may fail if they are perceived in a distorted fashion.[5-8]

The major challenge lies in educating and treating "Special health care needs (SHCNs)" children due to communication skill problems, and alternative pedagogical requirements. "Special needs is an umbrella term for a wide array of diagnoses, from those that resolve quickly to those that will be a challenge for life". Any child who is held back from accomplishing his/her potential physically, mentally, or socially belongs to SHCNs category.[9] It implies that a child cannot do things that other normal children of his or her age can easily accomplish.

Vision impairment is one such infirmity that has an inimical effect on the routine life of an individual. It is described by the WHO as "visual acuity of less than

3/60 m or corresponding visual field loss in the better eye with the best probable correction". This means, a visually impaired can visualize up till 3 m, while a non-visually impaired can view up till 60 m.[10]

WHO estimates that 36 million people around the globe are visually impaired whilst 11.7 million among them are in India.[11-12] According to the latest survey, there are 413,046,276 visually impaired children in India. It accounts for 72.9% of all the visually challenged children in South-East Asia who are below 15 years of age. [13]

Prevalence of dental diseases is high in visually impaired children when compared to normal children in India as quoted by the literature.[14-18] Lack of vision holds them back from noticing the changes that occur as they cannot perceive the world like normal children. This can further lead to development of various ailments because they are unable to recognize primary clinical manifestations. Early signs of gingivitis or dental cavities which can be typically identified through vision go unnoticed and hence appropriate precautions cannot be taken. These children although born healthy having healthy gums and teeth, their lifestyle such as eating, drinking, medication, negligence by parents or caretakers, socio-economic status influence their oral health. They are dependent on their parents and caretakers for their day to day routine proceedings including oral hygiene practices.[19-20] Improper access and knowledge to oral health education has a major impact on their oral health status.[21-22]

One of the intrinsic factors of clinical importance is saliva which serves as a mirror of the body's health. "Proteins, hormones, antibodies, and other molecules" are its major components that are often measured in routine blood investigation to keep a tab on health and diseases.[23-24]

Various Physicochemical properties of saliva like pH, buffering capacity, flow rate, microorganisms like *Streptococcus mutans*, *Lactobacillus acidophilus* have shown to have an impact on the oral hygiene status. Several medications used by special children alter the physical properties of saliva leading to dry mouth, burning sensation, ulceration, etc. Evaluation of salivary properties provides significant information about the risk for developing oral diseases and has been established as a sensitive parameter in caries prediction models.[23-25]

Studies till date have portrayed inadequate knowledge and awareness regarding "oral health" betwixt "visually impaired children" and "normal children" of the same age necessitating the need for appropriate oral health education.[15, 17, 26-27] Appropriate education would uplift their self-confidence and make them self-sufficient. Literature quotes various oral health education (OHE) intervention techniques for imparting knowledge to enlighten "visually impaired children" amongst which "Audio Tactile Performance" (ATP) technique is the most trending and effective method.[27-28]

The impact of specially curated oral health education on the salivary parameters with oral hygiene status of special health care needs children and normal children has not been evaluated extensively. Helen Keller has correctly said "Alone we can do so little; together we can do so much" which implies we live by each other and for each other. Hence the present study is formulated to uplift quality of life of "visually impaired children" with an aim to compare salivary parameters with "oral hygiene status" among 12 to 15 year old "visually impaired and normal children" before and after oral health education in Belagavi, Karnataka.

# REVIEW OF LITERATURE

"Oral diseases" constitutes a crucial public health concern among "special health care needs" individuals. Existing literature have exemplified high prevalence and severity of oral disease amongst this vulnerable group when compared to the general population.

Prashant ST et al in 2011 conducted a descriptive study "to assess the oral health knowledge, practice, oral hygiene status, and dental caries prevalence among visually impaired children in Bangalore". A total of eighty five children with vision impairment participated in this survey where they were asked questions regarding oral hygiene practices, role of sugar in dental caries and frequency of visit to the dentist. Caries experience was assessed using DMFT and def index and "Green and Vermillion" OHI-S index was used to assess oral hygiene status. The study highlighted the fact that an effective OHE method has not been well founded for children with vision impairment which may be the contributing factor for high dental caries prevalence and significant results were obtained with respect to "oral hygiene status" of "visually impaired children".[29]

An epidemiological investigation was administered among 228 children selected from 2 schools of comparable socioeconomic strata in Chennai city by KVKK Reddy et al in 2011. "The aim of the study was to assess and compare the prevalence of dental caries, oral hygiene, and traumatic injuries in visually impaired children and normal children". The study comprised of 128 visually impaired and 100 healthy children within the age bracket of 6 to 15 years. Criteria recommended by WHO in 1997 were harbored. This study revealed a high

prevalence of tooth decay, poor 'oral hygiene status' and high incidence of traumatic dental injuries in visually impaired children when compared to normal children.[30]

N Bekiroglu et al in 2012 conducted a descriptive study on 178 visually impaired students in Turkey. It was planned with an aim "to evaluate caries experience, oral hygiene status and oral health knowledge among visually impaired students". In this study, a 16-itemed questionnaire was administered to assess their knowledge regarding upkeeping of oral hygiene. DMFT, dft and oral hygiene index-simplified index were recorded. The results of the study revealed just 2.2% children with good "oral hygiene" whereas mere 26.4% children sans dental decay. In conclusion, sustenance of oral hygiene remains the greatest challenge in the care of visually impaired children.[31]

Jitender Solanki et al in 2013 conducted a cross-sectional study with an "aim to assess and compare the commonality of dental caries and oral hygiene among children with vision impairment and normal children". A total of 704 children belonging to 6-15 years were selected. 'World Health Organization primary oral health survey 1997 criteria' was used to record caries. The study delineated 60% and 31.5% prevalence of dental caries in children with vision impairment and normal children respectively. The oral hygiene status showed that the mean value in good category was found to be 0.19 and 0.67 in children with vision impairment and normal children respectively. This study also highlighted the need of appropriate OHE technique that can be better understood by children with vision impairment.[32]

A cross sectional study was conducted by Jain A et al in 2013 on 142 visually impaired pupils in the age of 6 to 18 years. The outcome variables checked were "oral

hygiene practices", "oral hygiene status", and "periodontal status". Age wise comparisons were made and significant results were reported with respect to bleeding scores. Bleeding scores were remarkably high in "9 to 11 years" and "12 to 14 years" in contrast to "6–8 years" and "15–18" years. This study concluded that the increased prevalence of bleeding sites could be because of the inability in seeing, identifying plaque and thereby inappropriate precautionary measures by the visually impaired group.[33]

A descriptive, cross-sectional study was conducted by Suresan V et al in 2017 amongst 238 visually impaired children, with an aim to "assess dentition status and treatment needs, oral hygiene status, and traumatic dental injuries among institutionalized children attending special schools for the visually impaired in eastern Odisha". Student's *t*-test, analysis of variance, and Chi-square test were statistical test applied. "Prevalence of dental caries" was 15% and 46% in primary and permanent dentition respectively. Mean oral hygiene index-simplified (OHI-S) was 2.43 ± 1.03 and the prevalence of traumatic dental injuries (TDI) was 11%. The study portrayed "high caries prevalence" and "poor oral hygiene" among "visually impaired children" and highlighted the need for excellent preventive dental care.[34]

**"Education is the most powerful weapon which you can use to change the world**."

– Nelson Mandela

Harbouring appropriate education in oral health is key for prevention of oral diseases in normal children as well as children with special health care needs. It is of

special importance while dealing with visually impaired children as they cannot visualize the world like normal children.

Hebbal M et al in 2012 conducted a non-randomised before and after comparison trial on 6 to 18 years' old visually impaired children. The motive of the study was "to generate and develop a special oral health education technique and compare plaque scores before and after oral health education (OHE)". The study comprised of 96 visually impaired children in the age range of 6 to 18 years. "Silness and Loe plaque index" was recorded and OHE was delivered using the "ATP Technique". Health education was reinforced after 9 months followed by reassessment of plaque scores post 18 months of intervention. The study highlighted surge in tooth brushing frequency post "health education". The mean PI score values pre and post education were "1.41 (±0.58) and 0.63 (±0.39)" respectively. Study revealed that children with vision impairment could maintain their "oral hygiene status" when taught using "Audio tactile performance" technique.[27]

A comparative, interventional study was conducted in 2016 by Bhor K et al among 12–17 years old visually impaired school girls studying in a residential school in Pune city. It was conducted "to assess the effect of oral health education (OHE) in the form of Braille and combination with Oral health talk (OHT) on oral hygiene knowledge, practices, and status of 12–17 years old visually impaired school girls in Pune city". The participants were categorized equally into 2 groups, namely, Group A ($n$ = 37) receiving OHE only in the form of Braille and Group B ($n$ = 37) receiving OHE in form of Braille and OHT. Knowledge in oral health was evaluated using a validated questionnaire (Marathi Braille). OHI-S index was recorded at baseline and 6 weeks to assess "Oral hygiene practices and status". The results showcased a

statistically remarkable increase in oral health knowledge levels in Braille and OHT group (4.95 ± 1.66) as compared to OHE group (2.97 ± 1.28). Significant increase in mouth-rinsing frequency was noted in Braille and OHT group (97.3%) as compared to OHE group (86.5%) at the end of 6 weeks. The study concluded that combination of Braille and OHT was more successful than OHE using only Braille.[35]

A 3-month follow-up study was conducted by Mahantesha T et al in 2015 with a goal "to compare the oral hygiene status among the visually impaired children in the age bracket between 6 to 20 years given with Braille and Audio instructions in Raichur city of Karnataka". Fifty children in the age group of 6 to 20 years were included in and randomly divided into 2 groups. Audio recordings were used to administer "oral hygiene instructions" to one group whereas Braille was used for the other. PHP index was employed for recording and comparing "oral hygiene status" and "dental caries experience". Reduction in "mean plaque score" indicating improved oral hygiene status was observed among both the groups. It revealed that OHE in "Braille" and "Audio" method was effective in achieving "good oral hygiene" levels in "visually impaired children".[36]

Aruna Kumari Ganapathi et al in 2015 conducted study with an aim "to evaluate effectiveness of various sensory input methods in dental health education among blind children". The study involved of 200 blind children with the age range of 8 to 14 years of both genders from two blind schools similar in standard of teaching. The total study population (n=200) was randomized and divided into five Groups (Group 1 – Audio, Group 2 - Braille, Group 3 – Tooth model group, Group 4 – Multisensory approach, Group 5 – Control) comprising of 40 children in each Group. Oral health related knowledge and plaque scores were assessed in all the study

Groups before and after dental health education. This study concluded that children with vision loss can upkeep an sufficient level of "oral hygiene" when taught with special customized methods like multisensory approach which was found to be effective than uni-sensory mode.[37]

Chowdary P B et al in 2016 conducted a prospective, interventional study with an aim "to evaluate the impact of verbal, braille text, and tactile oral hygiene awareness instructions on oral health status of visually impaired children". Three equal groups were made of one hundred and twenty children with vision impairment in the age bracket of 6 to 16 years. "Group I: Verbal and tactile", "Group II: Verbal and braille", "Group III: Verbal, braille, and tactile". Demonstration of steps for up keeping of "good oral hygiene and brushing technique" along with appropriate instructions was done. "Plaque index (Silness and Loe)" and "Gingival index (Loe and Silness)" was used for evaluating the oral health at 1, 3, and 6 months interval. All groups portrayed reduction in index scores for all groups. The study delineated that the amalgamation of all three, i.e., "verbal", "braille", and "tactile" mode of OHE aids proved to be effective.[38]

A randomized control trial was performed by Deshpande S et al in 2017 on 60 visually impaired adolescents. They were categorized equally into three groups which were Group 1 - Braille, Group 2 – "ATP technique" and Group 3 – "Combination of both methods" based on appropriate method of OHE. Pre and post scores were recorded by "Silness and Loe (1967)" plaque index. The study concluded that the conjugation of "Braille" and "ATP" technique was the most effective OHE method to impart education in oral health to visually impaired children.[39]

Randomized control trial was carried out by Barkha S Tiwari et al (2019) "to assess oral health status in visually impaired children before and after imparting three different modes of oral health education on 90 visually impaired children". They were assigned equally into 3 categories by "lottery method". Three educational modes included "ATP technique", "Braille text" and "combination of ATP + Braille". Plaque and gingival indices were employed for oral hygiene status evaluation. Findings of the study included poor awareness of oral health among visually impaired children. The children were not aware of tooth morphology, information regarding tongue cleaners, fluorides in toothpastes and dental floss. There was significant reduction in "plaque and gingival scores" at various intervals of the study when compared to baseline. Oral health status and knowledge regarding oral health improved significantly in group 3 where combination of Braille and ATP Technique were made use of.[28]

Sardana, D et al (2019) conducted a study on 148 visually impaired children "to evaluate efficacy of a specially designed oral health education programme and two different motivational techniques namely tactile (Group I: braille + plastic models) or auditory sensations (Group II: audio story + JAWS®, i.e. Job Access with Speech) over a period of 6 months". Pre and Post plaque and gingival scores were assessed. Significant enhancement in mean plaque and gingival scores was evident in both the groups at the 6-month evaluation, validating the effectiveness of both the programmes. The study concluded that Tactile and auditory measures were found to be effective in educating visually impaired children regarding maintenance of oral hygiene and knowledge regarding oral health.[40]

An interventional study was reported by Deolia S et al in 2019 on 92 visually impaired children in Wardha district. The aim of the study was "to check the

effectiveness of "Audio-tactile Performance Technique (ATP)" to improve oral hygiene status of visually impaired school children". Their cognition regarding oral hygiene practices was tested with a verbal questionnaire. Appropriate tooth brushing method was taught by "ATP" OHE method and a health talk was delivered. The plaque scores were recorded at baseline and after 3 months using the Quigley–Hein Plaque Index. Periodic reinforcement was given two times at time interval of 20 days in between the visits. Statistically remarkable reduction in the post interventional plaque scores and an increase in the post health education test scores was observed. The study concluded that the "ATP" along with oral health education served as a very effective method for teaching "oral hygiene practices" to the "visually impaired children".[41]

Charu Khurana et al in 2019 conducted a prospective non-randomized comparison trial among 165 children aged 7 to 19 years. "Oral health knowledge and practices", "Plaque index" (PI) and "Gingival index" (GI) was recorded at 1, 3, and 5 months follow-up interval. OHE was given in "Braille" language. The study revealed that, among "completely blind children", the mean difference of PI and GI score from baseline to the last evaluation was observed to be "0.56" and "0.28", whereas among "partially blind children", it was observed to be "0.58" and "0.25", respectively. The study delineated that acceptable level of oral hygiene was sustained by "visually impaired children" regardless of the degree of blindness among when OHE was given using Braille text.[42]

Caroline Stein et al (2016) conducted a systematic review with an aim "to evaluate the effectiveness of oral health education on oral hygiene and dental caries in school children". Clinical studies with school children in the age of 5 to 18 years old

were included. Outcomes variables assessed were caries, plaque, gingivitis, toothache or tooth loss published from 1995 to 2015 were included. Risk of bias was assessed using Cochrane Collaboration's tool. Meta-analysis was performed using fixed-effects models. A total of 4417 articles were screened, out of which 93 full texts were screened. Twelve articles were taken up for meta-analysis. Five studies demonstrated reduction in plaque levels, however two studies with gingivitis as the outcome found no effect. The systematic review highlighted that traditional OHE methods were effective in reducing plaque, but not gingivitis.[43]

Sadimin S et al in 2021 conducted an interventional study to determine the impact of dental health tele-promotion with animated video media on the knowledge and skills of tooth brushing among elementary school children. A total of 30 children joined in the study. The results of this study indicated that the level of knowledge of children improved significantly from 57% before treatment to 100 % after treatment. The study delineated significant improvement in tooth-brushing skills after imparting education in the form of animated video.[44]

Deokar R et al in 2021 conducted a study "to compare the effectiveness of three teaching methods on the oral health status of high school children". Random allocation of "791" children was done to three groups, namely group 1: Webinar group—260 subjects, group 2: Face to Face lecture using PowerPoint presentation—261 subjects and group 3: Control group—270 subjects. Oral Hygiene Index (OHI) and Gingival Index (GI) were recorded at baseline, at 1 month, 2 months' and 3 months' time periods. OHI and GI showed a significant reduction ($P = 0.001$) in the group 1 and group 2. The study concluded that "Face to Face lecture using

PowerPoint presentation" was most effective OHE method followed by "Webinar approach".[45]

"Dental caries" is a "multifactorial disease". A variety of "potential predictors" have been identified for their relation with "caries increments" such as characteristics of occlusal morphology, levels of "*Streptococcus mutans* and *Lactobacilli"*, salivary buffering capacity, dietary factors, sex, race, pH, salivary flow rate and socioeconomic status etc. Identification of these predictors at primary stage help in administration of specific prevention.

According to Bratthall (1980) and Loesche (1986), high caries risk have been associated when levels of *S. mutans* exceed $10^6$ CFU and/or *Lactobacillus* spp. exceed $10^5$ CFU of bacteria per 1 ml of saliva.[46-47]

Smiech-Slomkowska G et al in 2007 conducted a study "to determine the influence of oral hygiene instruction (OHI) on oral hygiene status and on the reduction of inducing bacteria". The study participants comprised of thirty subjects (12 males and 18 females) within the group from 10 to 14 years. The "Plaque index" (PI) was used to gauge oral hygiene status, and the level of *S. mutans* and *Lactobacillus* spp. which was determined using the colour reaction time (CRT) test before and after 1 month of OHI. The percentage of children with PI exceeding score 1 decreased from 23.3% to 10%. Whereas, for those with a PI below 0.1, it increased from 20% to 60%. Percentage of subjects with excessive levels of *S. mutans* decreased after OHI but only from 73.3% to 70%. No significant change was noted with *Lactobacillus* species.[48]

Prabhakar AR et al in 2009 performed an interventional study "to study the relationship between the physicochemical properties of saliva such as pH, flow rate,

buffering capacity, calcium level, total protein and total antioxidant levels in caries free and caries active children". 120 participants were divided into two groups which was again further categorized as "caries free" and "caries active" with 15 children in each arm. "Unstimulated saliva" was collected and "flow rates" were determined. The collected samples were then analyzed for "pH, buffering capacity, total protein, calcium and total antioxidant levels". The data was then statistically analysed using un- paired 't' test. The findings of the study revealed reduction in "flow rate, pH and buffering capacity" in caries active children. However, "total protein" and "total antioxidant capacity" of saliva increased significantly in "caries active children". The study concluded that the physicochemical properties of saliva play a major role in the development of caries.[49]

B. Sakeenabi et al in 2011 conducted a study with an aim "to assess the possible relationship among salivary cariogenic microflora, buffer capacity, secretion rate, and caries experience among 6-year-old school-going children in Davangere city, India". A sample size of 196 was considered and two-stage random sampling method was harboured. "Clinical examination" was performed to estimate "dental caries experience". "Stimulated saliva" was collected to assess "salivary physicochemical and microbiological parameters". Significant correlation was seen between mean the "caries score" and "salivary parameters". Increased levels of bacterial counts in saliva in association with caries data obtained, emphasize on the importance of "salivary parameters" and need to uptake preventive procedures. [50]

Mamata Hebbal et al in 2012 conducted longitudinal study "with an aim to assess the caries profile of 12 year old Indian children using Cariogram". Hundred "children" were enquired regarding and any "illness", "oral hygiene practices" and "fluoride exposure" after obtaining a three day diet diary were recorded. Plaque

scores and dental caries were recorded. Stimulated saliva was collected and salivary physicochemical and microbiological parameters were checked. Cariogram was created based upon the recorded information. Significant correlation was noticed between cariogram score and DMFT, diet content, diet frequency, plaque scores, *Streptococcus mutans* counts and fluoride programme. The study highlighted that variables like "caries experience", "*Lactobacillus counts"*, "*Streptococcus mutans"*, "diet frequency", "salivary flow rate", "Buffering capacity", "fluoride programme" and "plaque amount" present significant correlation with the "caries risk". These parameters can facilitate the dental surgeon to plan out suitable course of action in their routine clinical practice.[51]

Eşian D *et al* in 2017 conducted a study with an aim "to establish the correlations between the salivary levels of *Streptococcus mutans* and *Lactobacillus* with the degree of caries activity in children". Sixty children were selected who were in the age bracket of 6 to 11 years and assigned to 2 groups: "children from urban community" and "children from rural community". Both the groups were further subdivided into three sub-groups based on caries-activity. "Salivary *S. Mutans* and *Lactobacillus"* were determined by "CRT Bacteria test". Significant association between the "degree of caries activity in children" and "the salivary levels of *Streptococcus mutans*", was noted with certain differences with variations in age, sex and living environment of children assessed. Salivary levels of "*Lactobacillus"* and "degree of caries-activity" demonstrated no significant difference statistically. Study concluded that prompt detection of caries risk and adoption of specific preventive measures can be made possible by early detection of salivary level of cariogenic microorganisms.[52]

# AIM AND OBJECTIVES

**AIM:**

- To assess and compare salivary parameters with “oral hygiene status” among 12 to 15 year old visually impaired and normal children before and after oral health education in Belagavi, Karnataka.

**OBJECTIVES:**

- To assess and compare “oral hygiene status” in visually impaired and normal children.
- To assess and compare Physicochemical Salivary Parameters (“Salivary pH, Buffering capacity and Flow rate”) in visually impaired and normal children before and after Oral Health Education.
- To assess and compare microbiological parameters of saliva (*Lactobacillus acidophilus* and *Streptococcus mutans*) in visually impaired and normal children before and after oral health education.
- To assess and compare caries experience in visually impaired and normal children.

# HYPOTHESIS

**NULL HYPOTHESIS**: There is no difference in the "oral hygiene status" and "salivary parameters" of "visually impaired children" and "normal children" after "oral health education".

**ALTERNATIVE HYPOTHESIS:** There is difference in the "oral hygiene status" and "salivary parameters" of "visually impaired children" and "normal children" after "oral health education".

# MATERIAL AND METHODS

**Study design:** Interventional study

**Study duration:** The study was carried out from July 2021 to November 2021.

**Study population**: 12 -15 years old children from visually impaired school and regular school in Belagavi, Karnataka.

**Inclusion criteria:**

- Visually impaired children having "visual acuity ranging from 6/60 to 1/60" and normal children belonging to age group of 12 to 15 years.
- Children with completely erupted index teeth.
- Children who gave assent and children's parents/guardians who gave written consent.

**Exclusion criteria:**

- Parents/guardians not agreeing to give consents.
- Children wearing orthodontic appliances.
- Children with any systemic diseases, children on antibiotics 1 week before or during the course of the study and children using any "chemical mode of plaque control" during the course of the study in past 1 month.
- "Medically compromised children", children with "intellectual disability" and children with multiple conditions like visual impairment along with other condition.

**The following protocol was set prior to commencement of the study;**

I. Pretesting survey

   a) Sample size estimation and sampling technique

   b) Preparation of the questionnaire and assessment forms.

   c) Preparation of educational animated video for normal children

   d) Training and calibration of the examiner and pilot study to assess flaws and feasibility.

II. Approval from Institutional Review board, Deputy Director of Public Instructions (DDPI), Headmasters of the schools.

III. Selection of the schools for the study

IV. Screening of the participants according to inclusion and exclusion criteria

V. Obtaining informed consent and assent

VI. Procuring instruments and materials required for the study, sterilization protocol and personnel required.

VII. Baseline assessment of plaque scores, gingival scores, oral hygiene status score, dental caries experience, salivary physico-chemical parameters (pH, buffering capacity and flow-rate) and salivary microbial parameters (*Streptococcus mutans* and *Lactobacillus acidophilus*)

VIII. Administration of appropriate specialized oral health education

IX. Revaluation of parameters at 1 week and after 1 month.

## I. Pre-testing survey

### a) Sample size calculation and sampling technique

"Sample size" estimation was based upon the differences in Pre and Post education in Gingival Index scores as per the study done by Shetty V et al, 2014.[53]

**Type I error of 5%, power as 80% are considered.**

Mean and standard deviation in Group A (pre oral education) and Group B (post oral education) as 1.49 ± 0.40 and 1.19 ± 0.23 respectively were taken into consideration. Since the study involves follow up, **dropout was considered to be 30%.**

Following formula was used;

$$n = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 \ (SD_1^2 + SD_2^2)}{(\bar{x}_1 - \bar{x}_2)^2}$$ Where ,

$Z_{1-\alpha/2}$ corresponds to two-tailed significance level (1.96 for .05)

$Z_{1-\beta}$ corresponds to power (.84 = 80% power)

SD corresponds to standard deviation

$\bar{X}_1 - \bar{X}_2$ corresponds to effect size

$$n = \frac{(1.96 + 0.85)^2 + (0.4^2 + 0.23^2)}{(1.49 - 1.19)^2}$$

= 18 × 1.30 (1.30 is multiplied considering 30% dropout)

= 24. 28, Obtained value is rounded up to 25 in each group. So total sample size is **50**

"*p*- value less than 0.05 was considered statistically significant".

**Sampling technique:**

Simple random sampling technique using computer generated table of random numbers was used to achieve required sample size.

**b) Preparation of the questionnaire and assessment forms.**

This questionnaire was divided into 2 parts [Annexure IX]:

- First part was for recording socio demographic data, past medical and dental history, food and dietary habits, oral hygiene practices.
- Second part was for recording "Gingival Index (GI)", "Plaque Index (PI)" and "Oral Hygiene Index – Simplified (OHI-S)", "Decayed Missing Filled Teeth Index (DMFT)", physicochemical and microbiological parameters of saliva.
- The questionnaire was translated into Kannada and Marathi language by person well versed in that language. The translated questionnaire was then checked for grammar and comprehension.
- "A periodic assessment form" was prepared for evaluation of plaque, debris and calculus scores along with salivary physicochemical and microbial parameters at baseline, 1 week and after 1 month.

**c) Preparation of educational animated video for normal children:**

A self-designed customized animated video was developed describing development of "oral diseases", "oral hygiene practices", relation of "oral health" and "general health", 5 golden rules and appropriate brushing technique. The content of the video was evaluated by 4 subject experts and was found to be satisfactory.

**d) Training and calibration of the examiner and pilot study to assess flaws and feasibility:**

**Training and Calibration:**

Prior to conducting the study, the calibration of the examiner (principle investigator) was done to record indices "(Plaque Index, Gingival Index, Decayed Missing Filled Teeth Index and Oral Hygiene Index – Simplified)" used in the study, in "Department of Public Health Dentistry, KLE VK Institute of Dental Sciences, Belagavi" under the guidance of a subject expert in order to limit the "intra examiner variability". "Recording assistant was trained in documenting the readings accurately". The intra examiner variability was calculated using "Kappa statistics".

| Parameter | Kappa values – Intra Examiner |
|---|---|
| Plaque index | 0.90 |
| Gingival index | 0.86 |
| Oral Hygiene Index - Simplified | 0.84 |
| DMFT Index | 0.94 |

**Pilot study**

It was performed on "10 children" from normal school and "10 children" from visually impaired school to assess flaws and feasibility of the study. No major flaw was reported.

**II. Approval from Authorities**

Permission to conduct the study was obtained from all the concerned authorities

1. Institutional Review Board (Ethical Committee of the institution). [Annexure – I]
2. Deputy Director of Public Instructions (DDPI), Belagavi.
3. Headmasters of the respective schools. [Annexure – IIa and Annexure – IIb]

**III. Selection of the schools for the study**

A list of all the government schools for normal children was obtained from Deputy Director of Public Instructions (DDPI), from these schools, one school randomly selected.

One more list of special schools in Belagavi was obtained from Deputy Director of Public Instructions (DDPI), from which one school for visually impaired was selected.

The schools selected were;

1. Maheshwari school for the blind, Nehrunagar, Belagavi
2. G.G Yellur, Siddharamesh primary school, shivbasavnagar, Belagavi

**IV. Screening of the participants according to inclusion and exclusion criteria**

All the participants aged between 12-15 years were screened for inclusion and exclusion criteria from both the schools.

**Assignment of the study participants to 2 different groups:**

- **GROUP A** - Children of age 12-15 years attending school for visually impaired.
- **GROUP B** - Children of the age 12-15 years attending regular schools.

A total of 57 children from "visually impaired" school aged 12-15 years underwent the screening procedure of which 34 children fulfilled the "inclusion and exclusion criteria".

A total of 97 children from normal school aged 12-15 years underwent the screening procedure of which 58 children fulfilled the "inclusion and exclusion criteria".

Of these, 25 subjects in each group were selected randomly from both the schools by using computer generated table of random numbers, making a total sample size of 50.

**V. Obtaining Ethical clearance, Informed consent and Assent**

Ethical approval was obtained from Institutional Research and Ethics Committee, KLE V K Institute of Dental Sciences, Belagavi (Reference number – 1307). Permissions were taken from school headmasters of both the schools. Details and need for the study were explained to the parents/guardians and children on the scheduled date in the language that was most acceptable by them.

Once the study procedure was explained, a written informed consent was obtained from guardians/parents. Assent was obtained from the children to conduct their oral examination and salivary parameters evaluation. [Annexure – III and IV]

Parents and children were encouraged to ask questions to the investigator. All the participants were informed that they were free to drop out from the study anytime they want.

## VI. Instruments and Materials used in the study, method used for sterilization and personnel involved in the research

**Instruments and materials used during the study**

1) **Instruments for clinical examination**

- Mouth mirror
- Explorer
- CPI probe
- Tweezers
- Kidney tray
- Disposable gloves
- Savlon solution
- Checklist

2) **Materials for oral health education**

- Teeth model
- Tooth brush
- Animated video
- Laptop
- LCD Projector

**3) For saliva collection and analysis –**

- Sterile Eppendorf tubes for saliva sample collection
- Disposable syringes
- Reduced transport media (RTF)
- 0.005 m Hcl

**4) Materials used for microbial analysis**

- Test tubes
- Culture plates
- MSA agar media (Mitis Salivarius Agar)
- Rogosa SL
- Inoculating loops
- Spirit lamp
- Incubator
- Electron microscope
- Micropipette
- Normal saline

**Sterilization protocol**

The present study was conducted during COVID 19 Pandemic. Strict standard operating protocol was followed as the study involved saliva collection and analysis of saliva. Disposable mouth-mask and gloves, surgical gown were worn by the investigator throughout the study. Instruments were sterilized in the department in autoclave at $121^0$ C, 15 lb. pressure for 15-20 minutes. Twenty five sets of sterilized diagnostic instruments such as Mouth mirrors, CPI and Periodontal probes, explorers and tweezers were carried to the schools to conduct examination. Sterile eppendorf

tubes were used for saliva collection. Spot disinfection was done during the study (if required) using chemical disinfecting solution (Korsolex 2%)

**Personnel involved in the research:**

**Principle investigator –** did selection of the schools, obtained permission from schools, conducted "primary screening" and selection of the participants, collected data at baseline and after 1 week and after 1 month.

**Recording clerk –** assisted the examiner in recording socio-demographic details, Plaque Index, Gingival Index and Oral Hygiene Index – Simplified.

**Microbiologist** – assessed the salivary *Streptococcus mutans* and *Lactobacillus acidophilus* in colony forming units (CFU/ml) and prepared necessary chemicals for buffering capacity and transport media.

**Statistician –** Performed the data analysis. He was blinded to the type of children (normal/ visually impaired).

Prior to the beginning of the study, the investigator obtained permission from the school and the dates for the examination and data collection were scheduled.

## VII. Baseline parameters evaluation

The schools were visited on the scheduled dates and salivary physicochemical parameters (pH, buffering capacity and flow-rate) for all the selected children were evaluated followed by saliva collection for microbial analysis. After salivary parameters evaluation, "Plaque Index", "Gingival Index", "Oral Hygiene Index-Simplified" and "DMFT Index" were recorded. All the clinical examinations and

evaluation was conducted by the principle investigator. Type III examination was performed under natural lighting conditions.

**DETAILS OF THE PROCEDURES CONDUCTED DURING THE RESEARCH**

- The children were examined for:

1. Salivary physico-chemical and microbiological parameters
2. "Gingival Index (GI)"
3. "Plaque Index (PI)"
4. "Oral Hygiene Index-simplified (OHI-S)"
5. "Decayed Missing Filled Teeth (DMFT) Index"

**1. Saliva collection and Clinical Examination (At baseline, 1 week and 1 month)**

**Saliva collection:**

Standardized techniques of salivary assessments were used to make them cost effective and applicable for the field study. The collection of saliva was done between 8 and 11 am to maintain the circadian cycle. Children were asked not to eat, or drink any beverages except water, and to not perform any particular oral hygiene except rinsing the mouth with drinking water. The patients were given drinking water and asked to rinse their mouth well. Five minutes after this oral rinse, salivary parameters evaluation was performed. The patients were also asked to not cough up mucus during saliva collection.[50-52, 54-56]

**Physicochemical parameters of saliva:**

- **Salivary flow rate** – The collection of saliva was done between 8 and 11 am in Coachman position with passive drooling for a period of 5 minutes. The total quantity of saliva thus collected was divided by 5 to obtain the unstimulated salivary flow rate (USFR) per minute.

- **Salivary pH-** salivary pH was analysed using colour indicating pH strips of specific range. One drop of saliva was placed on the strip. Colour change was noted and compared with pH colour scale provided with strip.

- **"Buffering capacity** – "0.5 mL of saliva was added to 1.5 mL of 0.005 molarity Hydrochloric acid (HCL)". pH strip was dipped into this solution. Colour change was noted and compared with pH colour scale provided with the strip. The pH noted was the buffering capacity of saliva.

**Microbiological Parameters of Saliva:**

- Saliva was collected in disposable syringe and 1 mL of saliva was injected into 1 mL of "Reduced transport fluid" (RTF) transport media. "The saliva samples of all the subjects were identified by code number during the period of sample collection and processing." Same code was used for particular subject during subsequent sample collection. The sample was transported to the laboratory immediately after collection and cultured on the same day. The processing was done at Basic science research laboratory, KAHER and Department of Microbiology, JNMC, KAHER and mean was considered as the final value.

- Samples were vortexed to uniform mix of saliva using vortex mixer. 1st dilution of the sample was 1:2 (1mL of saliva sample into 1mL of RTF). Next dilution comprised of dilution of saliva (100 µl of the above mixture) into 4.5 ml of thioglycolate broth. Hence, then the dilution became 1:50. Taking into account the previous dilution (1:2) and the next dilution (1:50), the dilution then became 1:100, of which 10 µl was plated on individual media being Mitis Salivaris agar for "*Streptococcus mutans"* and Rogosa SL for "*Lactobacillus acidophilus"* using inoculation loop. Now the final dilution is 100 x 100 = 1 x $10^4$. The plates were incubated for 48 hours at $37^0$ C in 5 – 10 % $CO_2$ jar for 48 hours. After 48 hours, colony characteristics were studied and the number of "colony forming units" of "*Streptococcus mutans* (CFU/mL)" and "*Lactobacillus acidophilus* (CFU/ml)" of saliva were determined.

**Formula used for calculating colony forming unit:**

$$N = \frac{\text{colony forming unit} * \text{Dilution Factor}}{\text{Volume of the plate}}$$

Dilution factor – $10^4$, Volume of the plate – 10µl = 0.01 ml

*Streptococcus mutans* and *Lactobacillus acidophilus* were identified by colony morphology and characteristics on Mitis Salivaris agar and Rogosa SL selective media respectively. They were identified at genus level by gram staining.

**Gram staining procedure:** On a glass slide, three smears were made. One was positive control being standard strain of *Streptococcus mutans*, second one was the sample smear and third smear was negative control of *Escherichia Coli*. On the other slide again three smears were made, one being standard strain of *Lactobacillus acidophilus*, second one was the sample smear and third smear was negative control of *Escherichia Coli*.[56]

**Step 1 – Fixation**

The smears made on the slide were air dried and heat treated.

**Step 2 – Primary stain**

Crystal violet was applied for 1 minute followed by rinsing with water.

**Step 3 – Mordant**

Grams iodine was applied for 1 minute followed by rinsing with water

**Step 4 – Decolorization**

Acetone was applied for 2-3 seconds and rinsed with water

**Step 5 – Couterstain**

Safranin was applied for 30 seconds and rinsed with water and blotted dry.

The slide was then observed under electron microscope.

2. **Gingival index[57] (At baseline, 1 week and 1 month)**

   Gingival Index (GI) developed by **"Loe H and Silness J"** in the year 1963, was used to describe the clinical severity of gingival inflammation. [Annexure V]

3. **Plaque index[58] (At baseline, 1 week and 1 month)**

   **"Silness J. and Loe H."** Plaque Index (PI) (1964) was used for assessing the amount of dental plaque. [Annexure VI]

4. **Oral hygiene index – simplified[59] (At baseline, 1 week and 1 month)**

   Dental Calculus and debris were assessed by "**John C. Greene" and "Jack R. Vermillion's"** Oral Hygiene Simplified Index (OHI-S). [Annexure VII]

5. **Decayed Missing Filled Teeth Index[60] (At baseline)**

   Children were clinically assessed according to the WHO oral health assessment form. This involves the sum of "Decayed, Missing, and Filled teeth (DMFT for permanent teeth and dmft for primary teeth)". Plain mouth mirror and CPI probe were used to record Decayed Missing Filled Teeth (DMFT) Index. Each tooth was wiped with cotton and dried prior to examination. [Annexure VIII]

**VIII. Administration of appropriate specialized oral health education**

**For Group A, Audio tactile performance technique was used to impart oral health education to visually impaired children.**

In this method, the children were 1st informed verbally about the importance of teeth, method of brushing (Audio) and then they were made to feel the teeth on a large sized model (tactile) followed by brushing on the model using the "Modified Bass method" with assistance (performance). "This was repeated until the children could perform with ease". In addition, all the children, were explained about formation of oral diseases, diet counselling and were enlightened regarding five golden rules to maintain good oral hygiene and health.

**For Group B, Novel Visual performance (VP) technique was used to impart oral health education to normal children.**

In this method, the children were shown animated video describing development of "oral diseases", "oral hygiene practices", relation of "oral health" and "general health", 5 golden rules and appropriate brushing technique. After the video, all the children were asked to demonstrate the brushing technique on the tooth model and were asked questions based on the content of the video.

**Following oral hygiene instructions were covered for both the schools**

**Oral Health Education Instructions:**

- Brush twice daily (once in the morning and once at night).
- Use soft bristled tooth brush and toothpaste containing fluoride.
- 2-3 minutes should be spent for cleaning the teeth.
- Change the brush after 3 months.
- Tooth paste poured on the toothbrush should be of pea size.
- Eat healthy food such as fruits and vegetables.
- Avoid sticky food e.g. chocolates.
- Rinse the mouth with water after eating.
- Clean the tongue with the help of toothbrush or tongue scrapper.
- Massage your gums with the help of index finger.
- Visit dentist every 6 months.

**Brushing technique: Modified bass brushing technique was taught to them to enhance level of cleaning.**

**IX. Revaluation of parameters at 1 week and after 1 month.**

All the clinical parameters (Gingival Index, Plaque Index and Oral Hygiene Index – Simplified), salivary physicochemical (pH, buffering capacity and flow rate) and microbial (*Streptococcus mutans* and *Lactobacillus acidophilus*) parameters were evaluated at 1 week and 1 month from baseline examination.

**STATISTICAL TEST:**

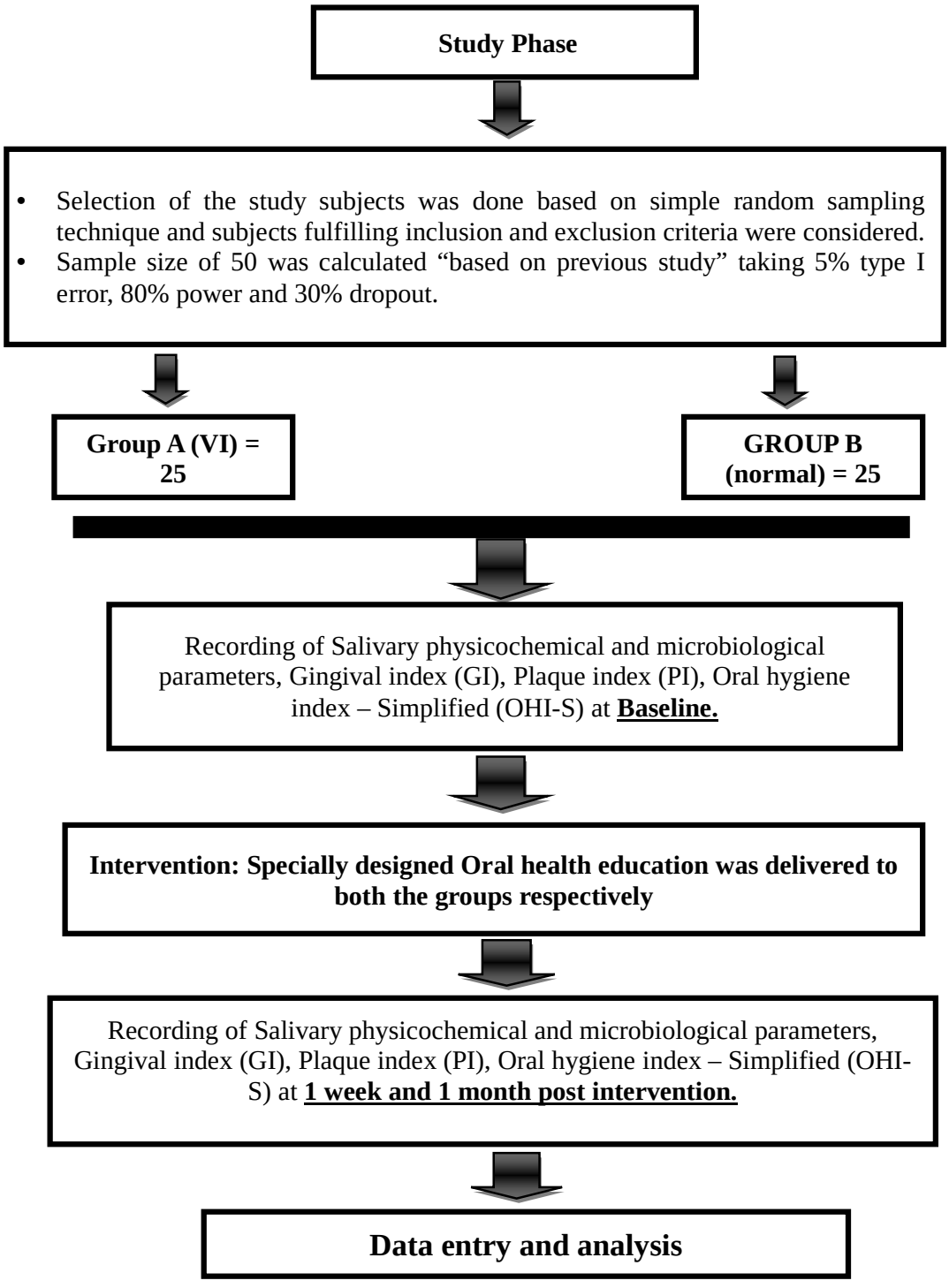
Data was entered in Microsoft excel and analysed using SPSS for windows, Version 21; SPSS Inc. (Chicago IL, USA). Descriptive statistics were used to calculate frequencies, percentage and mean values. The data obtained was subjected to normality (Shapiro-Wilk) test to check for normal distribution.

- Comparison of oral hygiene status and salivary parameters at (baseline, 1 week and 1 month) between normal and visually impaired groups was done by unpaired t test/Mann-Whitney U test.

- Comparison of change between pre and post oral health education test scores (oral hygiene status and salivary parameters) was done by paired t – test/Wilcoxon matched pairs test.

- *"p- value* of less than 0.05 was considered as statistically significant value for all the comparisons".

## METHODOLOGY WITH FLOWCHART:



## STUDY SETTING

**Study setting 1 -** Maheshwari School for the blind

**Study setting 2 -** G.G Yellur, Siddharamesh primary school

**Figure 1: Two schools where the study was conducted**

## STUDY POPULATION

**Study population 1 (Group A - Visually impaired children)**


**Study population 2 (Group B – Normal children)**

**Figure 2: Two study populations selected**

**Figure 3: Obtaining assent**

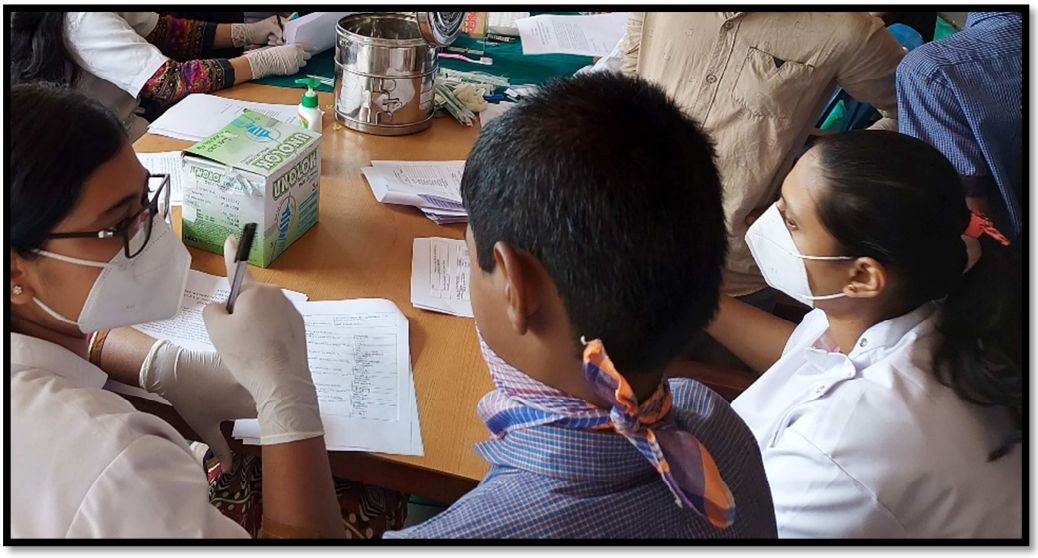


**Figure 4: Recording of socio-demographic details**

**Group A – visually impaired child**


**Group B – Normal child**

**Figure 5: Oral examination of both the groups**

**Figure 6: Salivary flow rate examination**


**Figure 7: Collection of saliva for salivary pH and buffering capacity**

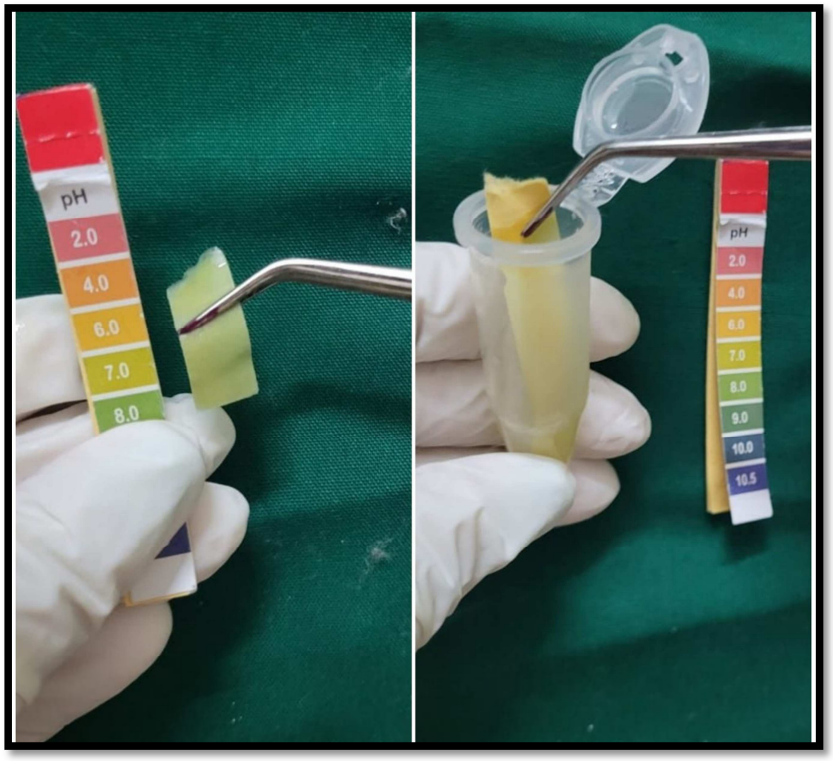



**Figure 8: Assessment of salivary pH and buffering capacity**


**Figure 9: Saliva collection for microbial examination**


**Figure 10: Health Education for visually impaired children using ATP technique**


**Figure 11: Health Education for normal children using Visual performance technique**

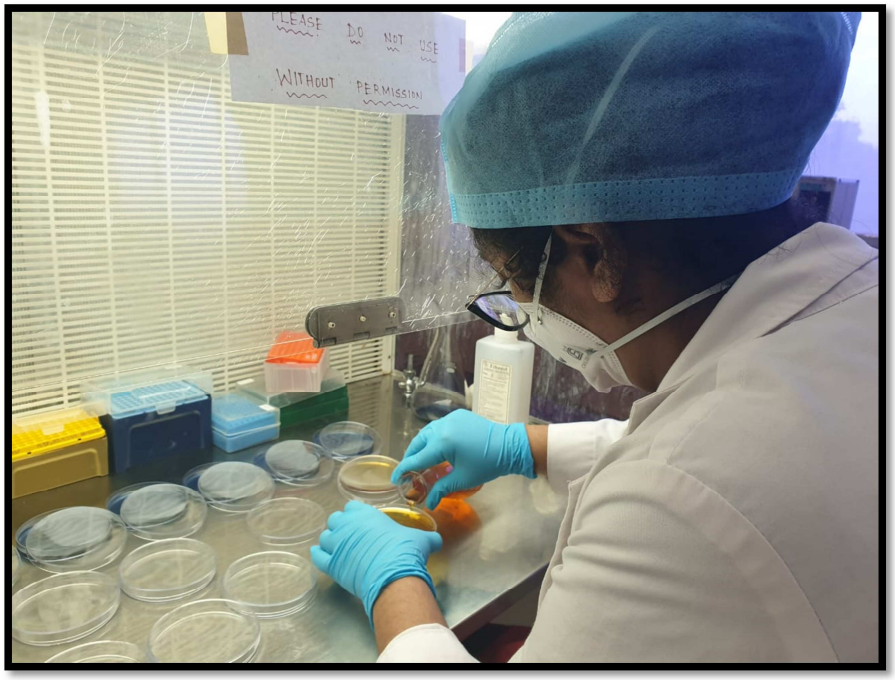



**Figure 12: Preparation of Petri plates with respective media**

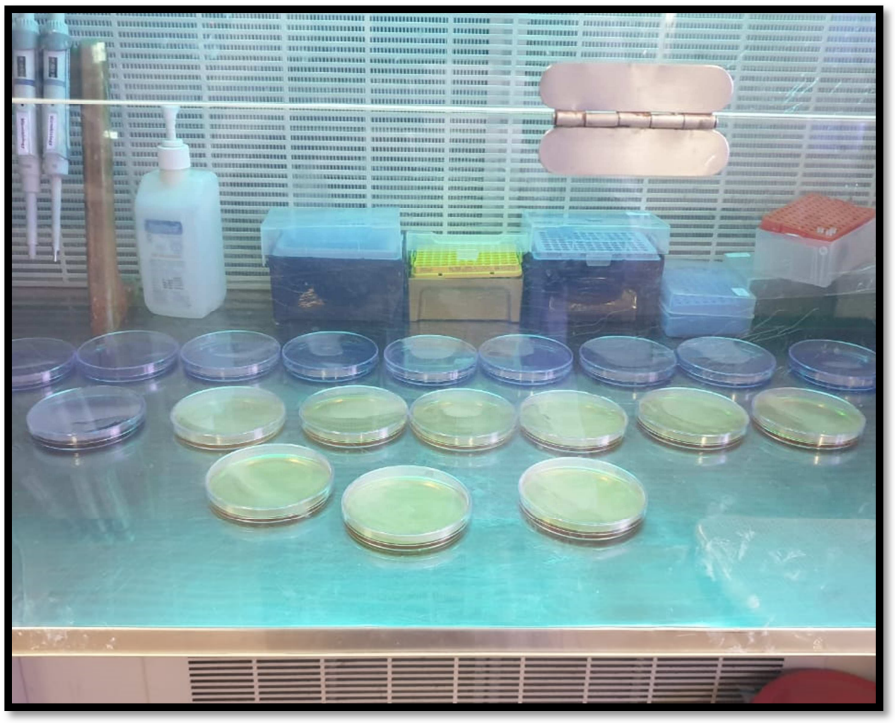


**Figure 13: UV Sterilization prior to streaking the petri plates**

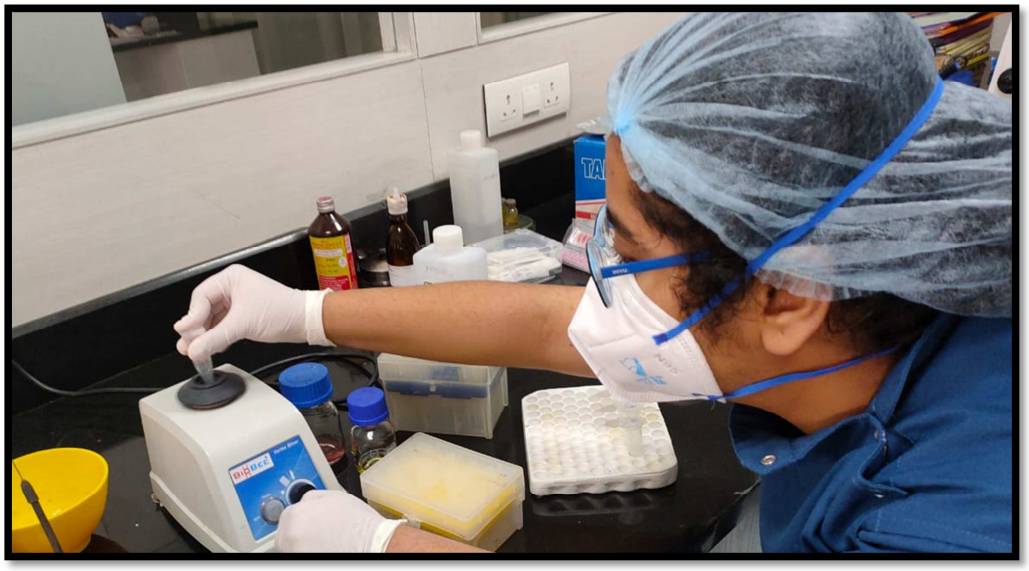


**Figure 14: Vortexing of the collected sample at laboratory**

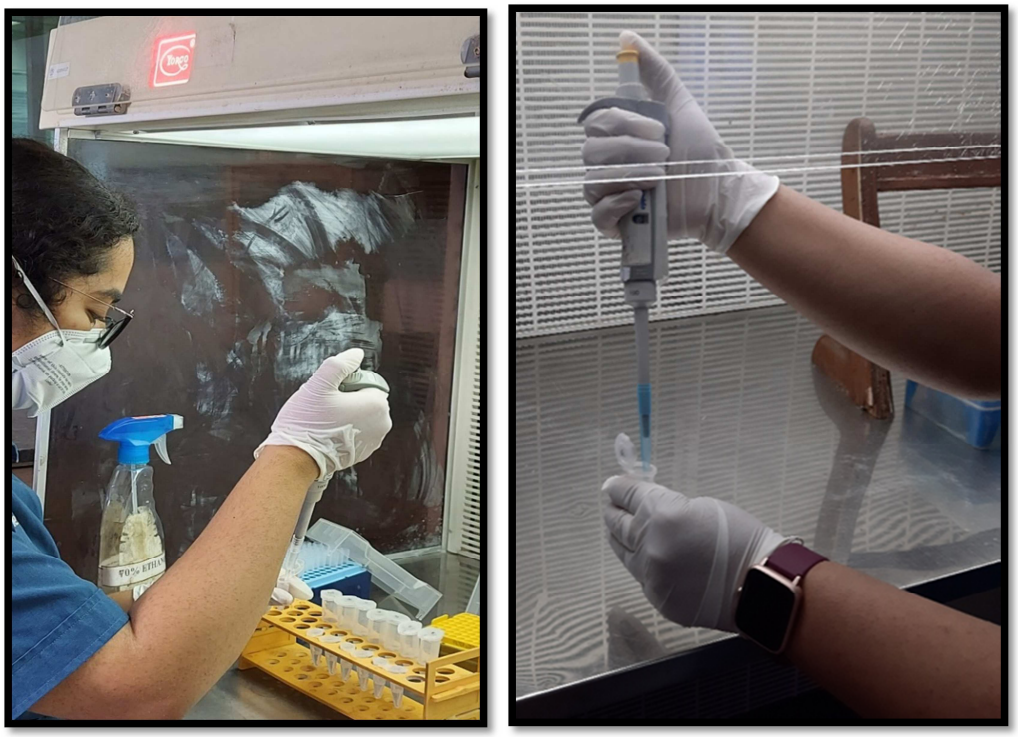


**Figure 15: Dilution in thioglycolate broth**

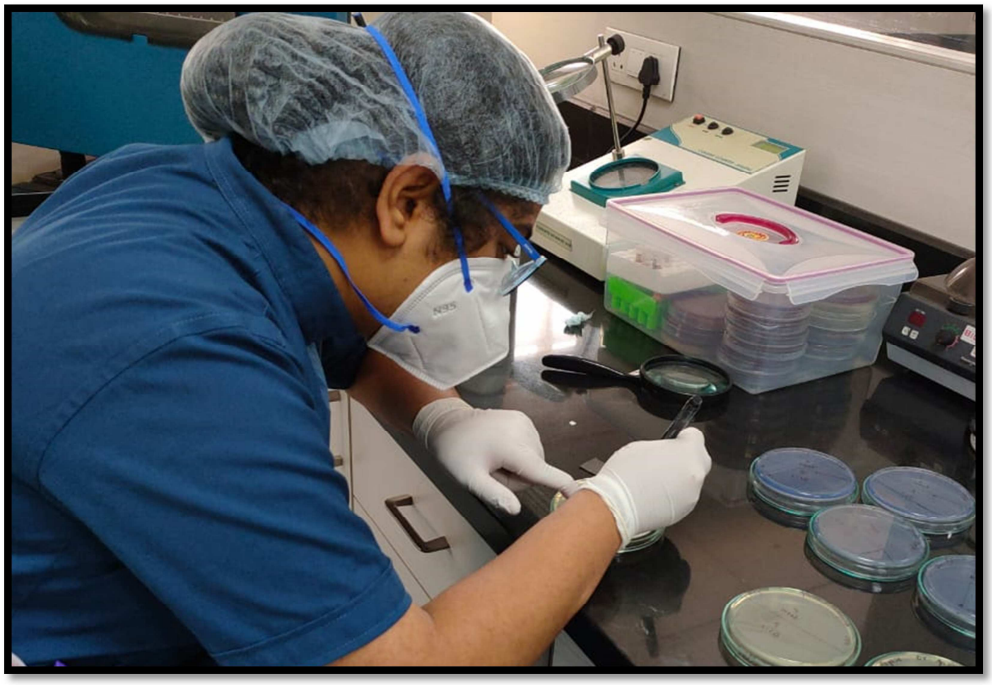


**Figure 16: Coding the plates for sample identification**

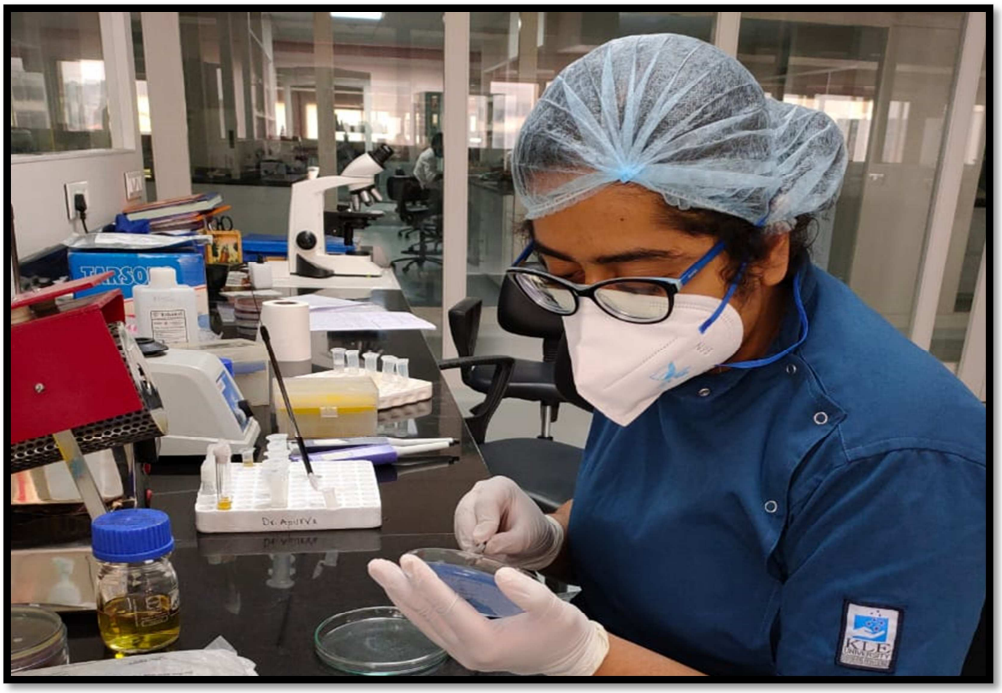


**Figure 17: Streaking of the Agar plate from collected saliva sample**


**Figure 18: Incubation of samples**

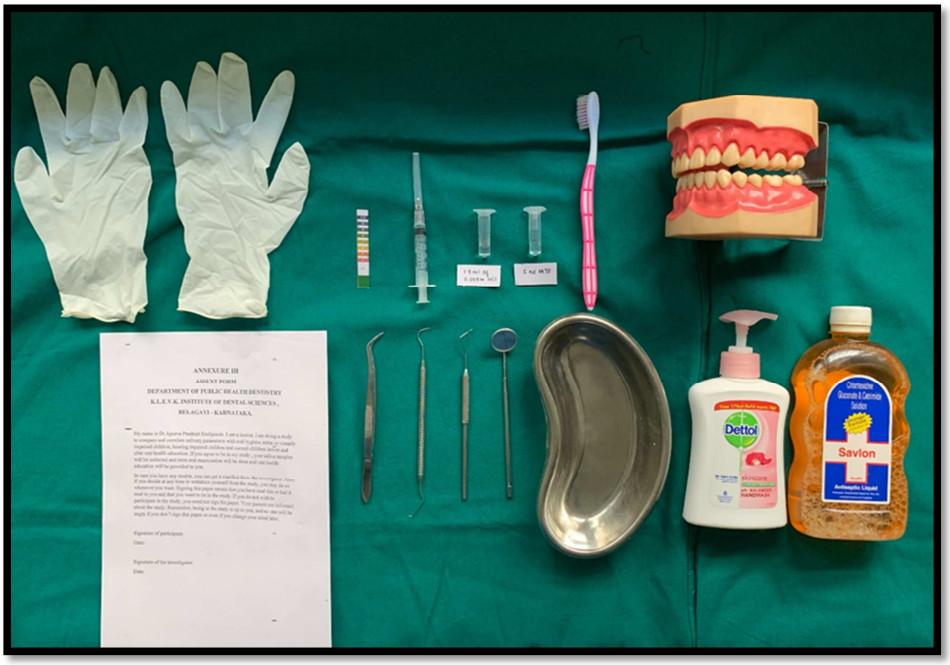
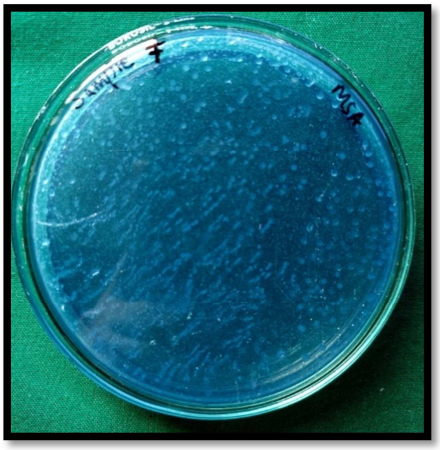


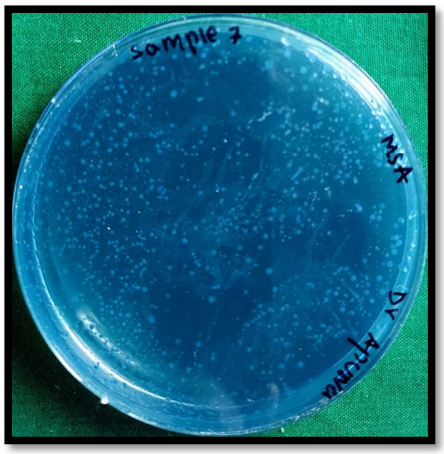

**Figure 19: Armamentarium for clinical examination and Saliva Collection**


**Figure 20: Gram staining armamentarium**

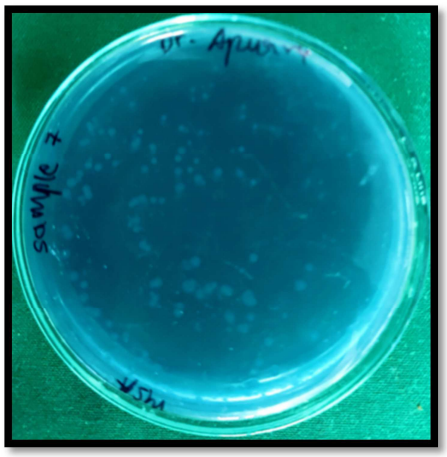

**Figure 21: Microbial analysis armamentarium**



Baseline

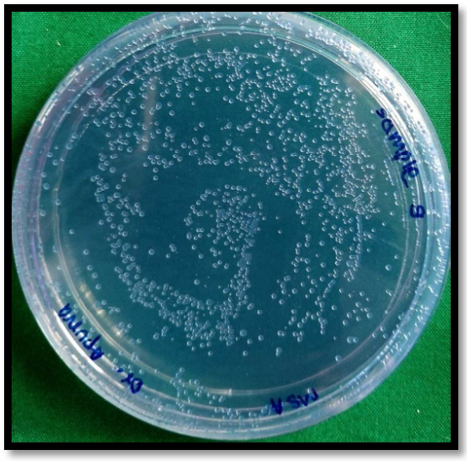



1 week

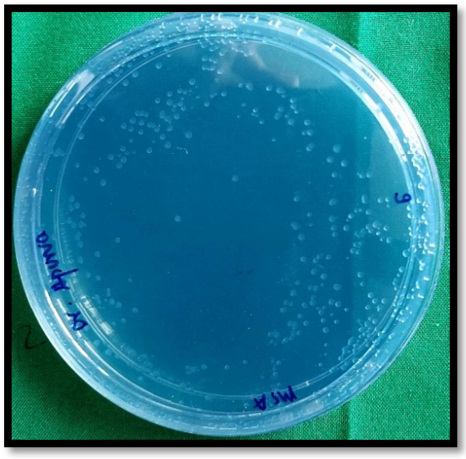



1 month

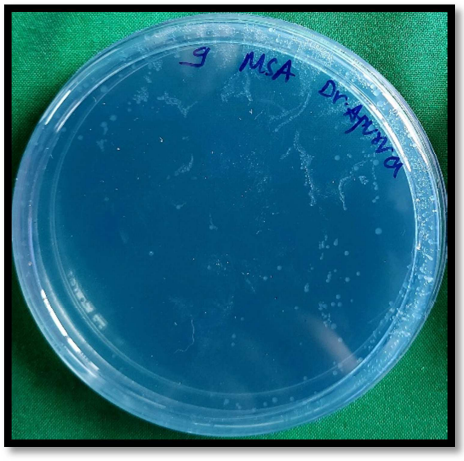
**Figure 22: *Streptococcus mutans* – Visually impaired children (Group A)**



**Baseline**

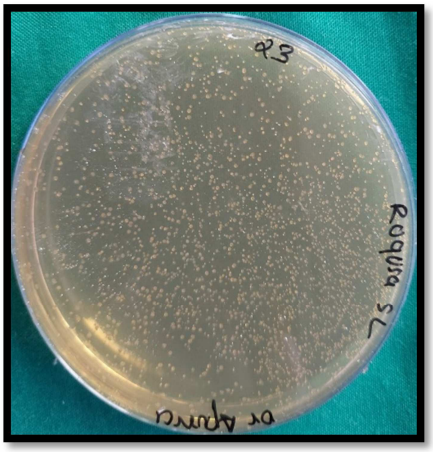


**1 Week**

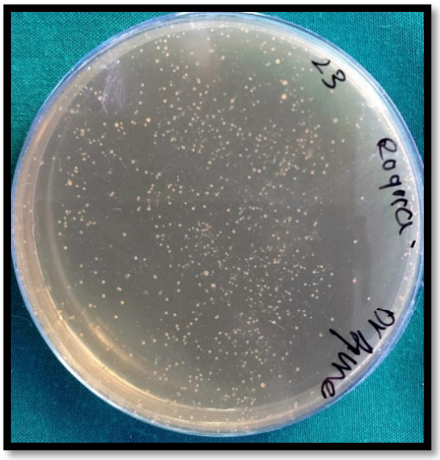


**1 Month**

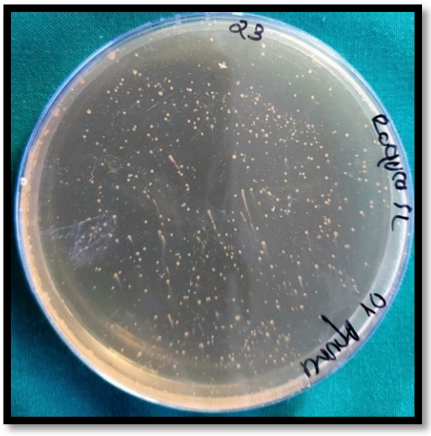
**Figure 23: *Streptococcus mutans* – Normal children (Group B)**



**Baseline**

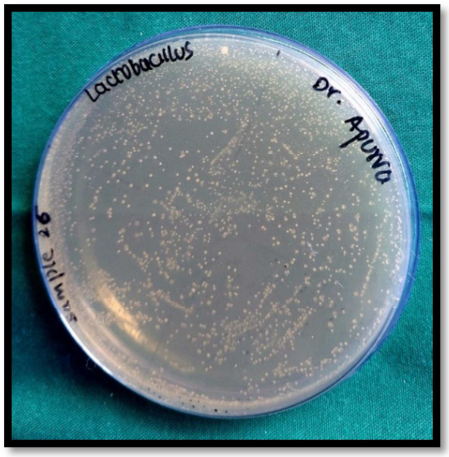


**1 Week**

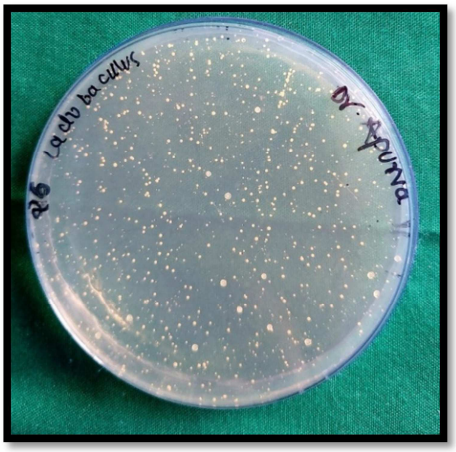


**1 Month**

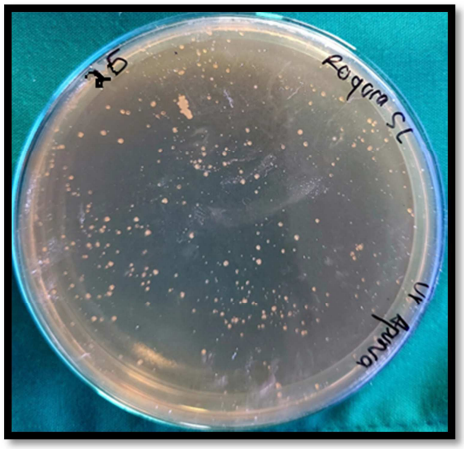
**Figure 24: *Lactobacillus acidophilus* – Visually impaired children (Group A)**




**Baseline**




**1 Week**




**1 Month**

**Figure 25: *Lactobacillus acidophilus* – Normal children (Group B)**

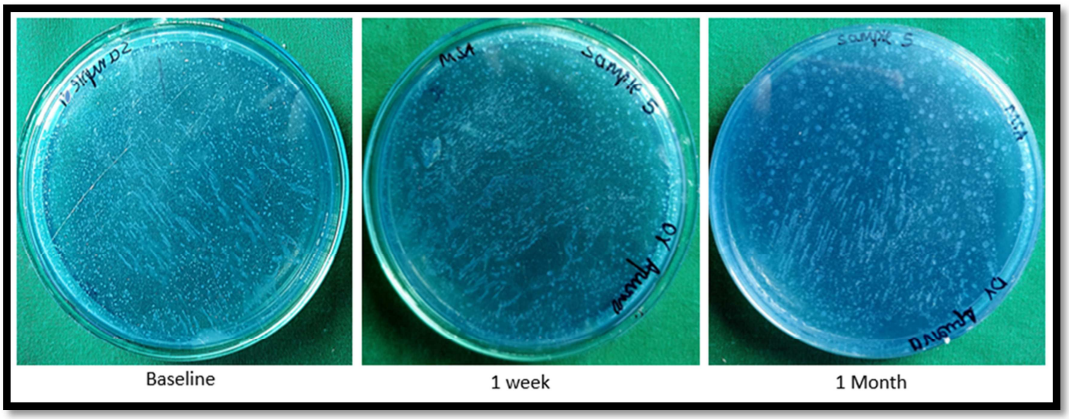



**Figure 26 a: *Streptococcus mutans* on Mitis Salivarius Agar**

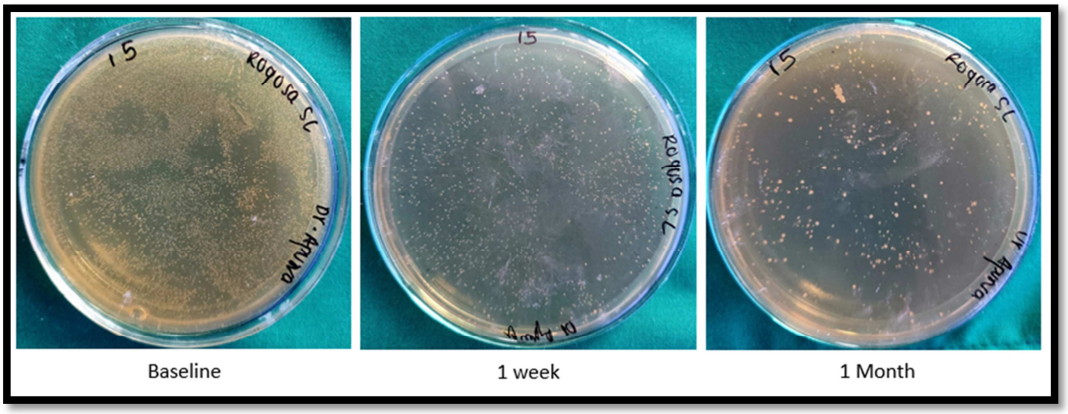



**Figure 26 b: *Lactobacillus acidophilus* on Rogusa SL**

**Figure 26 : Cariogenic pathogens on selective media**

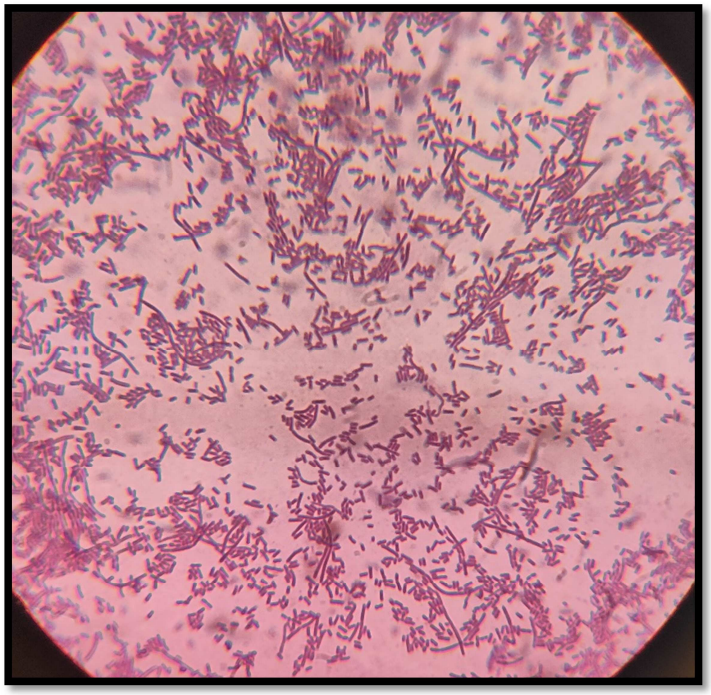


**Figure 27 (a): *Lactobacillus acidophilus* colony morphology by Gram staining**

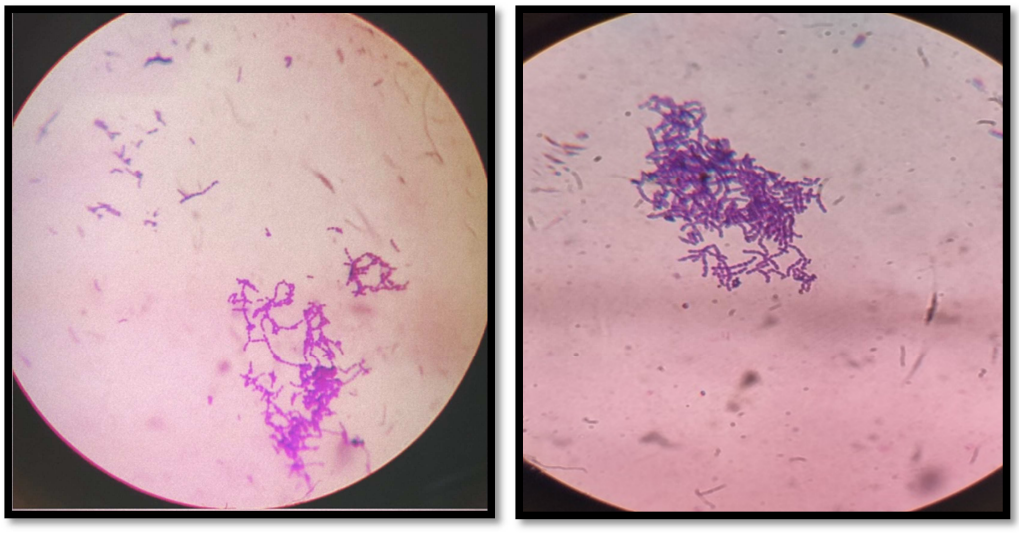


**Figure 27 (b): *streptococcus mutans* colony morphology by Gram staining**

**Figure 27: Morphology of microorganisms by Gram staining**

# CONCLUSION

In the current years, focus has shifted towards assessment of effectiveness of preventive strategies concerning "Education in Oral Health". Community or Population based interventions have greatest impact on a community which may be at school level, or neighborhood level or village level or at national level. Efficient community based intervention programs are planned procedures that prevents occurrence of a disease. Of the many approaches for preventing dental diseases, the best method is delivering appropriate OHE. With ongoing COVID 19 Pandemic, knowledge regarding 'oral health' and 'oral hygiene practices' is of special significance.

Use of "ATP" technique for "visually impaired children" and "VP" technique for "normal children" to impart education in oral health significantly reduced debris, calculus, plaque and gingival scores thereby improving gingival health. Apart from improving clinical parameters, salivary parameters like pH, buffering capacity and flow-rate significantly improved. Furthermore, *Streptococcus mutans* and *Lactobacillus acidophilus* colony counts also reduced significantly in both the groups.

The overall improvement in clinical parameters and reduction in *Lactobacillus acidophilus* count was more in normal children while improvement in "salivary pH, buffering capacity, and flow-rate" and reduction in *Streptococcus mutans* count was more in "visually impaired children". Thus appropriate education in oral health is of special significance in improvement of oral hygiene status and salivary parameters in normal and visually impaired children.

# RESULTS

An interventional study was conducted to assess and compare salivary parameters (pH, Buffering Capacity, Flow-rate, *Streptococcus mutans* and *Lactobacillus acidophilus*) with "oral hygiene status" among 12-15 years old "visually impaired" and "normal children" before and after oral health education in Belagavi, Karnataka.

The data obtained from the study was compiled, tabulated and subjected to statistical analysis. The results are presented here under the headings of the various parameters considered for the study.

**Number of study participants**

Fifty participants were present at the commencement of the study. The study comprised of two groups – Group A (School 1- visually impaired children) and Group B (School 2 - normal children), 25 participants in each group. There were no drop outs from any group.

**Table 1: Distribution of the visually impaired children (Group A) and normal children (Group B) according to age**

Group A consisted of 25 participants among whom 8 (32%) were 12 years, 7 (28%) were 13 years, 10 (40%) were 14 years. Group B comprised of 25 participants among whom 10 (40%) were 12 years, 14 (56%) were 13 years and 1 (4%) was 14 years. Mean age of the participants in Group A was 13.16 ± 0.96 and in Group B was 12.6 ± 0.63 [Table 1] [Diagram 1]

**Table 2: Distribution of visually impaired children (Group A) and normal children (Group B) according to Gender**

Group A comprised of 14 (56%) males and 11 (44%) females. Group B comprised of 13 (52%) males and 12 (48%) females. [Table 2] [Diagram 2]

**Table 3: Distribution of visually impaired children (Group A) and normal children (Group B) according to Kuppuswamy Socio - economic classification**

In Group A, none of the participants belonged to upper class and lower class, 2 (8%) belonged to upper middle class, 13 (52%) belonged to lower middle class and 10 (40%) belonged to upper lower class. In Group B, none of the participants belonged to lower class, 10 (40%) belonged to upper lower class, 11 (44%) belonged to lower middle class, 3 (12%) belonged to upper middle class and 1 (4%) belonged to upper class. [Table 3] [Diagram 3]

**Table 4: Distribution of visually impaired children (Group A) and normal children (Group B) according to Medical history**

In Group A, 6 (24%) participants suffered from illness and were on medication for the same. In Group B, 7 (28%) participants suffered from illness and took medication for the same. [Table 4] [Diagram 4]

**Table 5: Distribution of visually impaired children (Group A) and normal children (Group B) according to Dental history**

In Group A, only 1 (4%) participant gave history of dental treatment in the past, while 7 (28%) participants from Group B underwent dental treatment in the past. "Statistically significant difference was demonstrated between the two groups". ($p$ <0.05) [Table 5] [Diagram 4]

**Table 6: Distribution of visually impaired children (Group A) and normal children (Group B) according to Food habits**

In Group A, staple food of 15 (60%) participants was wheat while rice was staple food of 10 (40%) participants. In Group B, staple food of 16 (64%) participants was wheat while rice was staple food of 9 (36%) participants.

In Group A, 13 (52%) participants consumed vegetarian diet while 12 (48%) participants consumed mixed vegetarian diet. In Group B, 4 (16%) participants consumed vegetarian diet while 21 (84%) participants consumed mixed vegetarian diet. "Statistically significant difference was noted between both the groups". ($p$ <0.05)

In Group A, when inquired about sweet intake in last 24 hours, 3 (12%) participants consumed sweets more than 3 times, 11 (44%) participants consumed sweets 3 times, 5 (20%) participants consumed sweets twice, 5 (20%) participants consumed sweets only once while 1 (4%) participant did not consume any sweet item in last 24 hours. In Group B, 1 (4%) participant consumed sweets more than 3 times, 1 (4%) participant consumed sweets 3 times, 5 (20%) participants consumed sweets twice, 6 (24%) participants consumed sweets only once while 12 (48%) participants

gave no history of consuming any sweet item in last 24 hours. Statistically significant difference was noted between both the groups. ($p$ <0.05)

When inquired about the time of sweet in-take, in Group A, 5 (20%) participants ate sweets during meals, 8 (32%) participants ate sweets in between meals and 11 (44%) participants ate sweets during meals and in-between meals. In Group B, 5 (20%) participants ate sweets during meals, 3 (12%) participants ate sweets in between meals and 5 (20%) participants ate sweets during meals and in-between meals. These results were statistically significant between both the groups. ($p$ <0.05)

In Group A, 12 (48%) participants ate sweets of solid consistency, 8 (32%) participants ate sweets of liquid consistency while 4 (16%) participants ate sweets of sticky consistency. In Group B, 6 (24%) participants ate sweets of solid consistency, 4 (16%) participants ate sweets of liquid consistency while 3 (12%) participants ate sweets of sticky consistency. The results noted were statistically significant between both the groups. ($p$ <0.05) [Table 6]

**Table 7: Distribution of visually impaired children (Group A) and normal children (Group B) according to Oral hygiene practices**

All 50 (100%) participants from both the groups (Group A and Group B) used toothbrush as an oral hygiene aid to clean their teeth.

In Group A and Group B, 14 (56%) participants from each group cleaned their teeth once daily while 11 (44%) participants from each group cleaned their teeth twice daily.

In Group A, 23 (92%) participants used toothpaste while 2 (8%) participants used toothpowder to clean their teeth. In Group B, 24 (96%) participants used toothpaste while 1 (4%) participant used toothpowder to clean their teeth.

In Group A and Group B, 18 (72%) participants use fluoridated toothpaste/toothpowder while 7 (28%) participants used non fluoridated toothpaste/toothpowder respectively to clean their teeth.

In Group A, 12 (48%) participants changed their toothbrush after 1-3 months while 13 (52%) participants changed their toothbrush after 4-6 months. In Group B, 13 (52%) participants changed their toothbrush after 1-3 months while 12 (48%) participants changed their toothbrush after 4-6 months.

In Group A, 13 (52%) participants gave reason for changing their toothbrush as their gums hurt during brushing while 12 (48%) participants revealed that their parents replace the toothbrush. In Group B, 20 (80%) participants change their toothbrush as brush bristles wear off while 5 (20%) participants change their toothbrush as it gets dirty. “Statistically significant difference was seen among the two groups”. ($p$ <0.05)

In Group A, 13 (52%) participants never rinsed their mouth with water after eating, 4 (16%) participants rinsed their mouth sometimes while 8 (32%) participants always rinsed their mouth with water after eating. In Group B, 5 (20%) participants never rinsed their mouth with water after eating, 13 (52%) participants rinsed their mouth sometimes while 7 (28%) participants always rinsed their mouth with water after eating. “Statistically significant difference was seen among the two groups”. ($p$ <0.05)

In Group A and Group B, 24 (96%) participants from each group did not use any additional oral hygiene aids to clean their teeth.

In Group A, 5 (20%) participants brushed their teeth in vertical motion, 17 (68%) participants brushed their teeth in horizontal motion while 3 (12%) participants brushed their teeth in circular motion. In Group B, 4 (16%) participants brushed their teeth in vertical motion, 14 (56%) participants brushed their teeth in horizontal motion while 7 (28%) participants brushed their teeth in circular motion. [Table 7]

**Table 8: Distribution of visually impaired children (Group A) and normal children (Group B) according to caries experience at Baseline**

In Group A, the prevalence of dental caries in permanent teeth was 88%, while in Group B, the prevalence of dental caries in permanent teeth was observed to be 76%. However, there was no difference which was statistically significant between both the groups.

**Table 9: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with respect to caries experience at Baseline**

In Group A, the mean DMFT Index in Group A was 5.44 ± 3.00 while in Group B it was 3.30 ± 2.15. A statistically significant difference was observed in-between both the groups. The mean dmft Index in Group A was 0.84 ± 1.51 while in Group B it was 0.48 ± 0.69. However, there was no difference which was statistically significant between both the groups.

**Table 10: Distribution of visually impaired children (Group A) and normal children (Group B) according to clinical parameters assessed at Baseline**

In Group A, 1 (4%) participant had Good Debris Index – Simplified (DI-S) score, 10 (40%) participants had Fair DI-S score while 14 (56%) participants had Poor DI-S score. In Group B, 3 (12%) participants had Good DI-S score, 15 (60%) participants had Fair DI-S score while 7 (28%) participants had Poor DI-S score.

In Group A, 5 (20%) participants had Good Calculus Index –Simplified (CI-S) score, 10 (20%) participants had Fair CI-S score and 10 (20%) participants had Poor CI-S score. In Group B, 8 (32%) participants had Good CI-S score, 10 (40%) participants had Fair CI-S while 7 (28%) participants had Poor CI-S score.

In Group A, 3 (12%) participants had Good Oral Hygiene Index – Simplified (OHI-S) score, 10 (40%) participants had Fair OHI-S score and 12 (48%) participants had Poor OHI-S score. In Group B, 5 (20%) participants had Good OHI-S score, 11 (44%) participants had Fair OHI-S score while 9 (36%) participants had Poor OHI-S score.

In Group A, 10 (40%) participants suffered from mild gingivitis, 11 (44%) participants suffered from moderate gingivitis while 4 (16%) participants suffered from severe gingivitis. In Group B, 1 (4%) participant had normal gingiva, 9 (36%) participants suffered from mild gingivitis, 13 (52%) participants suffered from moderate gingivitis while 2 (8%) participants suffered from severe gingivitis.

In Group A, 5 (20%) participants had Good Plaque Index (PI) score, 11 (44%) participants had Fair PI score and 9 (36%) participants had Poor PI score. In Group B, 8 (32%) participants had Good PI score, 10 (40%) participants had Fair PI score while 7 (28%) participants had Poor PI score.

However, there seemed no statistically significant difference betwixt the two groups with respect to DI-S, CI-S, OHI-S, GI and PI at baseline. [Table 10]

**Table 11: Distribution of the participants in visually impaired children (Group A) and normal children (Group B) according to clinical parameters assessed at 1 week**

In Group A, 4 (16%) participant had Good Debris Index – Simplified (DI-S), 14 (56%) participants had Fair DI-S score while 7 (28%) participants had Poor DI-S score. In Group B, 9 (36%) participants had Good DI-S score, 14 (56%) participants had Fair DI-S score while 2 (8%) participants had Poor DI-S score.

In Group A, 6 (24%) participants had Good Calculus Index –Simplified (CI-S) score, 11 (44%) participants had Fair CI-S score and 8 (32%) participants had Poor CI-S score. In Group B, 14 (56%) participants had Good CI-S score, 8 (32%) participants had Fair CI-S score while 3 (12%) participants had Poor CI-S score.

In Group A, 4 (16%) participants had Good Oral Hygiene Index – Simplified (OHI-S) score, 10 (40%) participants had Fair OHI-S score and 11 (44%) participants had Poor OHI-S score. In Group B, 8 (32%) participants had Good OHI-S score, 12 (48%) participants had Fair OHI-S score while 5 (20%) participants had Poor OHI-S score.

In Group A, 1 (4%) participant had normal gingiva, 14 (56%) participants suffered from mild gingivitis, 10 (40%) participants suffered from moderate gingivitis while no (0%) participant suffered from severe gingivitis. In Group B, 2 (8%) participants had normal gingiva, 11 (44%) participants suffered from mild gingivitis,

11 (44%) participants suffered from moderate gingivitis while 1 (4%) participant suffered from severe gingivitis.

In Group A, 11 (44%) participants had Good Plaque Index (PI) score, 12 (48%) participants had Fair PI score and 2 (8%) participants had Poor PI score. In Group B, 2 (8%) participants had excellent PI score, 10 (40%) participants had Good PI score, 11 (44%) participants had Fair PI score while 2 (8%) participants had Poor PI score.

However, there seemed no statistically significant difference between the two groups with respect to DI-S, CI-S, OHI-S, GI and PI at 1 week. [Table 11]

**Table 12: Distribution of visually impaired children (Group A) and normal children (Group B) according to clinical parameters assessed at 1 Month**

In Group A, 14 (56%) participant had Good Debris Index – Simplified (DI-S) score, 10 (40%) participants had Fair DI-S score while 1 (4%) participant had Poor DI-S score. In Group B, 18 (72%) participants had Good DI-S score, 7 (28%) participants had Fair DI-S score while 0 (0%) participants had Poor DI-S score.

In Group A, 12 (48%) participants had Good Calculus Index –Simplified (CI-S) score, 11 (44%) participants had Fair CI-S score and 2 (8%) participants had Poor CI-S score. In Group B, 16 (64%) participants had Good CI-S score, 9 (36%) participants had Fair CI-S score while 0 (0%) participants had Poor CI-S score.

In Group A, 9 (36%) participants had Good Oral Hygiene Index – Simplified (OHI-S) score, 13 (52%) participants had Fair OHI-S score and 3 (12%) participants had Poor OHI-S score. In Group B, 16 (64%) participants had Good OHI-S score, 8

(32%) participants had Fair OHI-S score while 1 (4%) participant had Poor OHI-S score.

In Group A, 3 (12%) participants had normal gingiva, 20 (80%) participants suffered from mild gingivitis, 2 (8%) participants suffered from moderate gingivitis while nil (0%) participants suffered from severe gingivitis. In Group B, 3 (12%) participants had normal gingiva, 19 (76%) participants suffered from mild gingivitis, 3 (12%) participants suffered from moderate gingivitis while nil (0%) participants suffered from severe gingivitis.

In Group A, 3 (12%) participants had Excellent Plaque Index (PI) score, 16 (64%) participants had Good PI score, 6 (24%) participants had Fair PI score while nil (0%) participants had Poor PI score. In Group B, 4 (16%) had excellent PI score, 15 (60%) participants had Good PI score, 6 (24%) participants had Fair PI score while no (0%) participant had Poor PI score.

However, there seemed no statistically significant difference betwixt the two groups with respect to DI-S, CI-S, OHI-S, GI and PI at 1 month. [Table 12]

**Table 13: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Debris Index – Simplified (DI-S) scores at different time intervals**

The mean DI-S score was 1.84 ± 0.73 at baseline in Group A while it was 1.49 ± 0.70 at baseline in Group B. At 1 week follow-up, the mean DI-S score was 1.42 ± 0.72 and 1.04 ± 0.62 in Group A and Group B respectively. At 1 month follow-up the mean DI-S was 0.72 ± 0.57 and 0.48 ± 0.47 in Group A and Group B respectively. The mean difference from baseline and 1 week was 0.42 ± 0.20 and 0.45 ± 0.23, from

baseline and 1 month was 1.12 ± 0.38 and 1.00 ± 0.31 while from 1 week and 1 month was 0.70 ± 0.35 and 0.55 ± 0.29 in Group A and Group B respectively.

However, intergroup comparison for mean DI-S scores showed "no statistically significant difference", between the two groups at baseline, 1 week and 1 month ($p > 0.05$). [Table 13] [Diagram 5]

**Table 14: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with Debris Index – Simplified (DI-S) at different time intervals**

On intragroup comparison of mean DI-S scores at different time durations, there was a gradual decline from baseline to 1 month in both the groups. In group A, percentage of change in mean reduction was 22.83% from baseline to 1 week, 60.65% from baseline to 1 month and 49.01% from 1 week to 1 month. Highest mean difference in DI-S score was seen from baseline to 1 month (1.12 ± 0.38).

In group B, percentage of change in mean reduction was 30.38% from baseline to 1 week, 67.47% from baseline to 1 month and 53.28% from 1 week to 1 month. Highest mean difference in DI-S score was seen from baseline to 1 month (1.00 ± 0.31). Group B demonstrated greater DI-S score reduction when compared to Group A. A highly statistically significant difference was noted betwixt both the groups during all the time intervals. ($p < 0.05$). [Table 14]

**Table 15: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Calculus Index – Simplified (CI-S) scores at different time intervals**

The mean CI-S score was 1.51 ± 1.01 at baseline in Group A while it was 1.26 ± 0.90 at baseline in Group B. At 1 week follow-up, the mean CI-S score was 1.27 ± 0.87 and 0.97 ± 0.80 in Group A and Group B respectively. At 1 month follow-up, the mean CI-S was 0.94 ± 0.75 and 0.47 ± 0.52 in Group A and Group B respectively. The mean difference from baseline and 1 week was 0.24 ± 0.37 and 0.29 ± 0.36, from baseline and 1 month was 0.57 ± 0.53 and 0.79 ± 0.51 while from 1 week and 1 month was 0.33 ± 0.37 and 0.50 ± 0.43 in Group A and Group B respectively.

"Statistically significant result was noted on intergroup comparison for mean CI-S scores after 1 month". ($p < 0.05$). [Table 15] [Diagram 6]

**Table 16: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with Calculus Index – Simplified (CI-S) scores at different time intervals**

Upon "Intragroup comparison" of mean CI-S scores at different time intervals, there was a gradual decrease from baseline to 1 month in both the groups. In group A, percentage of change in mean reduction was 15.87% from baseline to 1 week, 37.83% from baseline to 1 month and 26.10% from 1 week to 1 month. Highest mean difference in CI-S score was seen from baseline to 1 month (0.57 ± 0.53).

In group B, percentage of change in mean reduction was 22.86% from baseline to 1 week, 62.86% from baseline to 1 month and 51.85% from 1 week to 1 month. Highest mean difference in CI-S score was seen from baseline to 1 month

(0.79 ± 0.51). Group B demonstrated greater CI-S score reduction when compared to Group A. Differences observed between both the groups at all the time intervals were statistically significant. ($p < 0.05$). [Table 16]

**Table 17: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Oral Hygiene Index – Simplified (OHI-S) scores at different time intervals**

The mean OHI-S score was 3.35 ± 1.63 at baseline in Group A while it was 2.75 ± 1.52 at baseline in Group B. At 1 week follow-up, the mean OHI-S score was 2.69 ± 1.52 and 2.00 ± 1.36 in Group A and Group B respectively. At 1 month follow-up, the mean OHI-S score was 1.66 ± 1.26 and 0.98 ± 0.92 in Group A and Group B respectively. The mean difference from baseline and 1 week was 0.66 ± 0.50 and 0.75 ± 0.46, from baseline and 1 month was 1.69 ± 0.78 and 1.77 ± 0.77 while from 1 week and 1 month was 1.03 ± 0.61 and 1.02 ± 0.64 in Group A and Group B respectively.

However, “no statistically significant difference” was found upon “intergroup comparison” for mean OHI-S score between the two groups at baseline, 1 week and 1 month. ($p > 0.05$) [Table 17] [Diagram 7]

**Table 18: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with Oral Hygiene Index – Simplified (OHI-S) scores at different time intervals**

On “intragroup comparison” of mean OHI-S score at different time periods, there was a gradual decline from baseline to 1 month in both the groups. In group A, percentage of change in mean reduction was 19.69% from baseline to 1 week, 50.36%

from baseline to 1 month and 38.19% from 1 week to 1 month. Highest mean difference in OHI-S score was seen from baseline to 1 month (1.69 ± 0.78).

In group B, percentage of change in mean reduction was 27.37% from baseline to 1 week, 64.48% from baseline to 1 month and 51.10% from 1 week to 1 month. Highest mean difference in OHI-S score was seen from baseline to 1 month (1.77 ± 0.77). Group B demonstrated greater OHI-S score reduction when compared to Group A. At all the time intervals, there was statistically significant difference in both the groups. ($p < 0.05$) [Table 18]

**Table 19: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Gingival Index (GI) scores at different time intervals**

The mean GI score was 1.35 ± 0.57 at baseline in Group A while it was 1.32 ± 0.77 at baseline in Group B. At 1 week follow-up, the mean GI score was 1.00 ± 0.44 and 1.02 ± 0.61 in Group A and Group B respectively. At 1 month follow-up the mean GI was 0.58 ± 0.39 and 0.54 ± 0.47 in Group A and Group B respectively. The mean difference from baseline and 1 week was 0.35 ± 0.26 and 0.30 ± 0.58, from baseline and 1 month was 0.77 ± 0.51 and 0.79 ± 0.52 while from 1 week and 1 month was 0.42 ± 0.34 and 0.48 ± 0.37 in Group A and Group B respectively.

However, for mean GI score, “no statistically significant difference was found upon intergroup comparison between the two groups at baseline, 1 week and 1 month ($p > 0.05$)”. [Table 19] [Diagram 8]

**Table 20: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with Gingival Index (GI) scores at different time intervals**

On "intragroup comparison" of mean GI score at different time intervals, there was a gradual decline from baseline to 1 month in both the groups. In group A, percentage of change in mean reduction was 25.66% from baseline to 1 week, 56.74% from baseline to 1 month and 41.81% from 1 week to 1 month. Highest mean difference in GI score was seen from baseline to 1 month (0.77 ± 0.51).

In group B, percentage of change in mean reduction was 22.96% from baseline to 1 week, 59.52% from baseline to 1 month and 47.45% from 1 week to 1 month. Highest mean difference in GI score was seen from baseline to 1 month (0.79 ± 0.52). Group B demonstrated greater GI score reduction when compared to Group A. At all the time intervals in both the groups, there was statistically significant difference. ($p < 0.05$) [Table 20]

**Table 21: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Plaque Index (PI) scores at different time intervals**

The mean PI score was 1.56 ± 0.73 at baseline in Group A while it was 1.38 ± 0.73 at baseline in Group B. At 1 week follow-up, the mean PI score was 1.08 ± 0.58 and 0.95 ± 0.61 in Group A and Group B respectively. At 1 month follow-up the mean PI was 0.59 ± 0.42 and 0.46 ± 0.40 in Group A and Group B respectively. The mean difference from baseline and 1 week was 0.48 ± 0.37 and 0.44 ± 0.59, from

baseline and 1 month was 0.98 ± 0.55 and 0.92 ± 0.57 while from 1 week and 1 month was 0.50 ± 0.32 and 0.48 ± 0.37 in Group A and Group B respectively.

However, "intergroup comparison" for mean PI score, "no statistically significant difference was found between the two groups at baseline, 1 week and 1 month ($p > 0.05$)". [Table 21] [Diagram 9]

**Table 22: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with Plaque Index (PI) scores at different time intervals**

On "intragroup comparison" of mean PI score at different time intervals, there was a gradual decline from baseline to 1 month in both the groups. In group A, percentage of change in mean reduction was 30.69% from baseline to 1 week, 62.40% from baseline to 1 month and 45.76% from 1 week to 1 month. Highest mean difference in PI score was seen from baseline to 1 month (0.98 ± 0.55).

In group B, percentage of change in mean reduction was 31.50% from baseline to 1 week, 66.47% from baseline to 1 month and 51.05% from 1 week to 1 month. Highest mean difference in PI score was seen from baseline to 1 month (0.92 ± 0.57). Group B demonstrated greater PI score reduction when compared to Group A. "At all the time intervals, there was statistically significant difference in both the groups". ($p < 0.05$). [Table 22]

**Table 23: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with salivary pH scores at different time intervals**

The mean salivary pH score was 6.20 ± 0.41 at baseline in Group A while it was 6.56 ± 0.58 at baseline in Group B. At 1 week follow-up, the mean salivary pH score was 6.48 ± 0.51 and 6.76 ± 0.52 in Group A and Group B respectively. At 1 month follow-up, the mean salivary pH was 6.96 ± 0.20 and 7.04 ± 0.20 in Group A and Group B respectively. The mean difference from baseline and 1 week was 0.28 ± 0.46 and 0.20 ± 0.41, from baseline and 1 month was 0.76 ± 0.44 and 0.48 ± 0.51 while from 1 week and 1 month was 0.48 ± 0.51 and 0.28 ± 0.46 in Group A and Group B respectively.

On intergroup comparison for mean salivary pH, "statistically significant difference was noted at baseline and from baseline to 1 month time interval". ($p < 0.05$). [Table 23] [Diagram 10]

**Table 24: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with salivary pH scores at different time intervals**

On intragroup comparison of mean salivary pH at different time intervals, there was a gradual increase from baseline to 1 month in both the groups. In group A, percentage of change in mean was 4.52 % from baseline to 1 week, 12.26 % from baseline to 1 month and 7.41 % from 1 week to 1 month. Highest increase in salivary pH was seen from baseline to 1 month (0.76 ± 0.44).

In group B, percentage of change in mean was 3.05 % from baseline to 1 week, 7.32 % from baseline to 1 month and 4.14 % from 1 week to 1 month. Highest increase in salivary pH was seen from baseline to 1 month (0.48 ± 0.51). Group A

demonstrated greater change in Salivary pH when compared to Group B. At all the time intervals, there was statistically significant difference in both the groups. ($p < 0.05$) [Table 24]

**Table 25: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Salivary Buffering Capacity scores at different time intervals**

The mean salivary buffering capacity score was 5.80 ± 0.82 at baseline in Group A while it was 6.40 ± 0.65 at baseline in Group B. At 1 week follow-up, the mean salivary buffering capacity score was 6.36 ± 0.76 and 7.00 ± 0.76 in Group A and Group B respectively. At 1 month follow-up, the mean salivary buffering capacity was 7.20 ± 0.65 and 7.44 ± 0.58 in Group A and Group B respectively. The mean difference from baseline and 1 week was 0.56 ± 0.51 and 0.60 ± 0.50, from baseline and 1 month was 1.40 ± 0.50 and 1.04 ± 0.35 while from 1 week and 1 month was 0.84 ± 0.47 and 0.44 ± 0.51 in Group A and Group B respectively.

On intergroup comparison for mean salivary buffering capacity, a statistically significant change was noted at baseline, 1 week, from baseline to 1 month and 1 week to 1 month time interval. ($p < 0.05$). [Table 25] [Diagram 11]

**Table 26: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with Salivary Buffering Capacity scores at different time intervals**

On intragroup comparison of mean salivary buffering capacity at different time periods, there was a gradual increase from baseline to 1 month in both the groups. In group A, percentage of change in mean was 9.66 % from baseline to 1 week, 24.14 % from baseline to 1 month and 13.21 % from 1 week to 1 month. Highest change in salivary buffering capacity was seen from baseline to 1 month (1.40 ± 0.50).

In group B, percentage of change in mean was 9.38 % from baseline to 1 week, 16.25 % from baseline to 1 month and 6.29 % from 1 week to 1 month. Highest change in salivary buffering capacity was seen from baseline to 1 month (1.04 ± 0.35). Group A demonstrated greater change in salivary buffering capacity when compared to Group B. At all the time intervals, there was statistically significant difference in both the groups. ($p < 0.05$) [Table 26]

**Table 27: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Salivary Flow-rate scores at different time intervals**

The mean salivary flow-rate score was 1.00 ± 0.33 at baseline in Group A while it was 1.23 ± 0.31 at baseline in Group B. At 1 week follow-up, the mean salivary flow-rate score was 1.11 ± 0.28 and 1.34 ± 0.30 in Group A and Group B respectively. At 1 month follow-up, the mean salivary flow-rate was 1.25 ± 0.25 and 1.53 ± 0.28 in Group A and Group B respectively. The mean difference from baseline

and 1 week was 0.11 ± 0.10 and 0.12 ± 0.09, from baseline and 1 month was 0.26 ± 0.15 and 0.30 ± 0.21 while from 1 week and 1 month was 0.14 ± 0.10 and 0.18 ± 0.18 in Group A and Group B respectively.

On "intergroup comparison" for mean salivary flow rate, "a statistically significant difference" was noted at baseline, 1 week and 1 month. ($p < 0.05$) [Table 27] [Diagram 12]

**Table 28: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with Salivary Flow-rate scores at different time intervals**

On intragroup comparison of mean salivary flow rate at different time intervals, there was a gradual increase from baseline to 1 month in both the groups. In group A, percentage of change in mean was 11.24 % from baseline to 1 week, 25.70 % from baseline to 1 month and 13.00 % from 1 week to 1 month. Highest change in salivary flow rate was seen from baseline to 1 month (0.26 ± 0.15).

In group B, percentage of change in mean salivary flow rate was 9.45 % from baseline to 1 week, 24.43 % from baseline to 1 month and 13.69 % from 1 week to 1 month. Highest change in salivary flow rate was seen from baseline to 1 month (0.30 ± 0.21). Group A demonstrated greater change in salivary flow rate when compared to Group B. At all the time intervals, there was statistically significant difference in both the groups. ($p < 0.05$) [Table 28]

**Table 29: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with *Streptococcus mutans* count scores at different time intervals**

The mean *Streptococcus mutans* count was 9.36 ± 0.41 at baseline in Group A while it was 8.58 ± 0.63 at baseline in Group B. At 1 week follow-up, the mean *Streptococcus mutans* count was 9.18 ± 0.44 and 8.37 ± 0.67 in Group A and Group B respectively. At 1 month follow-up, the mean *Streptococcus mutans* count was 8.70 ± 0.45 and 8.02 ± 0.65 in Group A and Group B respectively. The mean difference from baseline and 1 week was 0.18 ± 0.14 and 0.21 ± 0.12, from baseline and 1 month was 0.66 ± 0.24 and 0.56 ± 0.16 while from 1 week and 1 month was 0.48 ± 0.17 and 0.35 ± 0.13 in Group A and Group B respectively.

On intergroup comparison for mean *Streptococcus mutans* count, statistically significant difference was noted at baseline, 1 week and 1 month and from 1 week to 1 month. ($p < 0.05$) [Table 29] [Diagram 13]

**Table 30: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with *Streptococcus mutans* count scores at different time intervals**

On “intragroup comparison” of mean *Streptococcus mutans count* at different time intervals, there was a gradual decline from baseline to 1 month in both the groups. In group A, percentage of change in mean reduction was 1.92% from baseline to 1 week, 7.09 % from baseline to 1 month and 5.27 % from 1 week to 1 month. Highest mean reduction in *Streptococcus mutans count* was seen from baseline to 1 month (0.66 ± 0.24).

In group B, percentage of change in mean reduction of *Streptococcus mutans count* was 2.47% from baseline to 1 week, 6.57% from baseline to 1 month and 4.20% from 1 week to 1 month. Highest mean reduction in *Streptococcus mutans* count was seen from baseline to 1 month (0.56 ± 0.16). Group A demonstrated greater *Streptococcus mutans count* reduction when compared to Group B. A statistically significant differences was observed between both the groups at all the time intervals. ($p < 0.01$). [Table 30]

**Table 31: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with *Lactobacillus acidophilus* count scores at different time intervals**

The mean *Lactobacillus acidophilus* count was 8.79 ± 0.35 at baseline in Group A while it was 7.96 ± 0.66 at baseline in Group B. At 1 week follow-up, the mean *Lactobacillus acidophilus* count was 8.66 ± 0.35 and 7.78 ± 0.62 in Group A and Group B respectively. At 1 month follow-up, the mean *Lactobacillus acidophilus* count was 8.31 ± 0.38 and 7.50 ± 0.64 in Group A and Group B respectively. The mean difference from baseline and 1 week was 0.13 ± 0.06 and 0.18 ± 0.13, from baseline and 1 month was 0.48 ± 0.21 and 0.46 ± 0.16 while from 1 week and 1 month was 0.35 ± 0.18 and 0.28 ± 0.14 in Group A and Group B respectively.

On intergroup comparison for mean *Lactobacillus acidophilus* count, statistically significant difference was noted at baseline, 1 week and 1 month. ($p < 0.05$). [Table 31] [Diagram 14]

**Table 32: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with *Lactobacillus acidophilus* count scores at different time intervals**

On "intragroup comparison" of mean *Lactobacillus acidophilus count* at different time intervals, there was a gradual decline from baseline to 1 month in both the groups. In group A, percentage of change in mean reduction was 1.46% from baseline to 1 week, 5.46 % from baseline to 1 month and 4.06 % from 1 week to 1 month. Highest mean reduction in *Lactobacillus acidophilus count* was seen from baseline to 1 month ($0.48 \pm 0.21$).

In group B, percentage of change in mean reduction of *Lactobacillus acidophilus count* was 2.31% from baseline to 1 week, 5.83% from baseline to 1 month and 3.60% from 1 week to 1 month. Highest mean reduction in *Lactobacillus acidophilus* count was seen from baseline to 1 month ($0.46 \pm 0.16$). Group B demonstrated greater *Lactobacillus acidophilus count* reduction when compared to Group A. At all the time intervals, there was statistically significant difference in both the groups. ($p < 0.05$). [Table 32]

**Table 1: Distribution of the visually impaired children (Group A) and normal children (Group B) according to age**

| Age (Years) | Group A n (%) | Group B n (%) | Chi square value | *p*- value |
|---|---|---|---|---|
| 12 | 8 (32%) | 10 (40%) | 9.919 | 0.007* |
| 13 | 7 (28%) | 14 (56%) | | |
| 14 | 10 (40%) | 1 (4%) | | |
| 15 | 0 (0%) | 0 (0%) | | |
| **Total n (%)** | **25 (100%)** | **25 (100%)** | | |
| **Mean (± S.D)** | **13.16 ± 0.96** | **12.6 ± 0.63** | | |

***p*<0.05, Chi-square test applied**

**Table 2: Distribution of visually impaired children (Group A) and normal children (Group B) according to Gender**

| Gender | Group A n (%) | Group B n (%) | Chi square value | *p*- value |
|---|---|---|---|---|
| Male | 14 (56%) | 13 (52%) | 0.0810 | 0.7770 |
| Female | 11 (44%) | 12 (48%) | | |
| Total **n (%)** | 25 (100%) | 25 (100%) | | |

***p*<0.05, Chi-square test applied**

**Table 3: Distribution of visually impaired children (Group A) and normal children (Group B) according to Kuppuswamy Socio - economic classification**

| Socio-Economic Status | Group A n (%) | Group B n (%) | Chi square value | *p*- value |
|---|---|---|---|---|
| Upper | 0 (0%) | 1 (4%) | 1.3670 | 0.7130 |
| Upper Middle | 2 (8%) | 3 (12%) | | |
| Lower Middle | 13 (52%) | 11 (44%) | | |
| Upper Lower | 10 (40%) | 10 (40%) | | |
| Lower | 0 (0%) | 0 (0%) | | |
| **Total n (%)** | **25 (100%)** | **25 (100%)** | | |

***p*<0.05, Chi-square test applied**

**Table 4: Distribution of visually impaired children (Group A) and normal children (Group B) according to Medical history**

| Medical history | Group A n (%) | | | Group B n (%) | | | Chi square value | *p*- value |
|---|---|---|---|---|---|---|---|---|
| | Yes | No | Total n (%) | Yes | No | Total n (%) | | |
| Illness in past 1 year | 6 (24%) | 19 (76%) | 25 (100%) | 7 (28%) | 18 (72%) | 25 (100%) | 0.1040 | 0.7470 |
| Medication in past one year | 6 (24%) | 19 (76%) | 25 (100%) | 7 (28%) | 18 (72%) | 25 (100%) | 0.1040 | 0.7470 |

***p*<0.05, Chi-square test applied**

**Table 5: Distribution of visually impaired children (Group A) and normal children (Group B) according to Dental history**

| Dental history | Group A n (%) | | | Group B n (%) | | | Chi-square | *p* -value |
|---|---|---|---|---|---|---|---|---|
| | Yes | No | Total n (%) | Yes | No | Total n (%) | | |
| History of any previous dental treatment | 1 (4%) | 24 (96%) | 25 (100%) | 7 (28%) | 18 (72%) | 25 (100%) | 5.35 | 0.021* |

***p*<0.05, Chi-square test applied**

**Table 6: Distribution of visually impaired children (Group A) and normal children (Group B) according to Food habits**

| Questions | Responses | Group A n (%) | Group B n (%) | Total n (%) | Chi-square | p-value |
|---|---|---|---|---|---|---|
| **What is your staple diet?** | Wheat | 15 (60%) | 16 (64%) | 31 (62%) | 0.085 | 0.771 |
| | Rice | 10 (40%) | 9 (36%) | 19 (38%) | | |
| **Type of diet?** | Vegetarian | 13 (52%) | 4 (16%) | 17 (34%) | 5.704 | 0.017* |
| | Mixed | 12 (48%) | 21 (84%) | 33 (66%) | | |
| **How many times you ate sweets in last 24 hours?** | None | 1 (4%) | 12 (48%) | 13 (26%) | 18.732 | 0.001* |
| | Once | 5 (20%) | 6 (24%) | 11 (22%) | | |
| | Twice | 5 (20%) | 5 (20%) | 10 (20%) | | |
| | Thrice | 11 (44%) | 1 (4%) | 12 (24%) | | |
| | > 3times | 3 (12%) | 1 (4%) | 4 (8%) | | |
| **When were the sweets eaten?** | During meals | 5 (20%) | 5 (20%) | 10 (20%) | 13.83 | 0.003* |
| | In between meals | 8 (32%) | 3 (12%) | 11 (22%) | | |
| | Both | 11 (44%) | 5 (20%) | 16 (32%) | | |
| | Not applicable | 1 (4%) | 12 (48%) | 13 (26%) | | |
| **What is the consistency of the sweets?** | Solid | 12 (48%) | 6 (24%) | 18 (36%) | 12.78 | 0.005* |
| | Liquid | 8 (32%) | 4 (16%) | 12 (24%) | | |
| | Sticky | 4 (16%) | 3 (12%) | 7 (14%) | | |
| | Not applicable | 1 (4%) | 12 (48%) | 13 (26%) | | |
| | Total | 25 (100%) | 25 (100%) | 50 (100%) | | |
| **Total** | | **25 (100%)** | **25 (100%)** | **50 (100%)** | | |

***$p$<0.05, Chi-square test applied**

**Table 7: Distribution of visually impaired children (Group A) and normal children (Group B) according to Oral hygiene practices**

| Question | Oral hygiene practices | Group A n (%) | Group B n (%) | Total n (%) | Chi-square | p-value |
|---|---|---|---|---|---|---|
| **How you clean your teeth?** | Finger | 0 (0%) | 0 (0%) | 0 (0%) | - | - |
| | Brush | 25 (100%) | 25 (100%) | 50 (100%) | | |
| **How often you clean your teeth?** | Once | 14 (56%) | 14 (56%) | 28 (56%) | - | - |
| | Twice | 11 (44%) | 11 (44%) | 22 (44%) | | |
| **What material do you use to clean the teeth?** | Toothpaste | 23 (92%) | 24 (96%) | 47 (94%) | 0.0000 | 1.0000 |
| | Tooth powder | 2 (8%) | 1 (4%) | 3 (6%) | | |
| **Name of the toothpaste/powder** | Fluoridated | 18 (72%) | 18 (72%) | 36 (72%) | - | - |
| | Non-fluoridated | 7 (28%) | 7 (28%) | 14 (28%) | | |
| **How often you change your toothbrush?** | 1-3months | 12 (48%) | 13 (52%) | 25 (50%) | - | - |
| | 4-6months | 13 (52%) | 12 (48%) | 25 (50%) | | |
| **Reason for changing tooth brush** | Gums hurt while brushing | 13 (52%) | 0 (0%) | 13 (26%) | 50.0000 | 0.0001* |
| | Bristles get worn out | 0 (20%) | 20 (80%) | 20 (40%) | | |
| | Parents buy new brush | 12 (48%) | 0 (0%) | 12 (24%) | | |
| | Brush becomes dirty | 0 (0%) | 5 (20%) | 5 (10%) | | |
| **How often do you rinse your mouth with water after eating?** | Never | 13 (52%) | 5 (20%) | 18 (36%) | 8.3870 | 0.015* |
| | Somtimes | 4 (16%) | 13 (52%) | 17 (34%) | | |
| | Always | 8 (32%) | 7 (28%) | 15 (30%) | | |
| **Do you use additional oral hygiene aids?** | Yes | 1 (4%) | 1 (4%) | 2 (4%) | - | - |
| | No | 24 (96%) | 24 (96%) | 48 (96%) | | |
| **How do you brush your teeth?** | Vertical | 5 (20%) | 4 (16%) | 9 (18%) | 2.0010 | 0.3680 |
| | Horizontal | 17 (68%) | 14 (56%) | 31 (62%) | | |
| | Circular | 3 (12%) | 7 (28%) | 10 (20%) | | |
| Total | | 25 (100%) | 25 (100%) | 50 (100%) | | |

***p*<0.05, Chi-square test applied**

**Table 8: Distribution of visually impaired children (Group A) and normal children (Group B) according to caries experience**

| Dental Caries | | Caries experience Absent | Caries experience Present | Total | Chi square | *p* value |
|---|---|---|---|---|---|---|
| DMFT | Group A | 3 (12%) | 22 (88%) | 25 (100%) | 1.220 | 0.269 |
| dmft | Group B | 6 (24%) | 19 (76%) | 25 (100%) | 0.089 | 0.765 |

***p*<0.05, Chi-square test applied**

**Table 9: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with respect to caries experience**

| Variables | Group A Mean (± SD) | Group B Mean (± SD) | t test | *p* value |
|---|---|---|---|---|
| DMFT | 5.44 ± 3.00 | 3.20 ± 2.15 | 2.993 | 0.004* |
| dmft | 0.84 ± 1.51 | 0.48 ± 0.69 | 1.057 | 0.296 |

***p*<0.05, Independent t test applied**

**Table 10: Distribution of visually impaired children (Group A) and normal children (Group B) according to clinical parameters assessed at Baseline**

| Clinical parameters | Interpretation | Group A n (%) | Group B n (%) | Total n (%) | Chi-square | p-value |
|---|---|---|---|---|---|---|
| Debris Index – Simplified (DI-S) | Good | 1 (4%) | 3 (12%) | 4 (8%) | 4.333 | 0.115 |
| | Fair | 10 (40%) | 15 (60%) | 25 (50%) | | |
| | Poor | 14 (56%) | 7 (28%) | 21 (42%) | | |
| Calculus Index – Simplified (CI-S) | Good | 5 (20%) | 8 (32%) | 13 (26%) | 1.222 | 0.543 |
| | Fair | 10 (20%) | 10 (40%) | 20 (40%) | | |
| | Poor | 10 (20%) | 7 (28%) | 17 (34%) | | |
| Oral Hygiene Index – Simplified (OHI-S) | Good | 3 (12%) | 5 (20%) | 8 (16%) | 0.976 | 0.614 |
| | Fair | 10 (40%) | 11 (44%) | 21 (42%) | | |
| | Poor | 12 (48%) | 9 (36%) | 21 (42%) | | |
| Gingival Index (GI) | Normal | 0 (0%) | 1 (4%) | 1 (2%) | 1.886 | 0.596 |
| | Mild gingivitis | 10 (40%) | 9 (36%) | 19 (38%) | | |
| | Moderate gingivitis | 11 (44%) | 13 (52%) | 24 (48%) | | |
| | Severe gingivitis | 4 (16%) | 2 (8%) | 6 (12%) | | |
| Plaque Index (PI) | Excellent | 0 (0%) | 0 (0%) | 0 (0%) | 0.990 | 0.610 |
| | Good | 5 (20%) | 8 (32%) | 13 (26%) | | |
| | Fair | 11 (44%) | 10 (40%) | 21 (42%) | | |
| | Poor | 9 (36%) | 7 (28%) | 16 (32%) | | |

***$p$<0.05, Chi-square test applied**

**Table 11: Distribution of the participants in visually impaired children (Group A) and normal children (Group B) according to clinical parameters assessed at 1 week**

| Clinical parameters | Interpretation | Group A n (%) | Group B n (%) | Total n (%) | Chi-square | p-value |
|---|---|---|---|---|---|---|
| Debris Index – Simplified (DI-S) | Good | 4 (16%) | 9 (36%) | 13 (26%) | 4.701 | 0.095 |
| | Fair | 14 (56%) | 14 (56%) | 28 (56%) | | |
| | Poor | 7 (28%) | 2 (8%) | 9 (18%) | | |
| Calculus Index – Simplified (CI-S) | Good | 6 (24%) | 14 (56%) | 20 (40%) | 5.946 | 0.051 |
| | Fair | 11 (44%) | 8 (32%) | 19 (38%) | | |
| | Poor | 8 (32%) | 3 (12%) | 11 (22%) | | |
| Oral Hygiene Index – Simplified (OHI-S) | Good | 4 (16%) | 8 (32%) | 12 (24%) | 3.765 | 0.152 |
| | Fair | 10 (40%) | 12 (48%) | 22 (44%) | | |
| | Poor | 11 (44%) | 5 (20%) | 16 (32%) | | |
| Gingival Index (GI) | Normal | 1 (4%) | 2 (8%) | 3 (6%) | 1.741 | 0.628 |
| | Mild gingivitis | 14 (56%) | 11 (44%) | 25 (50%) | | |
| | Moderate gingivitis | 10 (40%) | 11 (44%) | 21 (42%) | | |
| | Severe gingivitis | 0 (0%) | 1 (4%) | 1 (2%) | | |
| Plaque Index (PI) | Excellent | 0 (0%) | 2 (8%) | 2 (4%) | 2.091 | 0.554 |
| | Good | 11 (44%) | 10 (40%) | 21 (42%) | | |
| | Fair | 12 (48%) | 11 (44%) | 23 (46%) | | |
| | Poor | 2 (8%) | 2 (8%) | 4 (8%) | | |

***p*<0.05, Chi-square test applied**

**Table 12: Distribution of visually impaired children (Group A) and normal children (Group B) according to clinical parameters assessed at 1 Month**

| Clinical parameters | Interpretation | Group A n (%) | Group B n (%) | Total n (%) | Chi-square | p-value |
|---|---|---|---|---|---|---|
| Debris Index – Simplified (DI-S) | Good | 14 (56%) | 18 (72%) | 32 (64%) | 2.029 | 0.363 |
| | Fair | 10 (40%) | 7 (28%) | 17 (34%) | | |
| | Poor | 1 (4%) | 0 (0%) | 1 (2%) | | |
| Calculus Index – Simplified (CI-S) | Good | 12 (48%) | 16 (64%) | 28 (56%) | 2.771 | 0.250 |
| | Fair | 11 (44%) | 9 (36%) | 20 (40%) | | |
| | Poor | 2 (8%) | 0 (0%) | 2 (4%) | | |
| Oral Hygiene Index – Simplified (OHI-S) | Good | 9 (36%) | 16 (64%) | 25 (50%) | 4.150 | 0.126 |
| | Fair | 13 (52%) | 8 (32%) | 21 (42%) | | |
| | Poor | 3 (12%) | 1 (4%) | 4 (8%) | | |
| Gingival Index (GI) | Normal | 3 (12%) | 3 (12%) | 6 (12%) | 0.226 | 0.893 |
| | Mild gingivitis | 20 (80%) | 19 (76%) | 39 (78%) | | |
| | Moderate gingivitis | 2 (8%) | 3 (12%) | 5 (10%) | | |
| | Severe gingivitis | 0 (0%) | 0 (0%) | 0 (0%) | | |
| Plaque Index (PI) | Excellent | 3 (12%) | 4 (16%) | 7 (14%) | 0.175 | 0.916 |
| | Good | 16 (64%) | 15 (60%) | 31 (62%) | | |
| | Fair | 6 (24%) | 6 (24%) | 12 (24%) | | |
| | Poor | 0 (0%) | 0 (0%) | 0 (0%) | | |

***p*<0.05, Chi-square test applied**

**Table 13: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Debris Index – Simplified (DI-S) scores at different time intervals**

| Time points | Group A | | Group B | | U-value | Z-value | P-value |
|---|---|---|---|---|---|---|---|
| | Mean ± SD | Mean rank | Mean ± SD | Mean rank | | | |
| Baseline | 1.84 ± 0.73 | 29.10 | 1.49 ± 0.70 | 21.90 | 222.50 | -1.7463 | 0.0808 |
| 1 week | 1.42 ± 0.72 | 29.54 | 1.04 ± 0.62 | 21.46 | 211.50 | -1.9597 | 0.0500* |
| 1 month | 0.72 ± 0.57 | 28.60 | 0.48 ± 0.47 | 22.40 | 235.00 | -1.5037 | 0.1327 |
| BL-1W | 0.42 ± 0.20 | 24.82 | 0.45 ± 0.23 | 26.18 | 295.50 | -0.3298 | 0.7415 |
| BL-1M | 1.12 ± 0.38 | 27.68 | 1.00 ± 0.31 | 23.32 | 258.00 | -1.0575 | 0.2903 |
| 1W-1M | 0.70 ± 0.35 | 28.42 | 0.55 ± 0.29 | 22.58 | 239.50 | -1.4164 | 0.1567 |

***$p$<0.05, Mann-Whitney U test applied**

**Table 14: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with Debris Index – Simplified (DI-S) at different time intervals**

| Groups | Time period | Mean ± SD | Mean Diff. | SD Diff. | % of change | Z-value | p-value |
|---|---|---|---|---|---|---|---|
| Group A | Baseline | 1.84 ± 0.73 | 0.42 | 0.20 | 22.83 | 4.2857 | 0.0001* |
| | 1 week | 1.42 ± 0.72 | | | | | |
| | Baseline | 1.84 ± 0.73 | 1.12 | 0.38 | 60.65 | 4.3724 | 0.0001* |
| | 1 month | 0.72 ± 0.57 | | | | | |
| | 1 week | 1.42 ± 0.72 | 0.70 | 0.35 | 49.01 | 4.2857 | 0.0001* |
| | 1 month | 0.72 ± 0.57 | | | | | |
| Group B | Baseline | 1.49 ± 0.70 | 0.45 | 0.23 | 30.38 | 4.2857 | 0.0001* |
| | 1 week | 1.04 ± 0.62 | | | | | |
| | Baseline | 1.49 ± 0.70 | 1.00 | 0.31 | 67.47 | 4.3724 | 0.0001* |
| | 1 month | 0.48 ± 0.47 | | | | | |
| | 1 week | 1.04 ± 0.62 | 0.55 | 0.29 | 53.28 | 4.1973 | 0.0001* |
| | 1 month | 0.48 ± 0.47 | | | | | |

***$p$<0.05, Wilcoxon matched pairs test applied**

**Table 15: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Calculus Index – Simplified (CI-S) scores at different time intervals**

| Time points | Group A | | Group B | | U-value | Z-value | P-value |
|---|---|---|---|---|---|---|---|
| | Mean ± SD | Mean rank | Mean ± SD | Mean rank | | | |
| Baseline | 1.51 ± 1.01 | 27.16 | 1.26 ± 0.90 | 23.84 | 271.00 | -0.8052 | 0.4207 |
| 1 week | 1.27 ± 0.87 | 28.40 | 0.97 ± 0.80 | 22.60 | 240.00 | -1.4067 | 0.1595 |
| 1 month | 0.94 ± 0.75 | 30.36 | 0.47 ± 0.52 | 20.64 | 191.00 | -2.3574 | 0.0184* |
| BL-1W | 0.24 ± 0.37 | 24.22 | 0.29 ± 0.36 | 26.78 | 280.50 | -0.6209 | 0.5347 |
| BL-1M | 0.57 ± 0.53 | 21.98 | 0.79 ± 0.51 | 29.02 | 224.50 | -1.7075 | 0.0877 |
| 1W-1M | 0.33 ± 0.37 | 21.50 | 0.50 ± 0.43 | 29.50 | 212.50 | -1.9403 | 0.0524 |

***$p$<0.05, Mann-Whitney U test applied**

**Table 16: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with Calculus Index – Simplified (CI-S) scores at different time intervals**

| Groups | Time period | Mean ± SD | Mean Diff. | SD Diff. | % of change | Z-value | p-value |
|---|---|---|---|---|---|---|---|
| Group A | Baseline | 1.51 ± 1.01 | 0.24 | 0.37 | 15.87 | 3.1074 | 0.0019* |
| | 1 week | 1.27 ± 0.87 | | | | | |
| | Baseline | 1.51 ± 1.01 | 0.57 | 0.53 | 37.83 | 3.8230 | 0.0001* |
| | 1 month | 0.94 ± 0.75 | | | | | |
| | 1 week | 1.27 ± 0.87 | 0.33 | 0.37 | 26.10 | 3.8230 | 0.0001* |
| | 1 month | 0.94 ± 0.75 | | | | | |
| Group B | Baseline | 1.26 ± 0.90 | 0.29 | 0.36 | 22.86 | 3.1238 | 0.0018* |
| | 1 week | 0.97 ± 0.80 | | | | | |
| | Baseline | 1.26 ± 0.90 | 0.79 | 0.51 | 62.86 | 4.2857 | 0.0001* |
| | 1 month | 0.47 ± 0.52 | | | | | |
| | 1 week | 0.97 ± 0.80 | 0.50 | 0.43 | 51.85 | 4.2857 | 0.0001* |
| | 1 month | 0.47 ± 0.52 | | | | | |

***$p$<0.05, Wilcoxon matched pairs test applied**

**Table 17: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Oral Hygiene Index – Simplified (OHI-S) scores at different time intervals**

| Time points | Group A | | Group B | | U-value | Z-value | P-value |
|---|---|---|---|---|---|---|---|
| | Mean ± SD | Mean rank | Mean ± SD | Mean rank | | | |
| Baseline | 3.35 ± 1.63 | 28.44 | 2.75 ± 1.52 | 22.56 | 239.00 | -1.4261 | 0.1538 |
| 1 week | 2.69 ± 1.52 | 29.00 | 2.00 ± 1.36 | 22.00 | 225.00 | -1.6978 | 0.0896 |
| 1 month | 1.66 ± 1.26 | 29.40 | 0.98 ± 0.92 | 21.60 | 215.00 | -1.8918 | 0.0585 |
| BL-1W | 0.66 ± 0.50 | 23.40 | 0.75 ± 0.46 | 27.60 | 260.00 | -1.0187 | 0.3084 |
| BL-1M | 1.69 ± 0.78 | 24.38 | 1.77 ± 0.77 | 26.62 | 284.50 | -0.5433 | 0.5869 |
| 1W-1M | 1.03 ± 0.61 | 25.66 | 1.02 ± 0.64 | 25.34 | 308.50 | -0.0776 | 0.9381 |

***$p$<0.05, Mann-Whitney U test applied**

**Table 18: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with Oral Hygiene Index – Simplified (OHI-S) scores at different time intervals**

| Groups | Time period | Mean ± SD | Mean Diff. | SD Diff. | % of change | Z-value | p-value |
|---|---|---|---|---|---|---|---|
| Group A | Baseline | 3.35 ± 1.63 | 0.66 | 0.50 | 19.69 | 4.3724 | 0.0001* |
| | 1 week | 2.69 ± 1.52 | | | | | |
| | Baseline | 3.35 ± 1.63 | 1.69 | 0.78 | 50.36 | 4.3724 | 0.0001* |
| | 1 month | 1.66 ± 1.26 | | | | | |
| | 1 week | 2.69 ± 1.52 | 1.03 | 0.61 | 38.19 | 4.2857 | 0.0001* |
| | 1 month | 1.66 ± 1.26 | | | | | |
| Group B | Baseline | 2.75 ± 1.52 | 0.75 | 0.46 | 27.37 | 4.2857 | 0.0001* |
| | 1 week | 2.00 ± 1.36 | | | | | |
| | Baseline | 2.75 ± 1.52 | 1.77 | 0.77 | 64.48 | 4.3724 | 0.0001* |
| | 1 month | 0.98 ± 0.92 | | | | | |
| | 1 week | 2.00 ± 1.36 | 1.02 | 0.64 | 51.10 | 4.3724 | 0.0001* |
| | 1 month | 0.98 ± 0.92 | | | | | |

***$p$<0.05, Wilcoxon matched pairs test applied**

**Table 19: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Gingival Index (GI) scores at different time intervals**

| Time points | Group A | | Group B | | U-value | Z-value | P-value |
|---|---|---|---|---|---|---|---|
| | Mean ± SD | Mean rank | Mean ± SD | Mean rank | | | |
| Baseline | 1.35 ± 0.57 | 25.32 | 1.32 ± 0.77 | 25.68 | 308.00 | -0.0873 | 0.9304 |
| 1 week | 1.00 ± 0.44 | 25.38 | 1.02 ± 0.61 | 25.62 | 309.50 | -0.0582 | 0.9536 |
| 1 month | 0.58 ± 0.39 | 27.08 | 0.54 ± 0.47 | 23.92 | 273.00 | -0.7664 | 0.4434 |
| BL-1W | 0.35 ± 0.26 | 25.86 | 0.30 ± 0.58 | 25.14 | 303.50 | -0.1746 | 0.8614 |
| BL-1M | 0.77 ± 0.51 | 24.12 | 0.79 ± 0.52 | 26.88 | 278.00 | -0.6694 | 0.5032 |
| 1W-1M | 0.42 ± 0.34 | 23.38 | 0.48 ± 0.37 | 27.62 | 259.50 | -1.0284 | 0.3038 |

***$p$<0.05, Mann-Whitney U test applied**

**Table 20: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with Gingival Index (GI) scores at different time intervals**

| Groups | Time period | Mean ± SD | Mean Diff. | SD Diff. | % of change | Z-value | p-value |
|---|---|---|---|---|---|---|---|
| Group A | Baseline | 1.35 ± 0.57 | 0.35 | 0.26 | 25.66 | 6.5526 | 0.0001* |
| | 1 week | 1.00 ± 0.44 | | | | | |
| | Baseline | 1.35 ± 0.57 | 0.77 | 0.51 | 56.74 | 7.4971 | 0.0001* |
| | 1 month | 0.58 ± 0.39 | | | | | |
| | 1 week | 1.00 ± 0.44 | 0.42 | 0.34 | 41.81 | 6.0962 | 0.0001* |
| | 1 month | 0.58 ± 0.39 | | | | | |
| Group B | Baseline | 1.32 ± 0.77 | 0.30 | 0.58 | 22.96 | 2.5989 | 0.0151* |
| | 1 week | 1.02 ± 0.61 | | | | | |
| | Baseline | 1.32 ± 0.77 | 0.79 | 0.52 | 59.52 | 7.6379 | 0.0001* |
| | 1 month | 0.54 ± 0.47 | | | | | |
| | 1 week | 1.02 ± 0.61 | 0.48 | 0.37 | 47.45 | 6.5525 | 0.0001* |
| | 1 month | 0.54 ± 0.47 | | | | | |

***p*<0.05, Wilcoxon matched pairs test applied**

**Table 21: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Plaque Index (PI) scores at different time intervals**

| Time points | Group A | | Group B | | U-value | Z-value | P-value |
|---|---|---|---|---|---|---|---|
| | Mean ± SD | Mean rank | Mean ± SD | Mean rank | | | |
| Baseline | 1.56 ± 0.73 | 27.40 | 1.38 ± 0.73 | 23.60 | 265.00 | -0.9216 | 0.3567 |
| 1 week | 1.08 ± 0.58 | 27.48 | 0.95 ± 0.61 | 23.52 | 263.00 | -0.9604 | 0.3368 |
| 1 month | 0.59 ± 0.42 | 27.56 | 0.46 ± 0.40 | 23.44 | 261.00 | -0.9992 | 0.3177 |
| BL-1W | 0.48 ± 0.37 | 24.90 | 0.44 ± 0.59 | 26.10 | 297.50 | -0.2910 | 0.7710 |
| BL-1M | 0.98 ± 0.55 | 25.60 | 0.92 ± 0.57 | 25.40 | 310.00 | -0.0485 | 0.9613 |
| 1W-1M | 0.50 ± 0.32 | 25.08 | 0.48 ± 0.37 | 25.92 | 302.00 | -0.2037 | 0.8386 |

***$p$<0.05, Mann-Whitney U test applied**

**Table 22: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with Plaque Index (PI) scores at different time intervals**

| Groups | Time period | Mean ± SD | Mean Diff. | SD Diff. | % of change | Z-value | p-value |
|---|---|---|---|---|---|---|---|
| Group A | Baseline | 1.56 ± 0.73 | 0.48 | 0.37 | 30.69 | 4.2857 | 0.0001* |
| | 1 week | 1.08 ± 0.58 | | | | | |
| | Baseline | 1.56 ± 0.73 | 0.98 | 0.55 | 62.40 | 4.3724 | 0.0001* |
| | 1 month | 0.59 ± 0.42 | | | | | |
| | 1 week | 1.08 ± 0.58 | 0.50 | 0.32 | 45.76 | 4.3724 | 0.0001* |
| | 1 month | 0.59 ± 0.42 | | | | | |
| Group B | Baseline | 1.38 ± 0.73 | 0.44 | 0.59 | 31.50 | 3.6143 | 0.0003* |
| | 1 week | 0.95 ± 0.61 | | | | | |
| | Baseline | 1.38 ± 0.73 | 0.92 | 0.57 | 66.47 | 4.2378 | 0.0001* |
| | 1 month | 0.46 ± 0.40 | | | | | |
| | 1 week | 0.95 ± 0.61 | 0.48 | 0.37 | 51.05 | 4.0148 | 0.0001* |
| | 1 month | 0.46 ± 0.40 | | | | | |

***$p$<0.05, Wilcoxon matched pairs test applied**

**Table 23: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with salivary pH scores at different time intervals**

| Time points | Group A | Group B | Z-value | P-value |
|---|---|---|---|---|
| | Mean ± SD | Mean ± SD | | |
| Baseline | 6.20 ± 0.41 | 6.56 ± 0.58 | -2.5288 | 0.0148* |
| 1 week | 6.48 ± 0.51 | 6.76 ± 0.52 | -1.9170 | 0.0612 |
| 1 month | 6.96 ± 0.20 | 7.04 ± 0.20 | -1.4142 | 0.1638 |
| BL-1W | -0.28 ± 0.46 | -0.20 ± 0.41 | -0.6518 | 0.5177 |
| BL-1M | -0.76 ± 0.44 | -0.48 ± 0.51 | -2.0870 | 0.0422* |
| 1W-1M | -0.48 ± 0.51 | -0.28 ± 0.46 | -1.4586 | 0.1512 |

***$p$<0.05, Independent t test applied**

**Table 24: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with salivary pH scores at different time intervals**

| Groups | Time period | Mean ± SD | Mean Diff. | SD Diff. | % of change | t-value | p-value |
|---|---|---|---|---|---|---|---|
| Group A | Baseline | 6.20 ± 0.41 | -0.28 | 0.46 | -4.52 | -3.0551 | 0.0054* |
| | 1 week | 6.48 ± 0.51 | | | | | |
| | Baseline | 6.20 ± 0.41 | -0.76 | 0.44 | -12.26 | -8.7178 | 0.0001* |
| | 1 month | 6.96 ± 0.20 | | | | | |
| | 1 week | 6.48 ± 0.51 | -0.48 | 0.51 | -7.41 | -4.7068 | 0.0001* |
| | 1 month | 6.96 ± 0.20 | | | | | |
| Group B | Baseline | 6.56 ± 0.58 | -0.20 | 0.41 | -3.05 | -2.4495 | 0.0220* |
| | 1 week | 6.76 ± 0.52 | | | | | |
| | Baseline | 6.56 ± 0.58 | -0.48 | 0.51 | -7.32 | -4.7068 | 0.0001* |
| | 1 month | 7.04 ± 0.20 | | | | | |
| | 1 week | 6.76 ± 0.52 | -0.28 | 0.46 | -4.14 | -3.0551 | 0.0054* |
| | 1 month | 7.04 ± 0.20 | | | | | |

***$p$<0.05, dependent t test applied**

**Table 25: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Salivary Buffering Capacity scores at different time intervals**

| Time points | Group A | Group B | Z-value | P-value |
|---|---|---|---|---|
| | Mean ± SD | Mean ± SD | | |
| Baseline | 5.80 ± 0.82 | 6.40 ± 0.65 | -2.8823 | 0.0059* |
| 1 week | 6.36 ± 0.76 | 7.00 ± 0.76 | -2.9754 | 0.0046* |
| 1 month | 7.20 ± 0.65 | 7.44 ± 0.58 | -1.3795 | 0.1741 |
| BL-1W | -0.56 ± 0.51 | -0.60 ± 0.50 | 0.2810 | 0.7799 |
| BL-1M | -1.40 ± 0.50 | -1.04 ± 0.35 | -2.9459 | 0.0050* |
| 1W-1M | -0.84 ± 0.47 | -0.44 ± 0.51 | -2.8868 | 0.0058* |

***$p$<0.05, Independent t test applied**

**Table 26: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with Salivary Buffering Capacity scores at different time intervals**

| Groups | Time period | Mean ± SD | Mean Diff. | SD Diff. | % of change | t-value | p-value |
|---|---|---|---|---|---|---|---|
| Group A | Baseline | 5.80 ± 0.82 | -0.56 | 0.51 | -9.66 | -5.5268 | 0.0001* |
| | 1 week | 6.36 ± 0.76 | | | | | |
| | Baseline | 5.80 ± 0.82 | -1.40 | 0.50 | -24.14 | -14.000 | 0.0001* |
| | 1 month | 7.20 ± 0.65 | | | | | |
| | 1 week | 6.36 ± 0.76 | -0.84 | 0.47 | -13.21 | -8.8874 | 0.0001* |
| | 1 month | 7.20 ± 0.65 | | | | | |
| Group B | Baseline | 6.40 ± 0.65 | -0.60 | 0.50 | -9.38 | -6.0000 | 0.0001* |
| | 1 week | 7.00 ± 0.76 | | | | | |
| | Baseline | 6.40 ± 0.65 | -1.04 | 0.35 | -16.25 | -14.806 | 0.0001* |
| | 1 month | 7.44 ± 0.58 | | | | | |
| | 1 week | 7.00 ± 0.76 | -0.44 | 0.51 | -6.29 | -4.3425 | 0.0002* |
| | 1 month | 7.44 ± 0.58 | | | | | |

***$p$<0.05, dependent t test applied**

**Table 27: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Salivary Flow-rate scores at different time intervals**

| Time points | Group A | Group B | Z-value | P-value |
|---|---|---|---|---|
| | Mean ± SD | Mean ± SD | | |
| Baseline | 1.00 ± 0.33 | 1.23 ± 0.31 | -2.5885 | 0.0127* |
| 1 week | 1.11 ± 0.28 | 1.34 ± 0.30 | -2.8690 | 0.0061* |
| 1 month | 1.25 ± 0.25 | 1.53 ± 0.28 | -3.6812 | 0.0006* |
| BL-1W | -0.11 ± 0.10 | -0.12 ± 0.09 | 0.1549 | 0.8775 |
| BL-1M | -0.26 ± 0.15 | -0.30 ± 0.21 | 0.8412 | 0.4044 |
| 1W-1M | -0.14 ± 0.10 | -0.18 ± 0.18 | 0.9822 | 0.3309 |

***$p$<0.05, Independent t test applied**

**Table 28: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with Salivary Flow-rate scores at different time intervals**

| Groups | Time period | Mean ± SD | Mean Diff. | SD Diff. | % of change | t-value | p-value |
|---|---|---|---|---|---|---|---|
| Group A | Baseline | 1.00 ± 0.33 | -0.11 | 0.10 | -11.24 | -5.7657 | 0.0001* |
| | 1 week | 1.11 ± 0.28 | | | | | |
| | Baseline | 1.00 ± 0.33 | -0.26 | 0.15 | -25.70 | -8.5207 | 0.0001* |
| | 1 month | 1.25 ± 0.25 | | | | | |
| | 1 week | 1.11 ± 0.28 | -0.14 | 0.10 | -13.00 | -7.1761 | 0.0001* |
| | 1 month | 1.25 ± 0.25 | | | | | |
| Group B | Baseline | 1.23 ± 0.31 | -0.12 | 0.09 | -9.45 | -6.8196 | 0.0001* |
| | 1 week | 1.34 ± 0.30 | | | | | |
| | Baseline | 1.23 ± 0.31 | -0.30 | 0.21 | -24.43 | -7.0065 | 0.0001* |
| | 1 month | 1.53 ± 0.28 | | | | | |
| | 1 week | 1.34 ± 0.30 | -0.18 | 0.18 | -13.69 | -5.1919 | 0.0001* |
| | 1 month | 1.53 ± 0.28 | | | | | |

***$p$<0.05, dependent t test applied**

**Table 29: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with *Streptococcus mutans* count scores (*$10^4$ CFU/ml) at different time intervals**

| Time points | Group A | Group B | Z-value | P-value |
|---|---|---|---|---|
| | Mean ± SD | Mean ± SD | | |
| Baseline | 9.36 ± 0.41 | 8.58 ± 0.68 | 4.9117 | 0.0001* |
| 1 week | 9.18 ± 0.44 | 8.37 ± 0.67 | 5.0743 | 0.0001* |
| 1 month | 8.70 ± 0.45 | 8.02 ± 0.65 | 4.2978 | 0.0001* |
| BL-1W | 0.18 ± 0.14 | 0.21 ± 0.12 | -0.8729 | 0.3871 |
| BL-1M | 0.66 ± 0.24 | 0.56 ± 0.16 | 1.7518 | 0.0862 |
| 1W-1M | 0.48 ± 0.17 | 0.35 ± 0.13 | 3.1464 | 0.0028* |

***$p$<0.05, Independent t test applied**

**Table 30: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with *Streptococcus mutans* count scores (*$10^4$ CFU/ml) by at different time intervals**

| Groups | Time period | Mean ± SD | Mean Diff. | SD Diff. | % of change | t-value | p-value |
|---|---|---|---|---|---|---|---|
| Group A | Baseline | 9.36 ± 0.41 | 0.18 | 0.14 | 1.92 | 6.5008 | 0.0001* |
| | 1 week | 9.18 ± 0.44 | | | | | |
| | Baseline | 9.36 ± 0.41 | 0.66 | 0.24 | 7.09 | 13.9591 | 0.0001* |
| | 1 month | 8.70 ± 0.45 | | | | | |
| | 1 week | 9.18 ± 0.44 | 0.48 | 0.17 | 5.27 | 14.6644 | 0.0001* |
| | 1 month | 8.70 ± 0.45 | | | | | |
| Group B | Baseline | 8.58 ± 0.68 | 0.21 | 0.12 | 2.47 | 8.8231 | 0.0001* |
| | 1 week | 8.37 ± 0.67 | | | | | |
| | Baseline | 8.58 ± 0.68 | 0.56 | 0.16 | 6.57 | 17.8710 | 0.0001* |
| | 1 month | 8.02 ± 0.65 | | | | | |
| | 1 week | 8.37 ± 0.67 | 0.35 | 0.13 | 4.20 | 13.5922 | 0.0001* |
| | 1 month | 8.02 ± 0.65 | | | | | |

***$p$<0.05, dependent t test applied**

**Table 31: Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with *Lactobacillus acidophilus* count scores (*$10^4$ CFU/ml) at different time intervals**

| Time points | Group A | Group B | Z-value | P-value |
|---|---|---|---|---|
| | Mean ± SD | Mean ± SD | | |
| Baseline | 8.79 ± 0.35 | 7.96 ± 0.66 | 5.5706 | 0.0001* |
| 1 week | 8.66 ± 0.35 | 7.78 ± 0.62 | 6.2153 | 0.0001* |
| 1 month | 8.31 ± 0.38 | 7.50 ± 0.64 | 5.4282 | 0.0001* |
| BL-1W | 0.13 ± 0.06 | 0.18 ± 0.13 | -1.8950 | 0.0641 |
| BL-1M | 0.48 ± 0.21 | 0.46 ± 0.16 | 0.3063 | 0.7607 |
| 1W-1M | 0.35 ± 0.18 | 0.28 ± 0.14 | 1.5951 | 0.1172 |

***$p$<0.05, Independent t test applied**

**Table 32: Intragroup comparison of visually impaired children (Group A) and normal children (Group B) with *Lactobacillus acidophilus* count scores (*$10^4$ CFU/ml) at different time intervals**

| Groups | Time period | Mean ± SD | Mean Diff. | SD Diff. | % of change | t-value | p-value |
|---|---|---|---|---|---|---|---|
| Group A | Baseline | 8.79 ± 0.35 | 0.13 | 0.06 | 1.46 | 10.428 | 0.0001* |
| | 1 week | 8.66 ± 0.35 | | | | | |
| | Baseline | 8.79 ± 0.35 | 0.48 | 0.21 | 5.46 | 11.641 | 0.0001* |
| | 1 month | 8.31 ± 0.38 | | | | | |
| | 1 week | 8.66 ± 0.35 | 0.35 | 0.18 | 4.06 | 10.006 | 0.0001* |
| | 1 month | 8.31 ± 0.38 | | | | | |
| Group B | Baseline | 7.96 ± 0.66 | 0.18 | 0.13 | 2.31 | 6.8446 | 0.0001* |
| | 1 week | 7.78 ± 0.62 | | | | | |
| | Baseline | 7.96 ± 0.66 | 0.46 | 0.16 | 5.83 | 14.462 | 0.0001* |
| | 1 month | 7.50 ± 0.64 | | | | | |
| | 1 week | 7.78 ± 0.62 | 0.28 | 0.14 | 3.60 | 9.8995 | 0.0001* |
| | 1 month | 7.50 ± 0.64 | | | | | |

***$p$<0.05, dependent t test applied**

**Diagram 1: Distribution of the visually impaired children (Group A) and normal children (Group B) according to age**

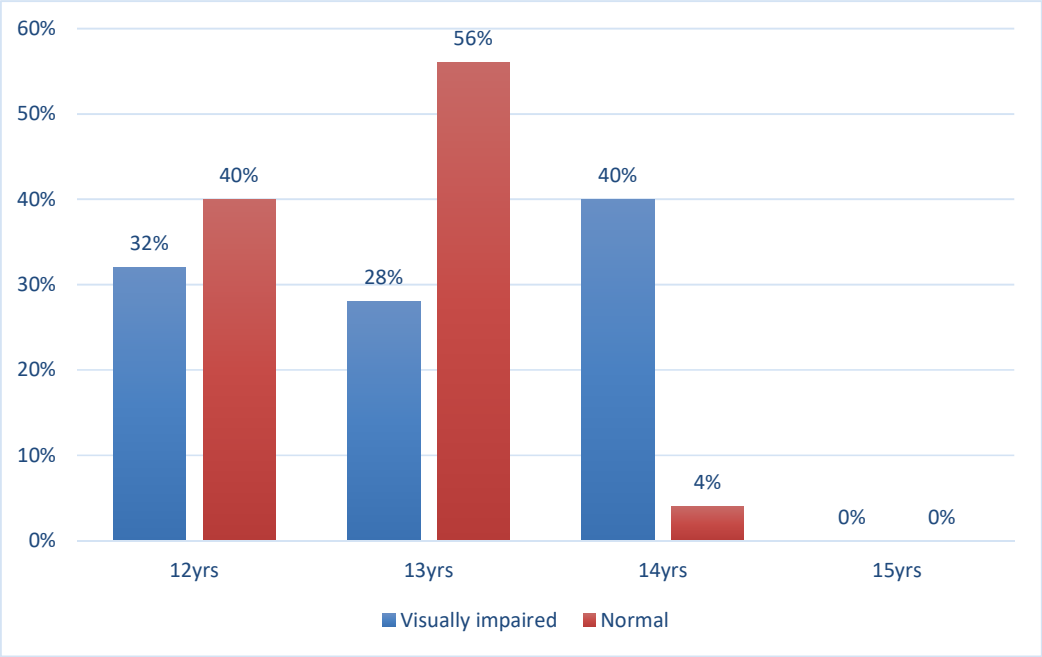



**Diagram 2: Distribution of visually impaired children (Group A) and normal children (Group B) according to Gender**

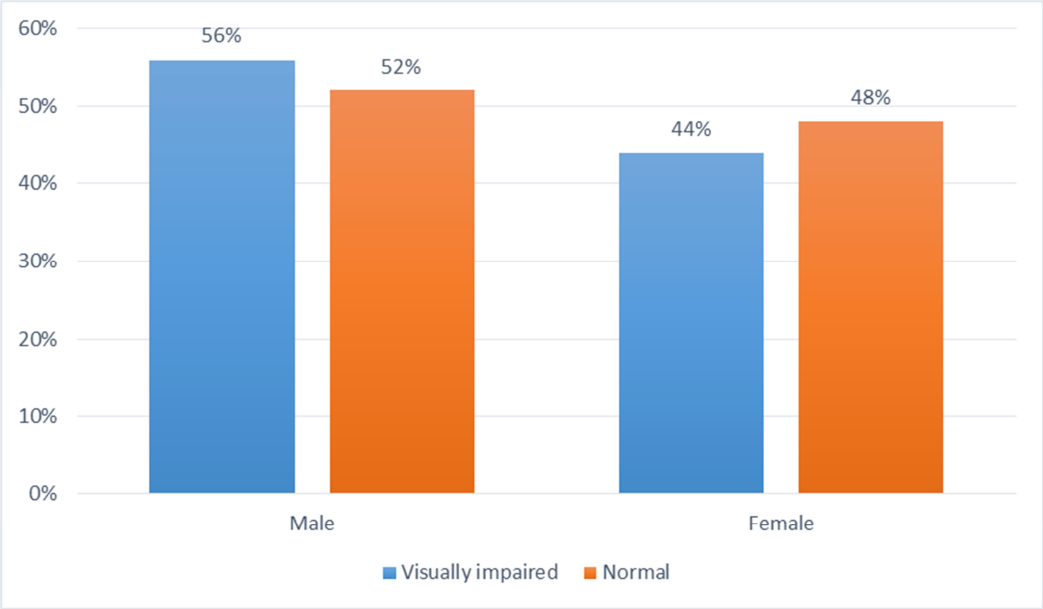


**Diagram 3: Distribution of visually impaired children (Group A) and normal children (Group B) according to Kuppuswamy Socio - economic classification**

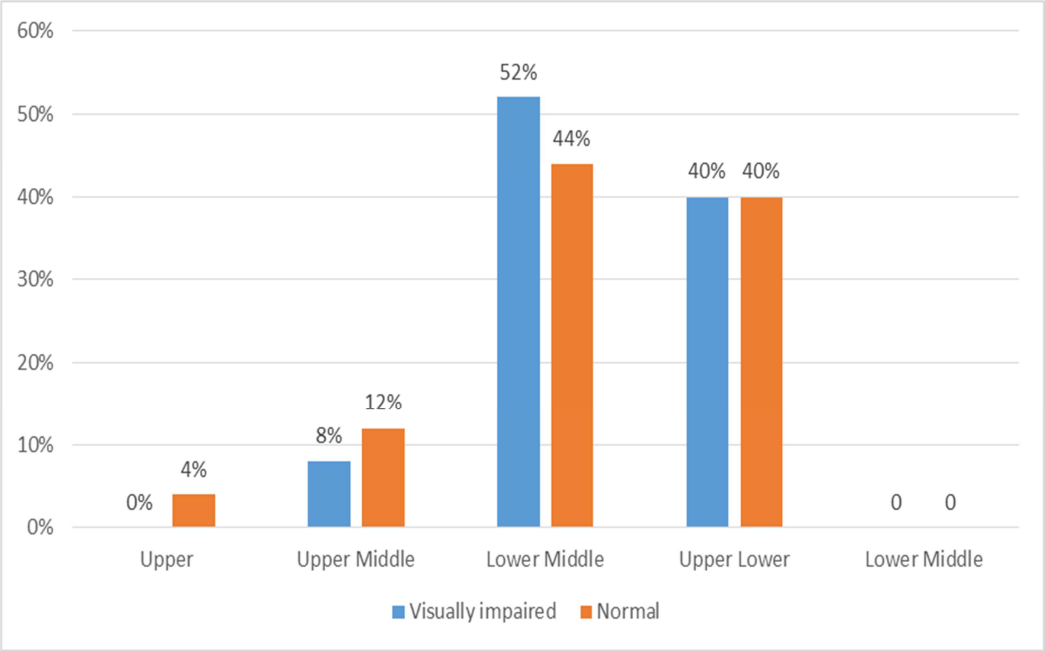



**Diagram 4: Distribution of visually impaired children (Group A) and normal children (Group B) according to Medical and Dental history**

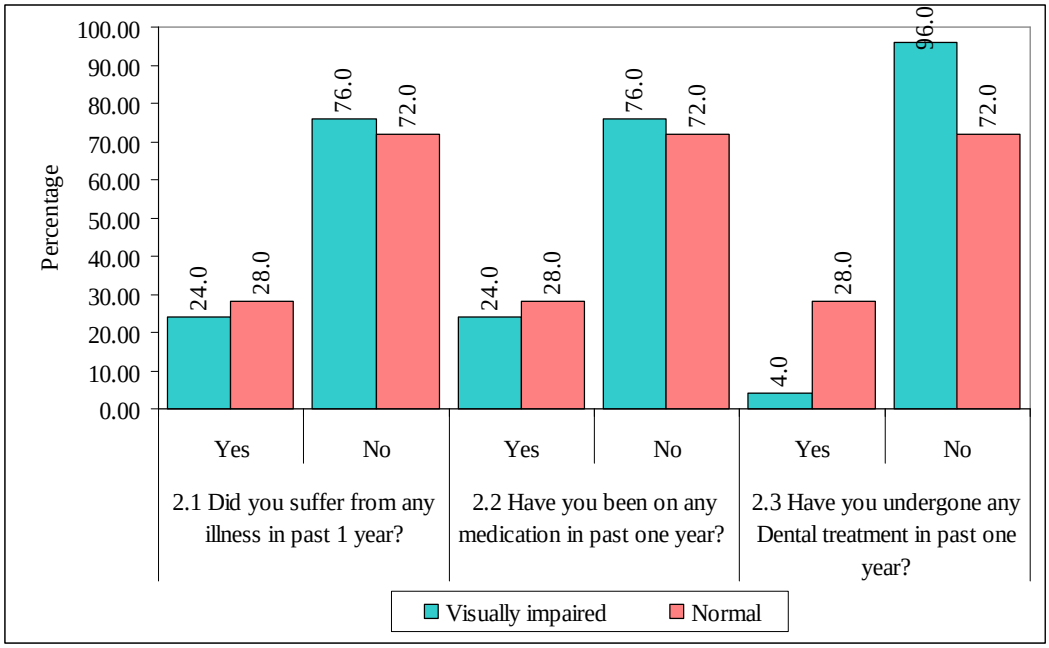
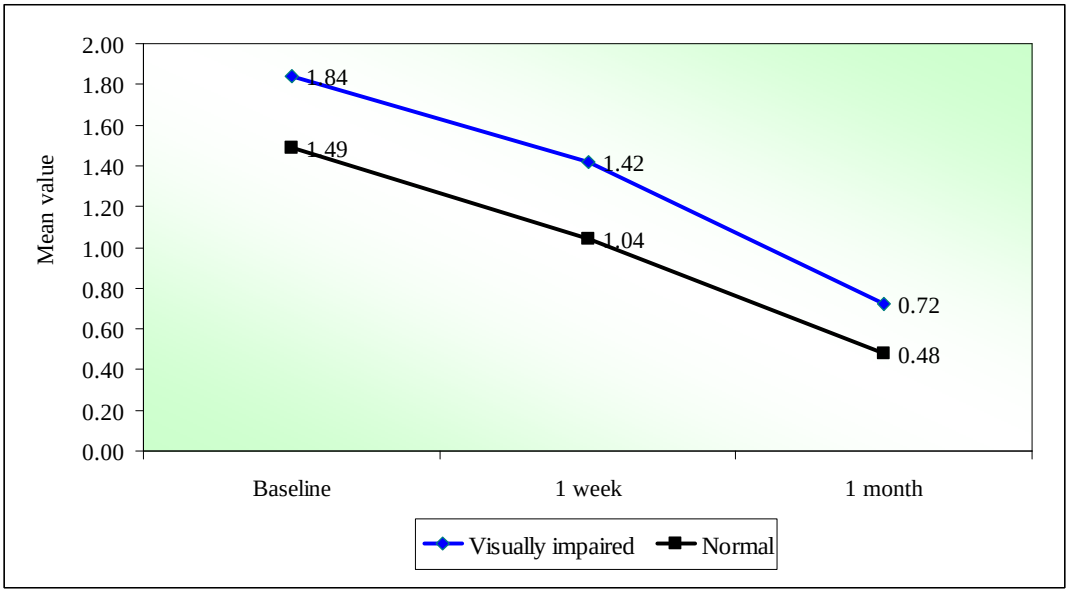
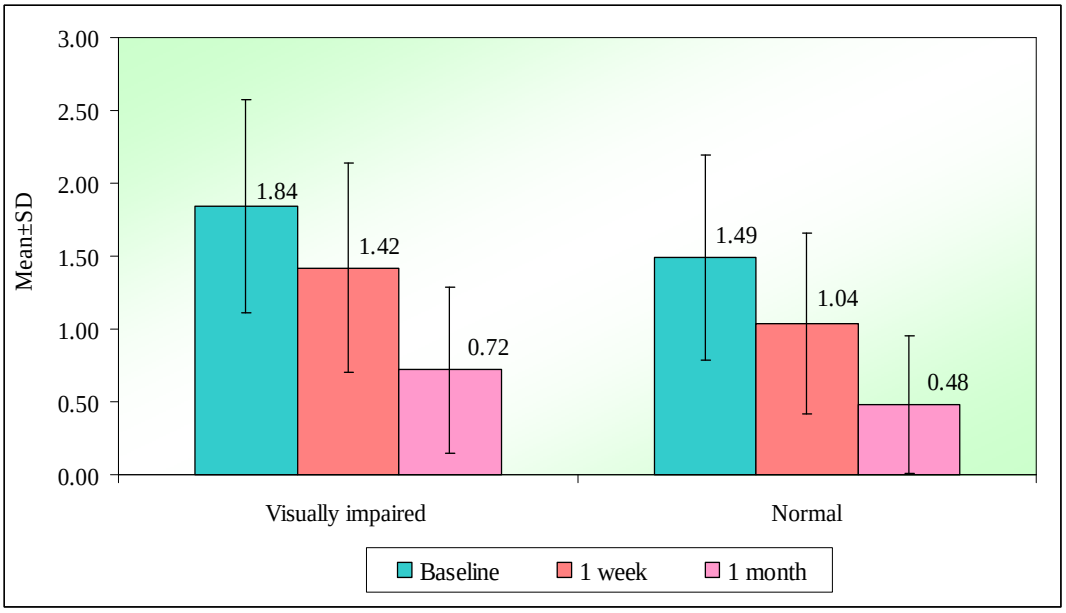


**Diagram 5 (a and b): Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Debris Index – Simplified (DI-S) scores at different time points**

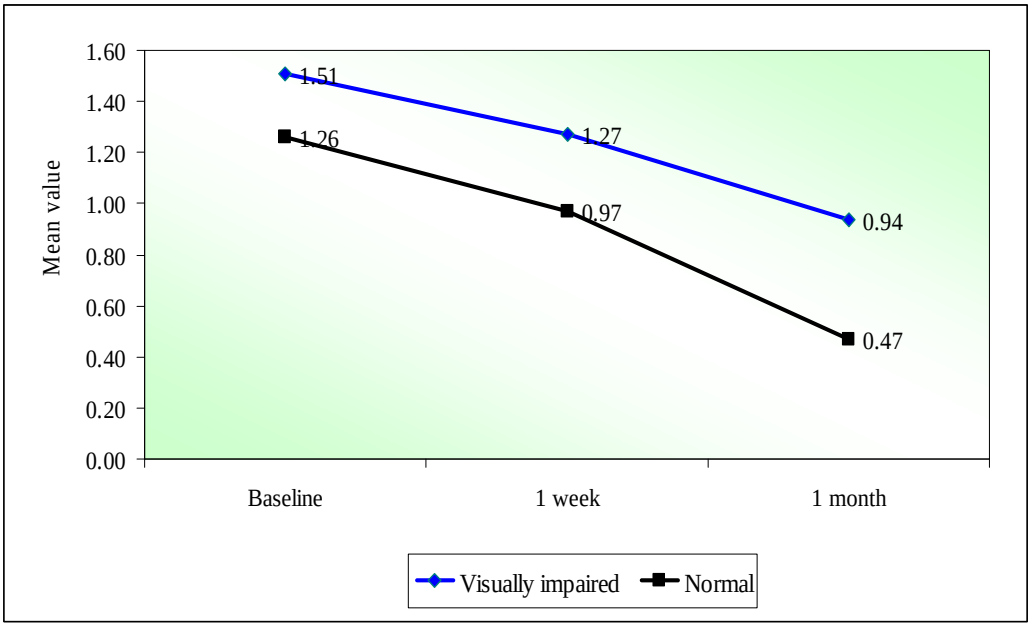



5 (a)

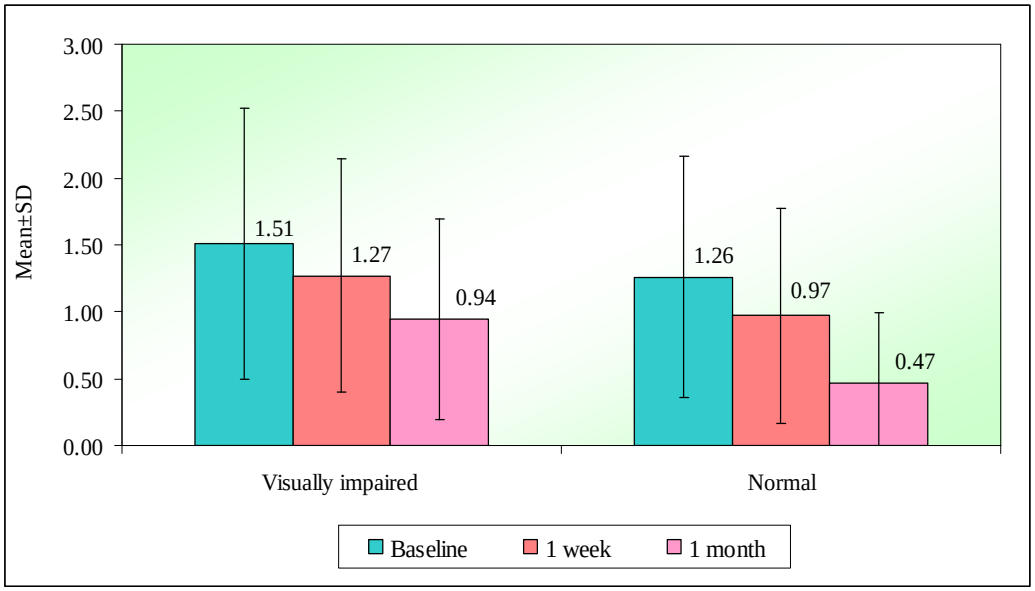



5 (b)

**Diagram 6 (a and b): Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Calculus Index – Simplified (CI-S) scores at different time points**

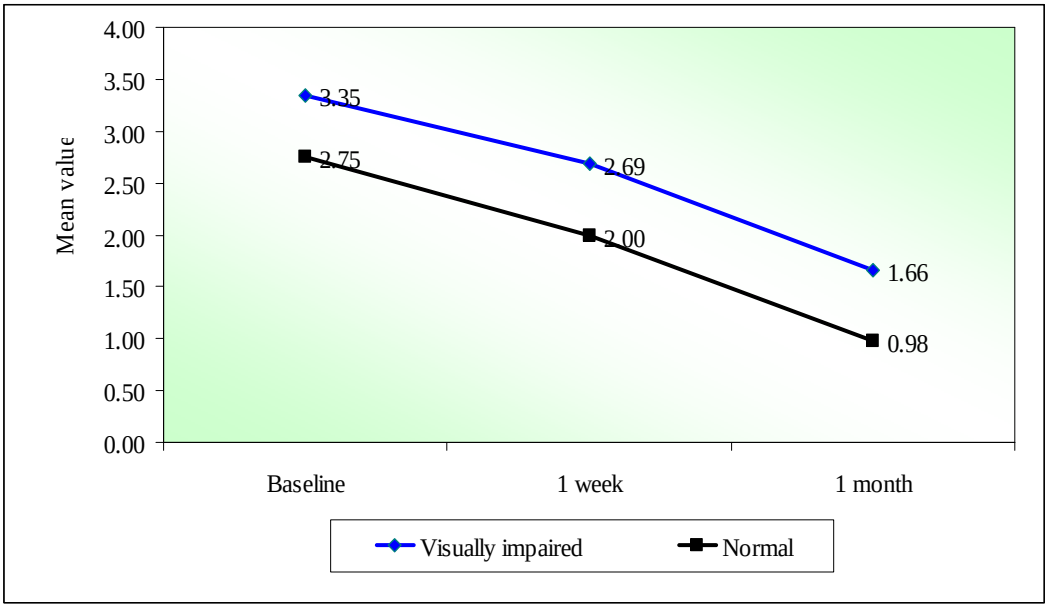



6 (a)

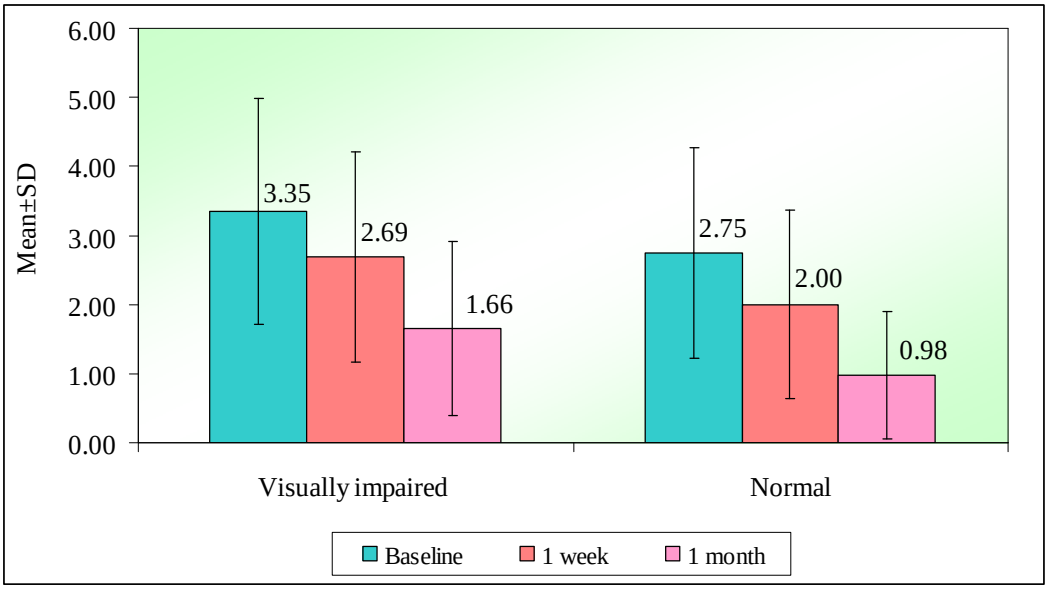



6 (b)

**Diagram 7 (a and b): Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Oral Hygiene Index – Simplified (OHI-S) scores at different time points**

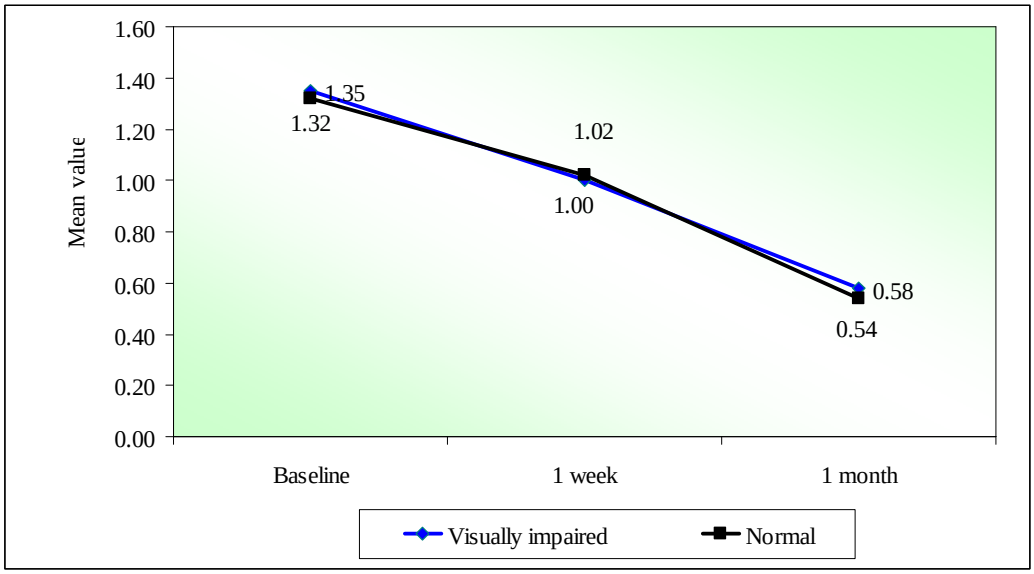



7 (a)

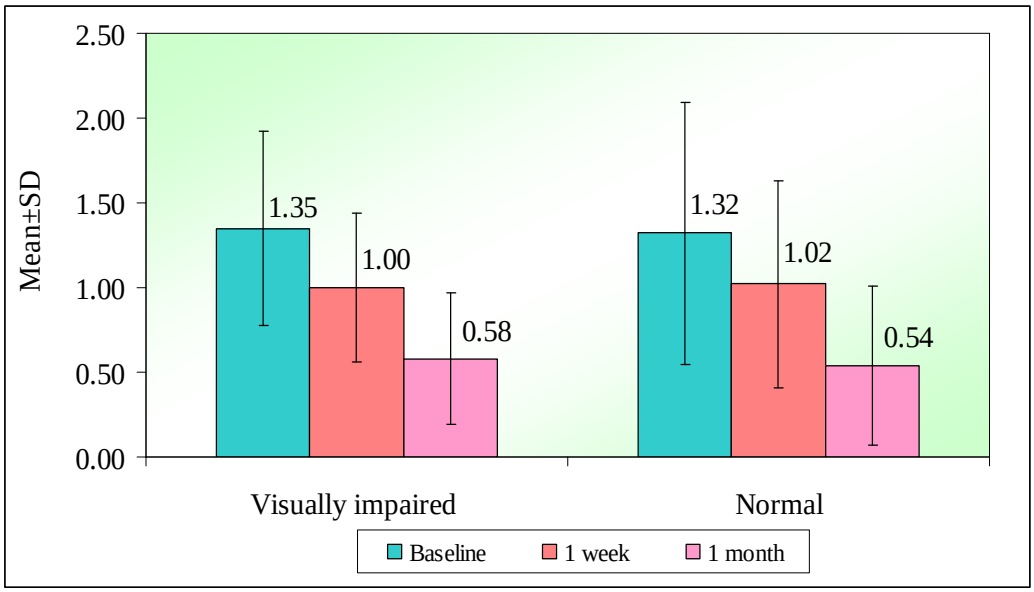



7 (b)

**Diagram 8 (a and b): Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Gingival Index (GI) scores at different time points**

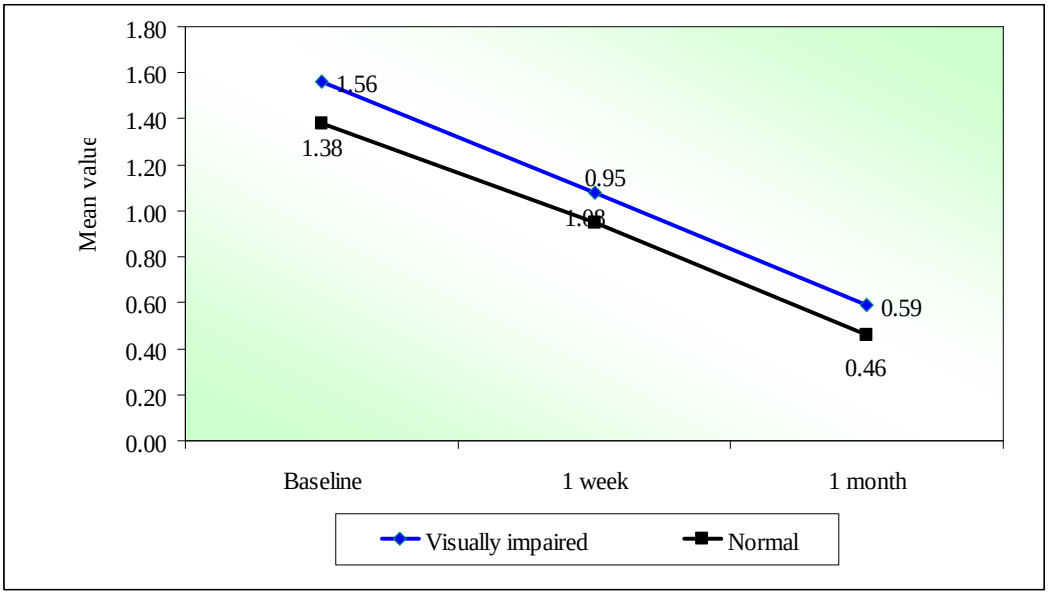



8 (a)

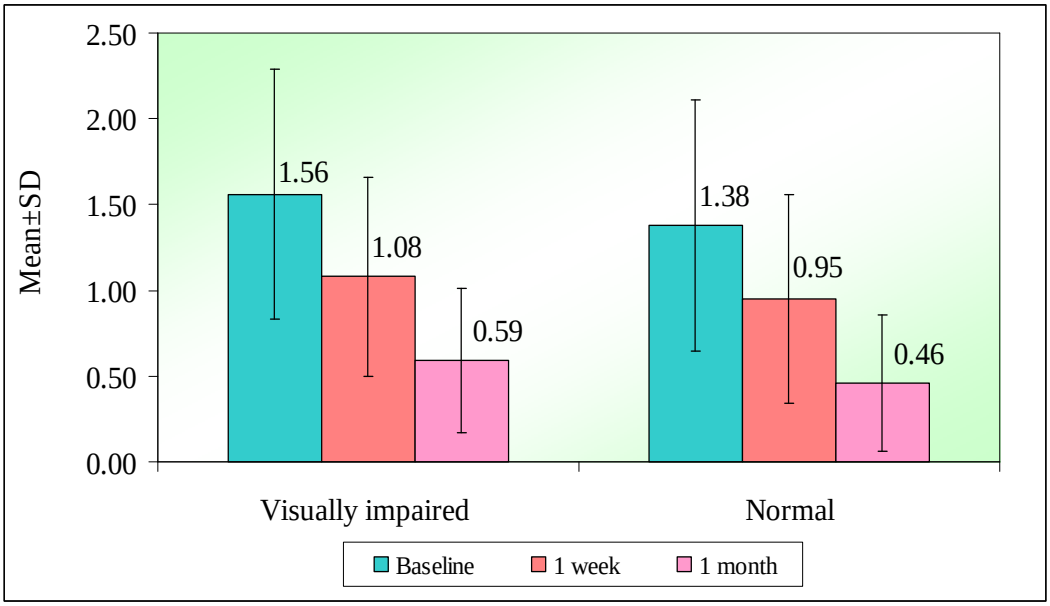



8 (b)

**Diagram 9 (a and b): Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Plaque Index (PI) scores at different time points**

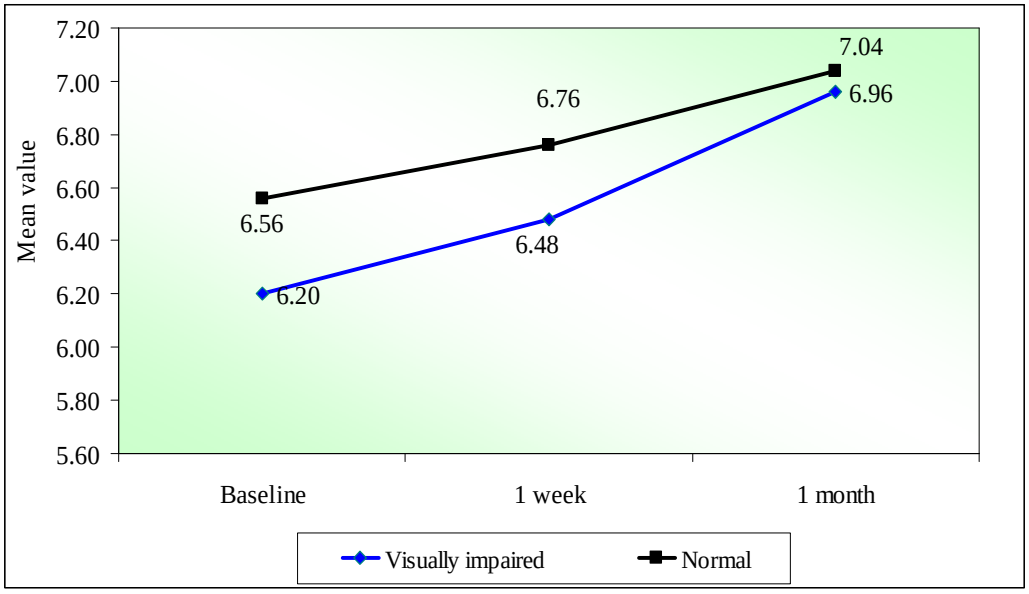



9 (a)

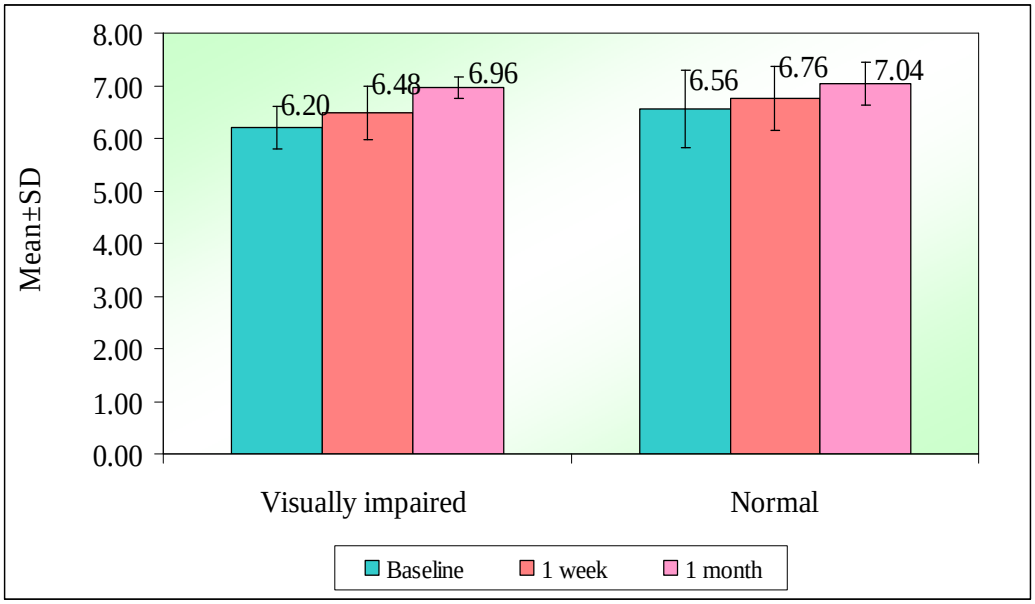



9 (b)

**Diagram 10 (a and b): Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with salivary pH scores at different time points**

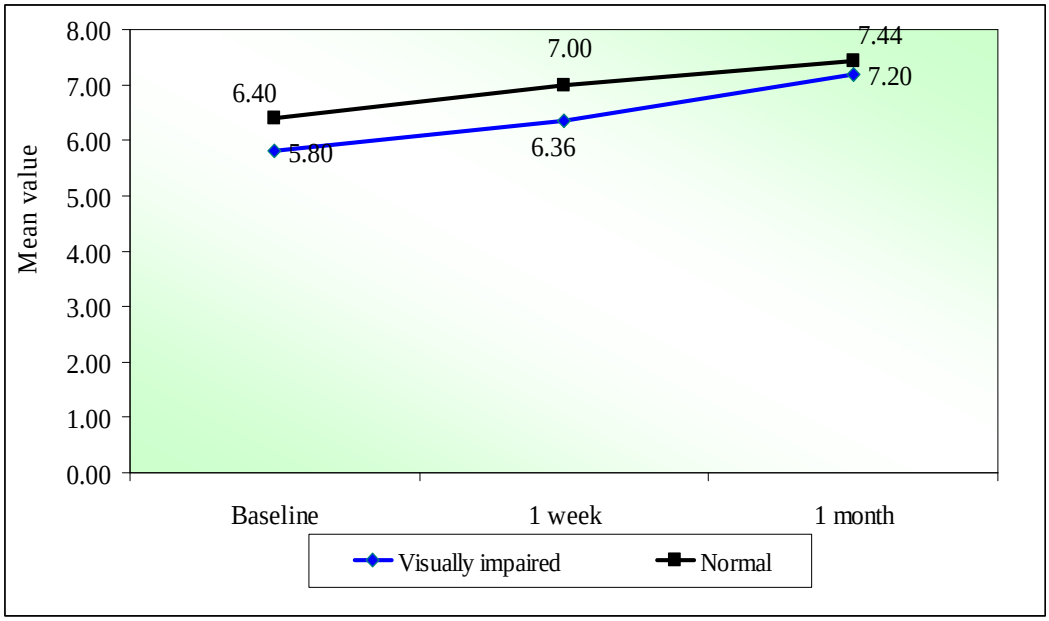



10 (a)

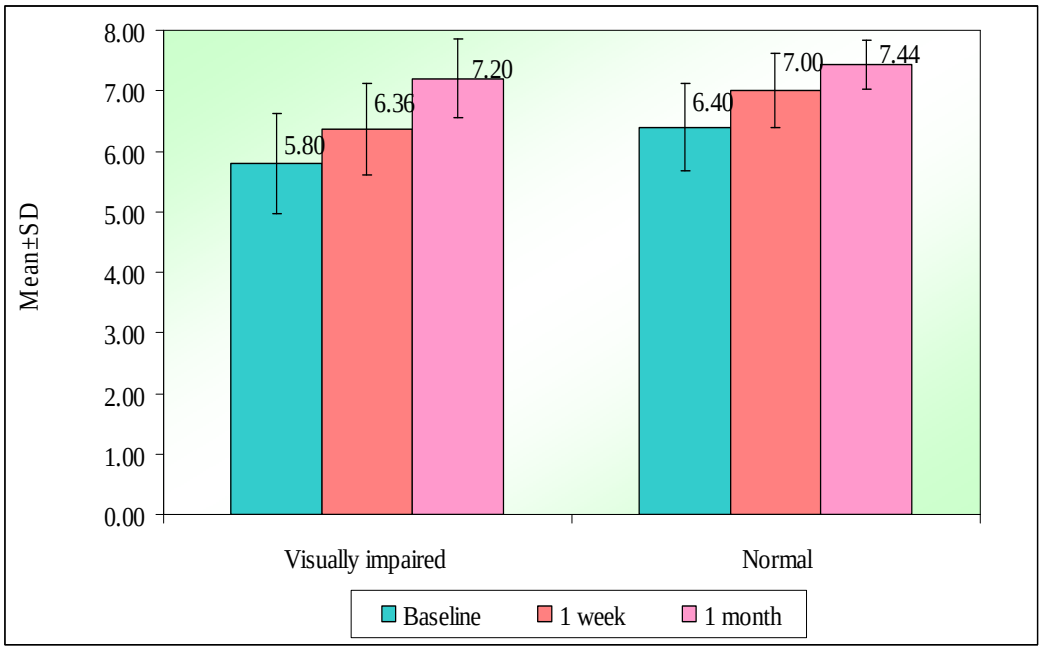



10 (b)

**Diagram 11 (a and b): Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Salivary Buffering Capacity scores at different time points**

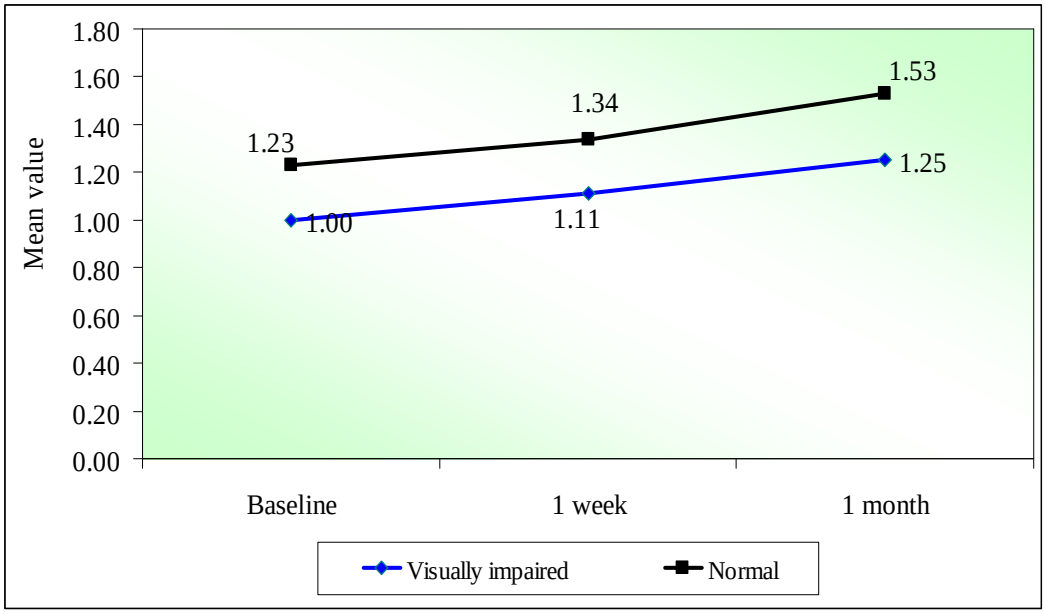



11 (a)

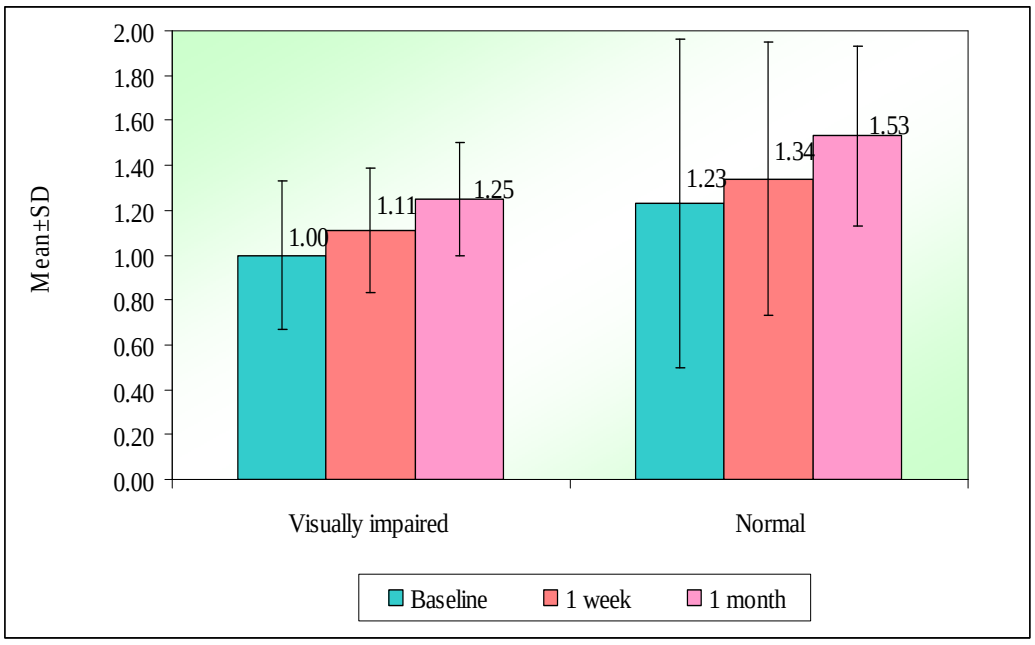



11 (b)

**Diagram 12 (a and b): Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with Salivary Flow-rate scores at different time points**

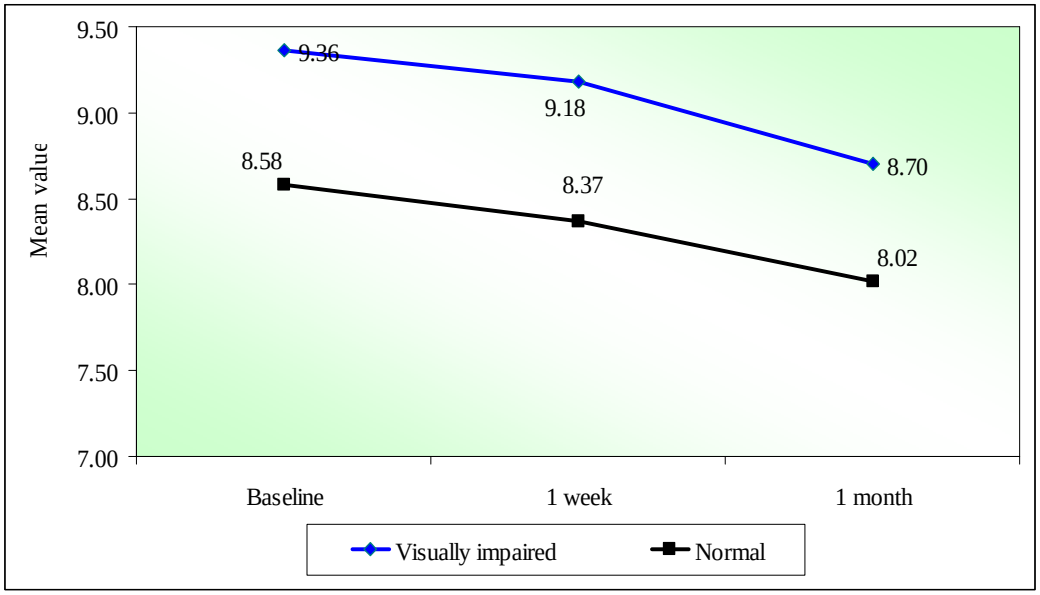



12 (a)

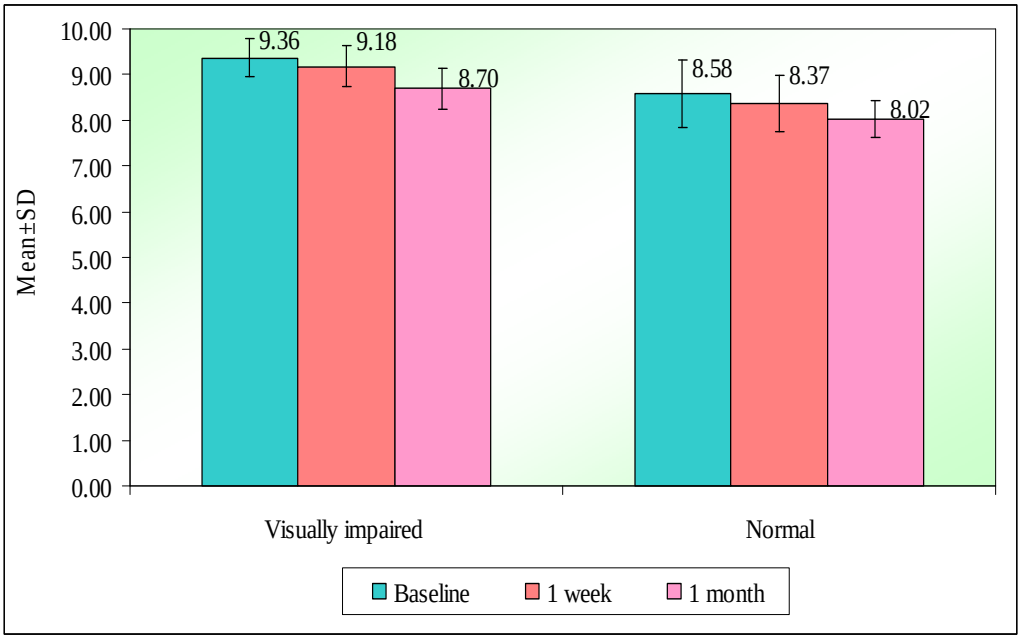



12 (b)

**Diagram 13 (a and b): Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with *Streptococcus mutans* count scores (*$10^4$ CFU/ml) at different time points**

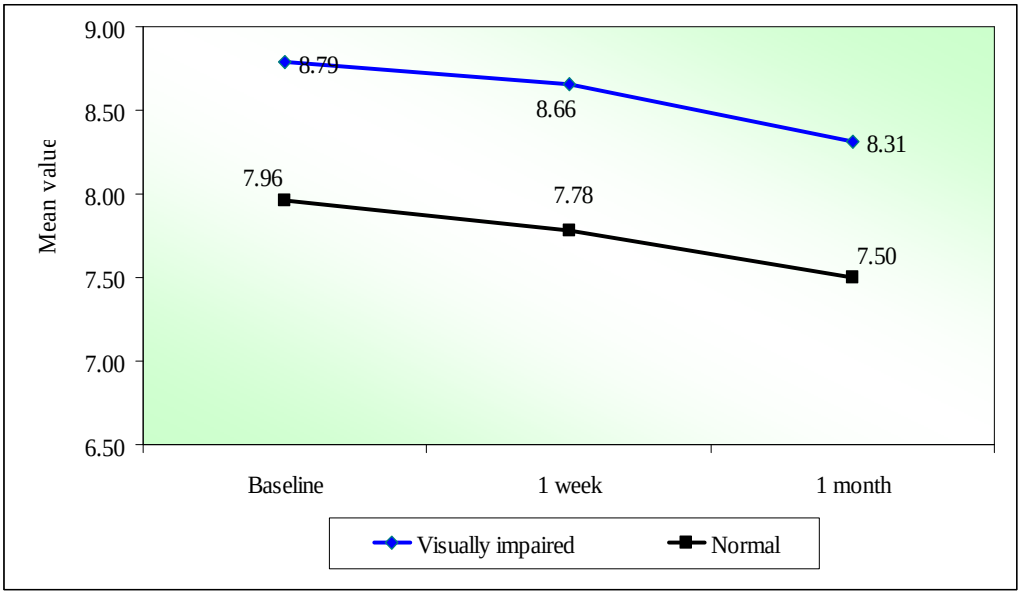



13 (a)

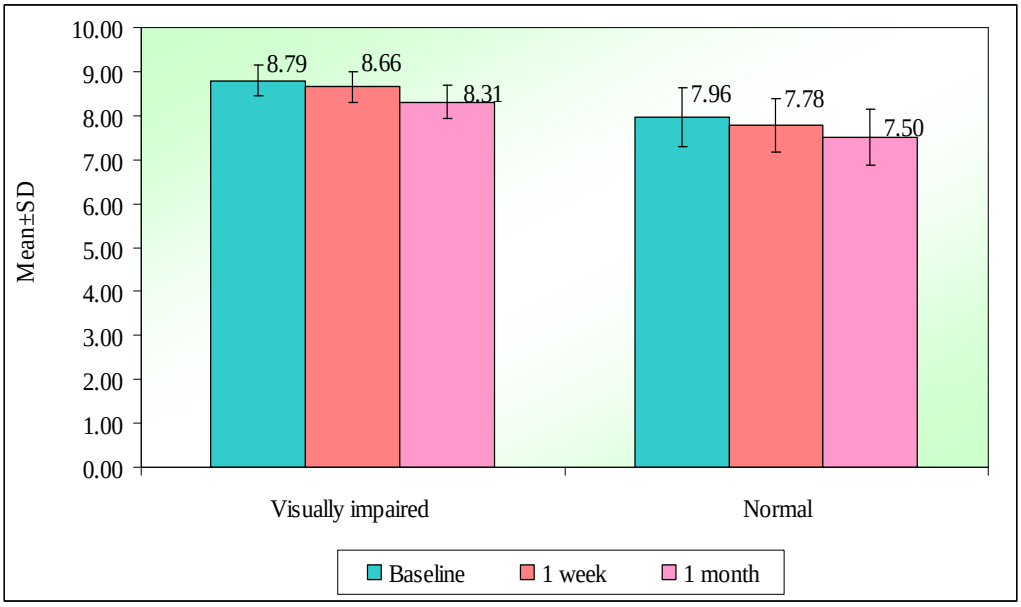



13 (b)

**Diagram 14 (a and b): Intergroup comparison of visually impaired children (Group A) and normal children (Group B) with *Lactobacillus acidophilus* count scores (*$10^4$ CFU/ml) at different time points**




14 (a)




14 (b)

# DISCUSSION

"An ounce of prevention is worth a pound of cure."

**— Benjamin Franklin**

## Global burden of Oral disease

According to study conducted by Dye BA et al (2017), to understand "The Global Burden of Disease", it is estimated that "oral diseases" affect nearly 3.5 billion people globally and permanent "Dental caries" is the most frequent condition. Around 2.3 billion of the population worldwide suffer from "permanent dental caries" while more than 530 million children suffer from caries in their milk teeth. The World Health Organization (WHO) has stated that nearly 60-90% of 12 year old children suffer from dental caries.[1, 61-62] The prevalence of "caries" in children is affected by multifactorial agents. [1, 61-63]

Additionally, one more oral disease of public health concern affecting 90% of world's population is "Periodontal disease".[64] The major local predisposing factor of importance is poor oral hygiene. It mainly stems from children's dependence on adults' assistance with routine oral hygiene measures and practices and also not having adequate knowledge regarding the same.[65]

## Burden of oral diseases in India

As per the "National Oral Health Survey and Fluoride Mapping (2002-2003), Dental Council of India, New Delhi, 2004", the prevalence of periodontal diseases was 57% and 67.7% in the age groups of 12 and 15 years, respectively necessitating

the need for preventive interventions. Furthermore, the prevalence of dental caries was 53.8% and 63.1% in 12 and 15 year old children respectively.[66-67]

Dental diseases have negative effect on child's growth and development, restricting activities at schools as well as home. Furthermore, it also impedes concentration of children in schools and is cause for loss of more than "51 million school hours" globally.[68-69]

The impact of oral diseases worsens in children with special health care needs, especially in visually impaired children when compared to normal children. Such children are not adept at maintaining "oral hygiene" and find it difficult to even identify the initial signs of dental problems. A national survey unsnarling the "oral health status" in "visually impaired children" is not initiated in India. Nevertheless, a small number of studies conducted in different states of India have reported poor "oral hygiene status" and high "caries prevalence" among "visually impaired children".[14-20]

**Role of health education**

Application of appropriate health education in oral health is a well acknowledged initiative in averting "oral diseases". It brings out new behaviors that will promote and improve individual health.[5, 70] Education in oral health if given during the formative years of child, it will be there with him for lifetime. Thus, child's schooling period is appropriate time to impart oral health education for prevention of oral health problems.[71-72]

Various OHE intervention strategies like conventional health education aids, such as lectures, live demonstration, and models have been employed to impart education in oral health in school education programmes.[73-74] It has been documented

that the oral health status and knowledge regarding oral health may significantly improve if health promotion of children is carried out in a comprehensive and interesting manner.[75] Amalgamation of education, entertainment and active participation of children could make learning process a joyful activity and would improve their learning skills.[20]

Use of Audio tactile Performance (ATP) technique and animations have gained popularity while giving education in oral health to visually impaired children and normal school children respectively. Various studies have shown remarkable development in oral hygiene status after delivering OHE using these techniques.[28, 39, 41, 45, 76-79]

**The study population**

Children in the age group of 12 to 15 years were selected to carry out this study. Major advantage in selecting this age group was that at this age all the index teeth are erupted and thus there is little probability of overestimating the disease due to eruption gingivitis. The children belonging to this age range are most susceptible to "caries" as well as "gingival and periodontal diseases" owing to hormonal influence, change in "dietary habits" and "lifestyle".[80]

**Socio economic status**

Distinguishable association has been established between oral diseases and socio economic status. Revised "Kuppuswamy socio economic classification" (2021) was used for the present study.[81-82]

Majority of the visually impaired children (52%) and normal children (44%) belonged to lower middle socioeconomic status. It may be attributed to the fact that

government schools provide free education and attract students from lower socio economic class. A study done by Malvania EA[83] et al (2014), Bekiroglu N[31] et al (2012) and Marshall TA et al[84] (2007) found similar results.[83-84] Poor socio economic status has been known to adversely affect gingival, periodontal condition and increases susceptibility of an individual to dental caries. Similarly high caries prevalence and poor oral hygiene status was observed in our study in both the groups.

**Past Dental visits**

Only 4% and 28% of children from visually impaired group and normal group had undergone dental treatment in the past highlighting the oral hygiene neglect amongst both the groups. Alike results were seen in studies conducted by Tiwari BS et al (2019), Al-Darwish MS et al (2016) and Blaggana A et al (2016).[28, 85-86]

**Diet history**

Majority of visually impaired children consumed vegetarian diet while majority of normal children consumed mixed vegetarian diet. A positive relation was obtained in study conducted by Lashkari KP (2016) which highlighted the fact that vegetarians have an increased risk of dental caries compared with non-vegetarians and DMFT score.[87] Similar results were seen in our study, visually impaired children had higher mean DMFT scores when compared to normal children.

Sweet consumption was observed more in visually impaired children when compared to normal children in last 24 hours. Moreover, greater percentage of visually impaired children consumed sweets during meals as-well as in-between the meals. It has been postulated from findings of "The Vipeholm dental caries study" that the increase in the frequency of consumption of sugar between meals was

associated to an increase in occurrence dental caries (Gustafsson BE, 1954). Similarly, the present study delineates higher dental caries prevalence in "visually impaired children" than "normal children" who gave more history of sugar consumption.[88]

**Oral hygiene practices**

Fairly similar oral hygiene practices were observed in both the groups in terms of use of toothbrush, fluoridated toothpaste as oral hygiene aid to clean their teeth. Children from both the groups did not use any additional oral hygiene aid to clean their teeth. Most of the "visually impaired children" (68%) and "normal children" (56%) brushed their teeth in horizontal motion which accentuates the fact that they are incognizant about correct brushing technique. However, visually impaired children (52%) revealed hurting of gums while brushing to be a reason for changing their toothbrush. The underlying cause for this reason may be either fraying of bristles or not knowing appropriate brushing technique. Yet another significant finding from this study was majority of visually impaired children (52%) never rinsed their mouth with water while 52% of normal children sometimes rinsed their mouth with water. The reasoning for this could be as visually impaired are dependent on others for their routine activity, they may omit rinsing their mouth with water after snacking. Appropriate education would make them understand the importance of maintaining their oral health in a correct way so they become confident to carry out oral hygiene practices. These findings are similar to studies conducted by Tiwari BS et al (2019) and Blaggana A et al (2016). [28, 86]

**Host factor**

One of the important host factor is "saliva" and any changes in its consistency, volume, microbial load will have definite impact on development of dental problems. It represents the oral load of microorganisms as well as their average colonization in dentition. Thus it has good potential in evaluating risk for development of oral diseases mainly dental caries.[89]

In the present study, unstimulated saliva was preferred over stimulated saliva as an increase in salivary flow rate can lead to elevation in concentration of proteins, sodium chloride and bicarbonate ions and thus leading to increase in salivary pH and would not portray actual representation of microbial load.[90-93]

**Clinical and salivary parameters:**

In the current study, dental caries experience was assessed at baseline, "Oral hygiene Index – Simplified (OHI-S)", "Gingival Index (GI)", "Plaque Index (PI)", "Salivary flow rate", "saliva pH", "salivary buffering capacity", "*Streptococcus mutans"* and "*Lactobacillus acidophilus"* were evaluated at baseline, immediately after intervention (health education) 1 week and 1 month after intervention (health education).

**Clinical parameters:**

In the current study, the "mean DMFT" scores were 5.44 ±3.00 and 3.20 ± 2.15 in "visually impaired" and "normal children" respectively. The mean dmft scores was 0.84 ± 1.51 in visually impaired children while it was 0.48 ± 0.69 in normal children. These findings were in agreement with the previous researches by Reddy KV et al (2011) and Solanki J et al (2013) where higher caries prevalence was noted

in visually impaired children. It may be attributed to the lack of awareness and knowledge regarding “oral hygiene practices” in “visually impaired children” and high intake of sugar intake which is observed in the current study.

At baseline, oral hygiene scores, gingival scores and plaque scores were on higher side in visually impaired children than Normal children. Maximum reduction in oral hygiene scores, gingival scores and plaque scores were observed in normal children when compared to visually impaired children during the time interval from baseline to 1 month. These findings imply that the practice of appropriate oral hygiene practices delivered by OHE were better practiced by normal children when compared to visually impaired children. The reasons could be attributed to the facts that in visually impaired children due to inherent loss of vision, they lack self-help skills and cannot visualize and remove plaque and debris. Adding to this factor, other reason could be negligence of parents/ guardians supervision while brushing which can result in poor oral hygiene. This result is in accordance with studies executed by Sinha N et al (2021)[94], Tiwari BS et al (2019)[28], Ramezaninia J et al (2018)[95], Deshpande S et al (2017)[39], Joybell C et al (2015)[96], Nguanjairak R et al (2016)[97].

No similar interventional studies are conducted till date comparing influence of OHE on “oral hygiene status” in “normal and visually impaired children” and hence exact comparison could not be done. In the present study, the impact of ATP technique on visually impaired children and VP technique for normal children was found to be significantly effective in reduction of oral hygiene scores, gingival scores and plaque scores of visually impaired and normal children.

**Salivary Parameters**

A statistically significant difference was observed at different time intervals in both the groups with respect to salivary physico-chemical and microbiological parameters. “salivary pH”, “buffering capacity” and “flow-rate” in normal children were more than visually impaired children at baseline. Microbiological parameters like *Streptococcus mutans* and *Lactobacillus acidophilus* were more in visually impaired children when compared to normal children at baseline.

These finding highlights the fact that visually impaired children are more susceptible to dental caries and poor oral hygiene when compared to normal children. However, post education improvement in “salivary pH”, “buffering capacity”, “flow-rate” and reduction in *Streptococcus mutans* counts was seen in visually impaired children when compared to normal children. Furthermore, maximum decrease in *Lactobacillus acidophilus* count was seen in normal children when compared to visually impaired children.

These findings also signify that appropriate oral health education helped children in both the groups to improve their salivary physicochemical and microbiological parameters. Furthermore, it can be noted that visually impaired children were more cautious about their oral health and needed appropriate guidance to practice correct oral hygiene practices.

Similar results were seen in observational studies conducted by Sakeenabi B et al (2011)[50], Hebbal M et al (2012)[51], Hegde P P et al (2005)[98] and Haryuni RF et al (2018)[99]. Literature is devoid of interventional studies assessing the effect of OHE on

"salivary parameters" and "oral hygiene status" among "visually impaired and normal children", hence exact comparison could not be made.

Overall, the "oral hygiene status" and "salivary parameters" of both "visually impaired and normal children" were unsatisfactory at baseline being more inferior among "visually impaired children". This may be attributed to the fact that during lockdown due to COVID 19 Pandemic, children were at home which would have led to frequent snacking and were devoid of "oral health education" to follow correct oral hygiene practices.

The current interventional study revealed that, by rendering appropriate integration of health education interventions and active participation of children, there was remarkable improvement in oral hygiene status and salivary parameters.

T.R. Reid has beautifully stated that, "For the mass prevention of disease, mass education is a key weapon".

**STRENGTHS OF THE STUDY:**

- The present study had no dropouts.
- As per our knowledge, this extensive study is first of its kind where salivary physicochemical and microbiological parameters, oral hygiene scores, debris scores, calculus scores, gingival scores and plaque scores are compared before and after specialized oral health education techniques in visually impaired and normal children.
- The present study was conducted during ongoing COVID 19 Pandemic where appropriate oral health education would help them take appropriate oral hygiene precautions and would aid in reducing salivary oral pathogens.
- In addition to oral hygiene instructions, both visually impaired and normal children were educated about standard precautions to be taken during COVID 19 Pandemic to prevent its transmission and spread.
- Children with special health care needs often lack choices that would assist them in improving their oral hygiene. The current study rendered them the chance that visually impaired children deserved.

**LIMITATIONS**

Shorter follow up period of 1 month due to prevailing COVID 19 Pandemic is the limitation of the study.

# CONCLUSION

In the current years, focus has shifted towards assessment of effectiveness of preventive strategies concerning "Education in Oral Health". Community or Population based interventions have greatest impact on a community which may be at school level, or neighborhood level or village level or at national level. Efficient community based intervention programs are planned procedures that prevents occurrence of a disease. Of the many approaches for preventing dental diseases, the best method is delivering appropriate OHE. With ongoing COVID 19 Pandemic, knowledge regarding 'oral health' and 'oral hygiene practices' is of special significance.

Use of "ATP" technique for "visually impaired children" and "VP" technique for "normal children" to impart education in oral health significantly reduced debris, calculus, plaque and gingival scores thereby improving gingival health. Apart from improving clinical parameters, salivary parameters like pH, buffering capacity and flow-rate significantly improved. Furthermore, *Streptococcus mutans* and *Lactobacillus acidophilus* colony counts also reduced significantly in both the groups.

The overall improvement in clinical parameters and reduction in *Lactobacillus acidophilus* count was more in normal children while improvement in "salivary pH, buffering capacity, and flow-rate" and reduction in *Streptococcus mutans* count was more in "visually impaired children". Thus appropriate education in oral health is of special significance in improvement of oral hygiene status and salivary parameters in normal and visually impaired children.

# FUTURE RECOMMENDATIONS

- Educating the parents, guardians, caregivers, and also the individual children about primary preventive strategies.
- Application of preventive pit and fissure sealants to the recently erupted permanent molars and premolars and guiding parents and guardians for regular surveillance of the sealants.
- Schools should include oral health as part of training programs and collaborations with dental colleges so appropriate oral hygiene practices can be inculcated at young age.
- Future interventional studies could be planned with longer follow-up period for more significant outcome.

# PUBLIC HEALTH SIGNIFICANCE

Special health care needs children are the most neglected and vulnerable batch of our society. They are always dependent on their parents, caregivers for most of their routine activities including oral hygiene practices. Communication is the greatest barrier while delivering oral health education to special health care needs children which can lead to misunderstanding, misinterpretation of the instructions given by the instructor. One such infirmity that affects routine life of an individual is vision impairment. The present study has successfully served the Motto of the department which is ***"Reaching the Unreached"***

This present study has following beneficial outcomes;

- Health habits formed at younger age will be carried to adult age, old age, and even to next generation. They will develop thorough understanding of significance of oral health and oral hygiene practices which will make them self-sufficient.
- Improvement in "oral hygiene status" of "visually impaired children" and "normal children".
- Improvement of salivary parameters (physicochemical and microbiological) of "visually impaired children" and "normal children".
- Improvement of "plaque and gingival scores" of "visually impaired children and normal children".
- Improvement of "knowledge, attitude and practices" regarding "oral health" of "visually impaired and normal children".

# SUMMARY

Oral diseases affect nearly 3.5 billion people globally of which dental caries and gingival diseases are two most common diseases. The World Health Organization (WHO) have stated that the nearly 60-90% of children suffer from dental caries. Furthermore, as per the "National Oral Health Survey and Fluoride Mapping (2002-2003), Dental Council of India, New Delhi, 2004", the prevalence of periodontal diseases was 57% and 67.7% in the age groups of 12 and 15 years, respectively. These findings calls for appropriate public health interventions.

The prevalence of "caries" in children is affected by multifactorial agents which constitute the "host (teeth and saliva)", "agent (cariogenic bacteria such as *Streptococcus mutans* and *Lactobacillus acidophilus*)", "environment" and "time". Thus, identification and balance between these factors play significant role in prevention of oral diseases. The impact of oral diseases worsens in children with special health care needs, especially in visually impaired children when compared to normal children. Such children are not adept at maintaining "oral hygiene" and find it difficult to even identify the initial signs of dental problems.

Application of appropriate health education in oral health is a well acknowledged initiative in averting "oral diseases". It evokes new behaviors for promoting and improving individual health. They are cost effective and easily administrable strategies. Such knowledge in oral health if given during the formative years of a child, it will be there with him for lifetime. Health habits inculcated during this age will remain till adulthood, old age, and will be passed on even to next

generation. Various oral health education intervention strategies have been employed to impart education in oral health in school education programmes.

Use of Audio tactile Performance (ATP) technique and animations have gained popularity while giving education in oral health to visually impaired children and normal school children respectively. Various studies have demonstrated significant improvement in oral hygiene status after delivering oral health education using these techniques. One of the important host factor is “saliva” and any changes in its consistency, volume, microbial load will have definite impact on development of dental problems. It has good potential in evaluating risk for development of oral diseases mainly dental caries.

Hence the present study was formulated to provide new insights for enhancing “oral health” of “visually impaired and normal children” by assessing extensive oral hygiene parameters and salivary parameters before and after specialized oral health education at a follow-up period of baseline, 1 week and 1 month. Oral education was delivered using ATP oral health education technique for visually impaired children and novel visual performance (VP) technique was used to impart oral health education to normal children.

The study comprised of 25 normal children and 25 visually impaired children in the age range of 12 to 15 years. At baseline, debris scores, calculus scores, oral hygiene scores, gingival scores and plaque scores were on higher side in Group A (visually impaired children) than Group B (Normal children). “Salivary pH”, “buffering capacity” and “flow-rate” in “normal children” were more than “visually impaired children” at baseline. Microbiological parameters like *Streptococcus mutans*

and *Lactobacillus acidophilus* were more in visually impaired children when compared to normal children at baseline.

Use of ATP technique for visually impaired children and VP technique for normal children to impart education in oral health significantly reduced debris, calculus, oral hygiene, plaque and gingival scores thereby improving gingival health. Apart from improving clinical parameters, salivary parameters like pH, buffering capacity, flow-rate, *Streptococcus mutans* and *Lactobacillus acidophilus* colony counts also significantly improved. The overall improvement in clinical parameters and reduction in *Lactobacillus acidophilus* count was more in normal children while improvement in "salivary pH", "buffering capacity", "flow-rate" and reduction in *Streptococcus mutans* count was more in "visually impaired children".

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# ANNEXURE I

**Ethical clearance from Research and Ethics committee**

**Research and Ethics Committee**
**KLE V K INSTITUTE OF DENTAL SCIENCES**
**KLE University**
Accredited 'A' Grade by NAAC  Placed in Category 'A' by MHRD (GoI)
Nehru Nagar, Belagavi - 590 010, Karnataka State
☎: 0831-2470362  Web: http://www.kledental-bgm.edu.in
FAX: 0831-2470640  E-mail:principal@kledental-bgm.edu.in

Sl. No. : 1307

**CERTIFICATE**

*This is to Certify that the synopsis titled*

COMPARISON OF SALIVARY PARAMETERS WITH ORAL HYGIENE STATUS AMONG 12-15 YEARS OLD VISUALLY IMPAIRED AND NORMAL CHILDREN BEFORE & AFTER ORAL HEALTH EDUCATION IN BELAGAVI — AN INTERVENTIONAL STUDY

*Submitted by Dr.* APURVA P. DESHPANDE *P. G. Student / Staff, Guided by* DR. ANIL V. ANKOLA *from Department of* PUBLIC HEALTH DENTISTRY *has been critically evaluated by committee members and granted ethical clearance to conduct the above mentioned study*

**Date :**

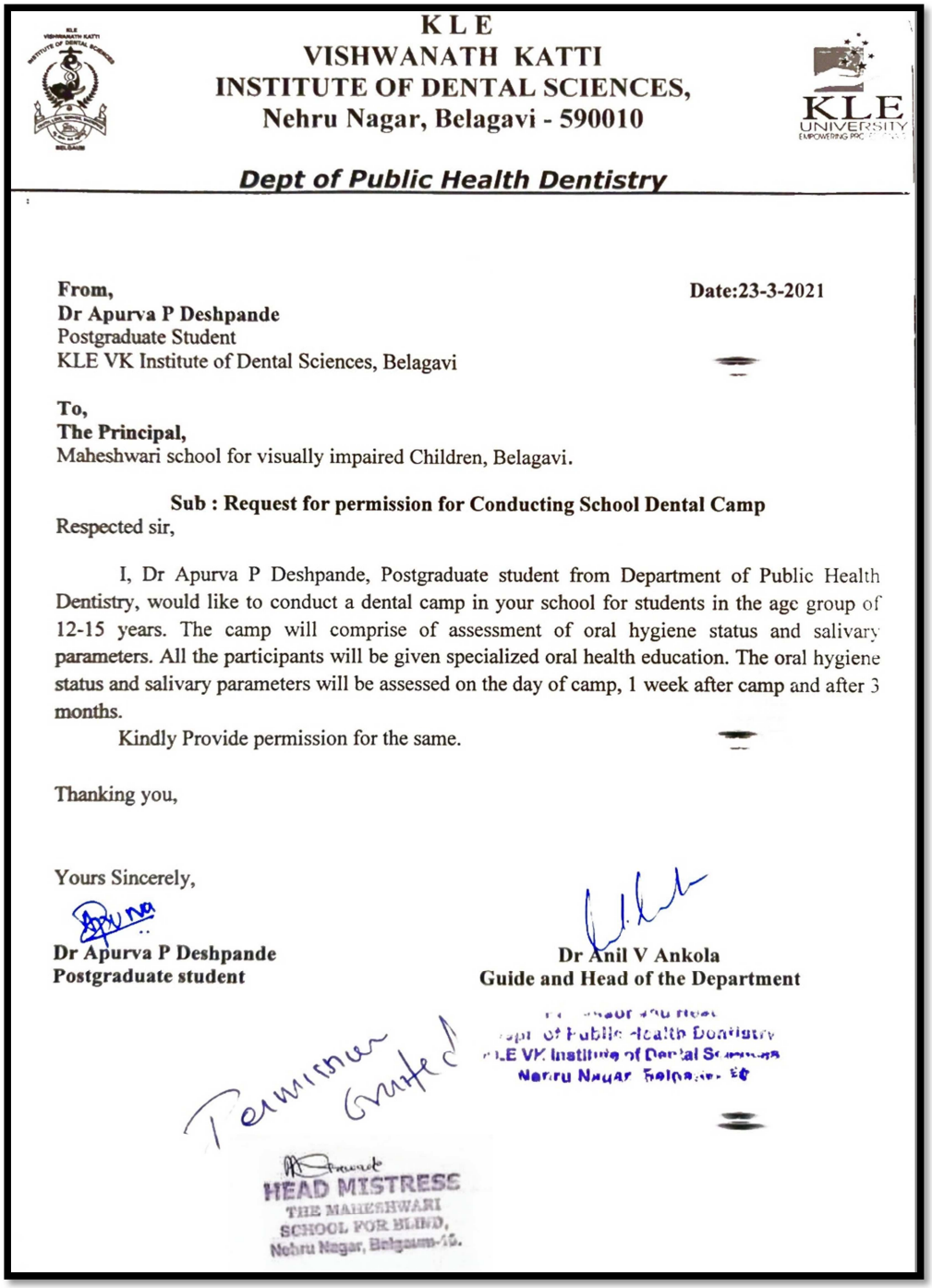
**Member Secretary**
Research and Ethical Committee
KLEVK Institute of Dental Sciences
Belagavi

**Chairman**
Research and Ethical Committee
KLEVK Institute of Dental Sciences
Belagavi

# ANNEXURE II a

## Permission letters from concerned School principals

## School – 1



KLE
VISHWANATH KATTI
INSTITUTE OF DENTAL SCIENCES,
Nehru Nagar, Belagavi - 590010

KLE UNIVERSITY

***Dept of Public Health Dentistry***

**From,**
**Dr Apurva P Deshpande**
Postgraduate Student
KLE VK Institute of Dental Sciences, Belagavi

**Date:23-3-2021**

**To,**
**The Principal,**
Maheshwari school for visually impaired Children, Belagavi.

**Sub : Request for permission for Conducting School Dental Camp**

Respected sir,

I, Dr Apurva P Deshpande, Postgraduate student from Department of Public Health Dentistry, would like to conduct a dental camp in your school for students in the age group of 12-15 years. The camp will comprise of assessment of oral hygiene status and salivary parameters. All the participants will be given specialized oral health education. The oral hygiene status and salivary parameters will be assessed on the day of camp, 1 week after camp and after 3 months.

Kindly Provide permission for the same.

Thanking you,

Yours Sincerely,

**Dr Apurva P Deshpande**
**Postgraduate student**

**Dr Anil V Ankola**
**Guide and Head of the Department**

Dept of Public Health Dentistry
KLE VK Institute of Dental Sciences
Nehru Nagar, Belgaum-10

Permission Granted

HEAD MISTRESS
THE MAHESHWARI
SCHOOL FOR BLIND,
Nehru Nagar, Belgaum-10.

# ANNEXURE II b

**Permission letters from concerned School principals**

**School – 2**

**K L E**
**VISHWANATH KATTI**
**INSTITUTE OF DENTAL SCIENCES,**
**Nehru Nagar, Belagavi - 590010**

KLE UNIVERSITY

***Dept of Public Health Dentistry***

**From,**
**Dr Apurva P Deshpande**
Post Graduate Student
KLE VK Institute of Dental sciences,
Belagavi

**Date:26-10-2021**

**To,**
**The Principal,**
Shri Siddharamesh Primary and High School,
Belagavi.

**Sub: Request for permission for conducting School Dental Camp**

Respected sir,

I, Dr Apurva P Deshpande, Post graduate student from Department of Public Health Dentistry, would like to conduct a dental camp in your school for students in the age group of 12-15 years. The camp will comprise of assessment of oral hygiene status and salivary parameters. All the participants will be given specialized oral health education. The oral hygiene status and salivary parameters will be assessed on the day of camp, 1 week after camp and after 1 month.

Kindly Provide permission for the same.

Thanking you,

Yours Sincerely,

**Dr Apurva P Deshpande**

Post Graduate student

**Dr Anil V Ankola**

Guide and Head of the Department

Professor and Head
Dept. of Public Health Dentistry
KLE VK Institute of Dental Sciences,
Nehru Nagar, Belagavi-590 010

Permission granted.

HEAD MASTER
S. S. Education Trust's
Smt. G. G. Yellur Primary School
Shivabasava Nagar, Belagavi-590 010.

# ANNEXURE III

## CONSENT FORM

**DEPARTMENT OF PUBLIC HEALTH DENTISTRY**
**K.L.E.V.K INSTITUTE OF DENTAL SCIENCES, NEHRU NAGAR, BELAGAVI-590010**

Comparison of salivary parameters with oral hygiene status among 12-15 years old visually impaired and normal children before and after oral health education in Belagavi, Karnataka - An interventional study

I, _____ have been informed about involvement of my child _____, aged ____ in the study in the language that I can understand.

I agree to give my child's personal details like name, age, sex, address, previous dental history and the details required for the study to the best of my knowledge.

I will co-operate with the dentist for my child's intra oral and extra oral examination and my child's saliva collection and its examination.

I will follow the instructions given by doctor during the study.

I will permit the investigator to utilize the information given by me and the results obtained from this study for presentation and publication.

I will not claim any returns for my child's co-operation in the study. My child is participating with my own will and wish.

I have read, gone through and understood the above information given by the doctor about the study.

I have entered and signed this application.

Parent/guardian signature:

Address:

Phone no:

Dentist name:

Dentist signature:

Address:

Phone no:

# ANNEXURE IV

## ASSENT FORM

**DEPARTMENT OF PUBLIC HEALTH DENTISTRY**
**K.L.E.V.K. INSTITUTE OF DENTAL SCIENCES,**
**BELAGAVI - KARNATAKA.**

My name is Dr Apurva Prashant Deshpande. I am a dentist. I am doing a study to compare salivary parameters with oral hygiene status in visually impaired children and normal children before and after oral health education. If you agree to be in my study, your saliva samples will be collected and intra oral examination will be done and oral health education will be provided to you.

In case you have any doubts, you can get it clarified from the investigator. Also, if you decide at any time to withdraw yourself from the study, you may do so whenever you want. Signing this paper means that you have read this or had it read to you and that you want to be in the study. If you do not wish to participate in the study, you need not sign the paper. Your parents are informed about the study. Remember, being in the study is up to you, and no one will be angry if you don't sign this paper or even if you change your mind later.

Signature of participant:

Date:

Signature of the investigator:

Date:

# ANNEXURE V

**Gingival index**

Gingival index (GI) developed by Loe H and Silness J in the year 1963, was used to describe the clinical severity of gingival inflammation.

- Teeth examined = 16, 12, 24, 36, 32, 44.
- Under the natural lighting, teeth and gingiva were dried lightly with cotton rolls.
- CPI probe was used to assess the bleeding potential of the tissues.

| Score | Criteria |
|---|---|
| 0 | Absence of inflammation / normal gingiva |
| 1 | Mild inflammation ; slight change in colour, slight oedema ; no bleeding on probing |
| 2 | Moderate inflammation; glazing, redness and oedema. Bleeding on probing. |
| 3 | Severe inflammation: marked redness and oedema, ulceration, tendency to spontaneous bleeding. |

**Gingival Index = Sum Of All Index Teeth / No Of Teeth Examined**

**Scoring =**

| | |
|---|---|
| 0 | Normal gingiva |
| 0.1 – 1.0 | Mild gingivitis |
| 1.1 – 2.0 | Moderate gingivitis |
| 2.1 – 3.0 | Severe gingivitis |

# ANNEXURE VI

## PLAQUE INDEX

Silness J. and Loe H. Plaque index (1964) was used for assessing the amount of dental plaque.

Teeth examined: 16, 12, 24, 36, 32 and 44

Index teeth were dried and examined visually. An explorer was used to test the tooth surface. Following criteria were used for scoring the teeth:

| **Score** | **Criteria** |
|---|---|
| 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 probe on tooth surface. |
| 2 | Moderate accumulation of soft deposits within the gingival pocket or the tooth and gingival margin which can be seen with naked eye. |
| 3 | Abundance of soft material within the gingival pocket and / or on the tooth and gingival margin. |

**Plaque index = sum of indices of index teeth / total number of teeth examined**

**Scoring =**

| | |
|---|---|
| 0 | Excellent |
| 0.1 – 0.9 | Good |
| 1 - 1.9 | Fair |
| 2-3 | Poor |

# ANNEXURE VII

**Oral hygiene index – simplified**

Developed by **John C. Greene and Jack R. Vermillion in 1964.** No 23 Explorer (Shepherds Hook) was used for examination

**Index teeth =**

| Tooth | Surface |
|---|---|
| 16 | Buccal |
| 11 | Labial |
| 26 | Buccal |
| 36 | Lingual |
| 31 | Labial |
| 46 | Lingual |

**For debris,**

| Score | Interpretation |
|---|---|
| 0 | No debris or stain present |
| 1 | Soft debris covering not more than one third of the tooth surface, or presence of extrinsic stains without other debris regardless of surface area covered |
| 2 | Soft debris covering more than one third, but not more than two thirds, of the exposed tooth surface. |
| 3 | Soft debris covering more than two thirds of the exposed tooth surface |

**Debris Index (DI-S)** =Total debris score/no. of surfaces scored

**For Calculus,**

| Score | Interpretation |
|---|---|
| 0 | No calculus present |
| 1 | Supragingival calculus covering not more than third of the exposed tooth surface |
| 2 | Supragingival calculus covering more than one third but not more than two thirds of the exposed tooth surface or the presence of individual flecks of subgingival calculus around the cervical portion of the tooth or both. |
| 3 | Supra-gingival calculus covering more than two third of the exposed tooth surface or a continuous heavy band of sub-gingival calculus around the cervical portion of the tooth or both |

**Calculus Index (CI-S)** = Total calculus score/ no of surfaces scored

**Oral Hygiene Index – Simplified (OHI-S) = DI-S + CI-S**

For CI-S and DI-S,

| | |
|---|---|
| 0 – 0.6 | GOOD |
| 0.7-1.8 | FAIR |
| 1.9-3.0 | POOR |

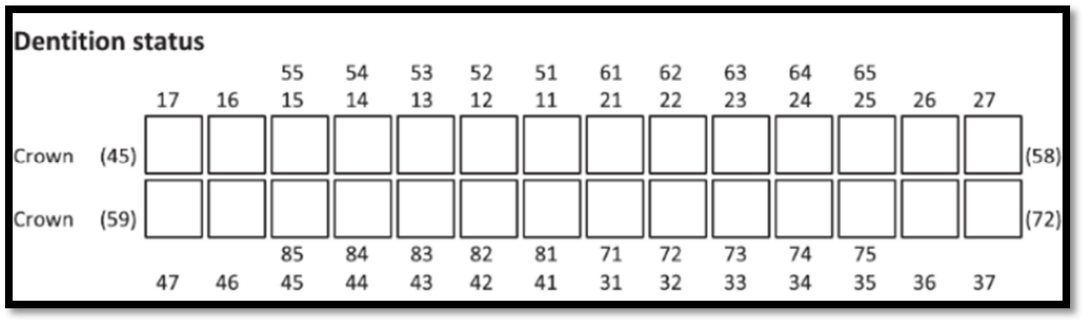
For OHI –S,

| | |
|---|---|
| 0 – 1.2 | GOOD |
| 1.3 - 3 | FAIR |
| 3.1 - 6 | POOR |

# ANNEXURE VIII

## Baseline evaluation of caries experience

All teeth were evaluated according to the criteria recommended by the World Health Organization (WHO) using the “dmft” and “DMFT” index for primary and permanent teeth, respectively. Plain mouth mirror and CPI probe were used to record Decayed Missing Filled Teeth (DMFT) Index. Each tooth was wiped with cotton and dried prior to examination.




**DMFT Index;**
**D =**
**M =**
**F =**
**DMFT =**

**dmft Index;**
**d =**
**m =**
**f =**
**dmft =**

# ANNEXURE IX

**DEPARTMENT OF PUBLIC HEALTH DENTISTRY**
**K.L.E.V.K INSTITUTE OF DENTAL SCIENCES, NEHRU NAGAR,**
**BELAGAVI - 590010**

## CHECKLIST

**Comparison of salivary parameters with oral hygiene status among 12-15 years old visually impaired and normal children before and after oral health education in Belagavi, Karnataka - An Interventional study.**

### 1. SOCIOECONOMIC STATUS AND DEMOGRAPHIC CHARACTERISTICS OF THE FAMILY

| Sl Number | Question | Response |
|---|---|---|
| 1 | Name of the student | |
| 2 | Age and DOB | |
| 3 | Sex | |
| 4 | Class studying | |
| 5 | Father's name | |
| 6 | Qualification | |
| 7 | Occupation | |
| 8 | Mother's name | |
| 9 | Qualification | |
| 10 | Occupation | |
| 11 | Monthly income | |
| 12 | Total number of members in the family | |
| 13 | Religion/caste | |

### 2. Dental and medical history

| Sl number | Question | Response |
|---|---|---|
| 1 | Did you suffer from any illness in past 1 year? | Yes /No |
| 2 | Have you been on any medication in the past 1 year? | Yes / No |
| 3 | Have you undergone any Dental treatment in the past 1 year? | Yes / No |

### 3. FOOD HABITS

| Sl number | Question | Response |
|---|---|---|
| 1 | What is your main food? | 1. Wheat<br>2. Rice<br>3. Ragi<br>4. Maize<br>5. Jowar<br>6. Others |
| 2 | Are you vegetarian / mixed? | 1. Vegetarian<br>2. Mixed |
| 3 | How many times you eat sweets yesterday? | 1. None<br>2. Once<br>3. 2 times<br>4. 3 times<br>5. >3 times |
| 4 | When were the sweets eaten? | 1. During meals<br>2. In-between meals<br>3. During and in-between meals<br>4. Not applicable |
| 5 | What is the consistency of sweets? | 1. Solid<br>2. Liquid<br>3. Sticky<br>4. Not applicaple |

**4. ORAL HYGIENE PRACTICES**

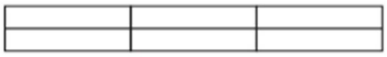
| Sl number | Question | Response |
|---|---|---|
| 1 | How do you clean your teeth? | 1. Finger<br>2. Brush<br>3. Others |
| 2 | How often do you clean your teeth in a day? | 1. Once<br>2. Twice<br>3. After every meal<br>4. Don't clean everyday |
| 3 | When do you clean your teeth | 1. Morning only<br>2. Night only<br>3. Morning and night |
| 4 | What material do you use to clean the teeth? | 1. Toothpaste<br>2. Toothpowder<br>3. Others [specify] |
| 5 | Name of the toothpaste / powder | |
| 6 | How often do you change your tooth brush? | 1. 1-3 months<br>2. 4-6 months<br>3. 6 months<br>4. Not applicable |
| 7 | Reason for changing toothbrush | |
| 8 | How often do you rinse your mouth with water after eating? | 1. Never<br>2. Sometimes<br>3. Always |
| 9 | Do you use any other oral hygiene aids? | 1. Yes<br>2. No |
| 10 | How do you brush your teeth? | 1. Vertical<br>2. Horizontal<br>3. Circular<br>4. Any other [specify] |

## Oral Hygiene Index-Simplified (OHI-S)

**1) Baseline**

**DEBRIS INDEX–SIMPLIFIED (DI-S)**

16 11 26



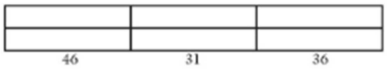
46 31 36

DI-S = Total score/no. of surfaces scored

= Interpretation = _____

**CALCULUS INDEX–SIMPLIFIED (CI-S)**

16 11 26



46 31 36

CI-S = Total score/no. of surfaces scored

= Interpretation = _____

OHI-S = DI-S + CI-S

= Interpretation = _____

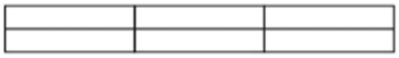
Score = Good / Fair / Poor

---

**2) 1st week**

**DEBRIS INDEX–SIMPLIFIED (DI-S)**

16 11 26



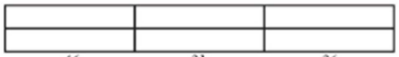
46 31 36

DI-S = Total score/no. of surfaces scored

= Interpretation = _____

**CALCULUS INDEX–SIMPLIFIED (CI-S)**

16 11 26



46 31 36

CI-S = Total score/no. of surfaces scored

= Interpretation = _____

OHI-S = DI-S + CI-S

= Interpretation = _____

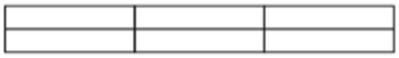
Score = Good / Fair / Poor

---

**3) One month**

**DEBRIS INDEX–SIMPLIFIED (DI-S)**

16 11 26



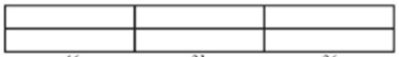
46 31 36

DI-S = Total score/no. of surfaces scored

= Interpretation = _____

**CALCULUS INDEX–SIMPLIFIED (CI-S)**

16 11 26



46 31 36

CI-S = Total score/no. of surfaces scored

= Interpretation = _____

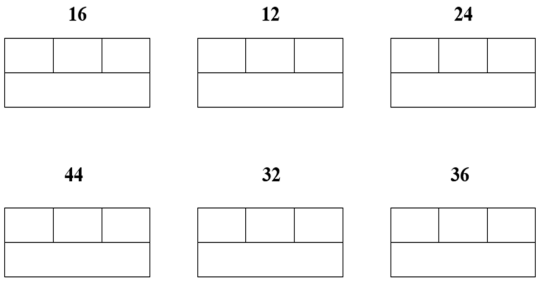
OHI-S = DI-S + CI-S

= Interpretation = _____

Score = Good / Fair / Poor

## Gingival Index

**1) Baseline**

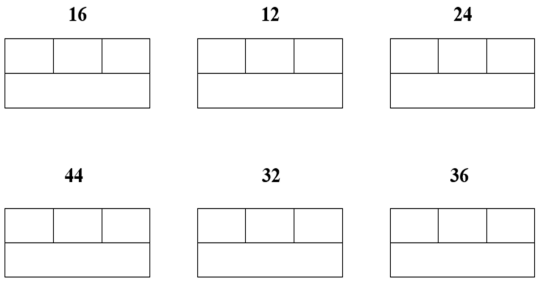



Gingival score =

Score = Normal / Mild / Moderate / Severe

---

**2) 1st week**

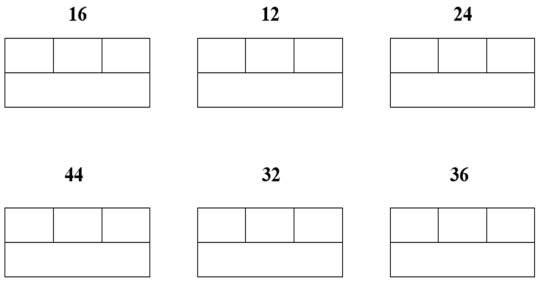



Gingival score =

Score = Normal / Mild / Moderate / Severe

---

**3) One month**

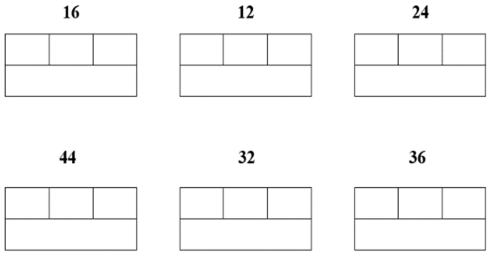



Gingival score =

Score = Normal / Mild / Moderate / Severe

## Plaque Index

**1) Baseline**

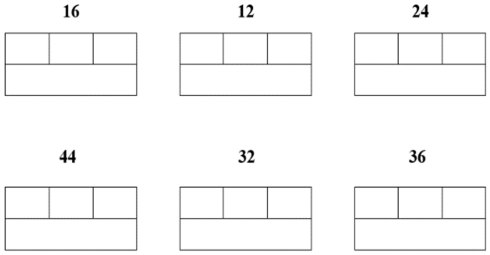



Plaque index score =

Score = Excellent/Good/Fair/Poor

---

**2) 1st week**

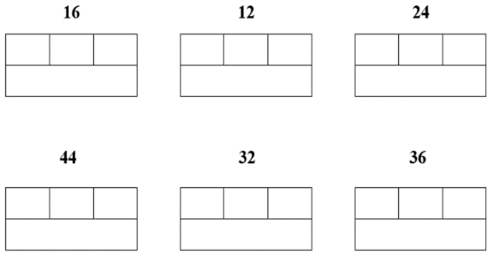



Plaque index score =

Score = Excellent /Good /Fair /Poor

---

**3) One month**




Plaque index score =

Score = Excellent/Good/Fair/Poor

## Salivary Parameters

### 1) Baseline

| Salivary parameter | Value |
|---|---|
| pH | |
| Buffering Capacity | |
| Flow-rate | |
| *Streptococcus mutans* | |
| *Lactobacillus acidophilus* | |

### 2) 1st week

| Salivary parameter | Value |
|---|---|
| pH | |
| Buffering Capacity | |
| Flow-rate | |
| *Streptococcus mutans* | |
| *Lactobacillus acidophilus* | |

### 3) One month

| Salivary parameter | Value |
|---|---|
| pH | |
| Buffering Capacity | |
| Flow-rate | |
| *Streptococcus mutans* | |
| *Lactobacillus acidophilus* | |