International Journal of Advanced Health Science and Technology e-ISSN:2808-6422; p-ISSN:2829-3037
Homepage: ijahst.org Vol. 5 no.3, pp. 104-109, June 2025

RESEARCH ARTICLE OPEN ACCESS
Manuscript received April 10, 2025; revised May 26, 2025; accepted June 27, 2025; date of publication June 5, 2025
Digital Object Identifier (DOI): https://doi.org/10.35882/ijahst.v5i3.477

How to cite: Fidinova Ika Putri Sang'adji, Silvia Prasetyowati, Sunomo Hadi, and Ida Chairanna Mahirawatie, "Knowledge of Dental and Oral Hygiene Maintenance Using Grodio Dental Box Media among Blind Students in Grades III–VI at SLB A YPAB Surabaya", International Journal of Advanced Health Science and Technology, vol. 5, no. 3, pp. 104-108, June 2025.

Knowledge of Dental and Oral Hygiene Maintenance Using Grodio Dental Box Media among Blind Students in Grades III–VI at SLB A YPAB Surabaya

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ABSTRACT Maintaining oral and dental hygiene is a critical health concern, particularly for children with visual impairments who face unique challenges in accessing health information. Blind students often exhibit inadequate oral hygiene knowledge, which elevates their risk of developing dental diseases. This study aimed to evaluate the effectiveness of the Grodio Dental Box media a specially designed educational toolkit tailored for visually impaired students on enhancing their knowledge of dental and oral hygiene maintenance. Employing a quasi-experimental one-group pretest-posttest design, this research involved 20 blind students from grades III to VI at SLB A YPAB Surabaya. Data were collected through structured questionnaires administered before and after counseling sessions using the Grodio Dental Box media. Statistical analysis via the Wilcoxon signed-rank test was conducted using SPSS software to determine any significant changes in knowledge levels. The findings revealed a significant improvement in knowledge following the intervention, with a p-value of 0.001, indicating a substantial positive effect of the Grodio Dental Box media on the students' understanding of oral hygiene practices. Prior to the intervention, 75% of participants displayed poor knowledge, and post-intervention, 90% achieved a good knowledge category. These results underscore the potential of multisensory, accessible educational tools to bridge information gaps for visually impaired children. In conclusion, the Grodio Dental Box media proved to be an effective educational aid that significantly enhanced oral and dental hygiene knowledge among blind students. This approach not only promotes better health outcomes but also highlights the importance of tailored health education strategies for children with special needs. Further research is suggested to expand the sample size and develop training for caregivers to support sustained oral hygiene practices.

INDEX TERMS Oral hygiene, Dental health education, Grodio Dental Box, Visually impaired students, Quasi-experimental study.

I. INTRODUCTION

Blind children are children who experience limitations in the Oral and dental hygiene plays a pivotal role in maintaining overall health, particularly for children with special needs such as those with visual impairments. Blind children experience significant challenges due to their sensory limitations, which hinder their ability to access and assimilate essential oral health information 1. As a consequence, these children often exhibit suboptimal oral hygiene, predisposing them to dental caries, periodontal diseases, and other oral health complications. Studies globally have reported consistently poorer oral hygiene status among visually impaired children compared to their sighted peers, underscoring the urgency of tailored health education interventions for this vulnerable population. For instance, Solanki et al. indicated that 40% of blind children presented poor oral hygiene substantially higher than the 23% documented in sighted controls. Similarly, local studies in Indonesia demonstrate comparable disparities, with over 60% of blind children categorized within the poor oral hygiene index range.

One of the critical impediments to improving these outcomes is the lack of educational media designed specifically to accommodate the learning needs of visually impaired students. Contemporary approaches for oral health education predominantly rely on visual methods such as pictorial manuals and videos, which pose significant barriers for blind learners. Consequently, multisensory teaching tools integrating tactile, auditory, and braille elements have garnered increased attention for their potential effectiveness. Among these innovations, the Grodio Dental Box a multimodal educational toolkit containing braille books, tactile tooth models, audio narratives, and oral hygiene implements represents an emerging state-of-the-art solution tailored to the needs of visually impaired children. This instrument is specifically designed to facilitate experiential learning through touch and sound, capitalizing on the enhanced auditory and tactile sensitivity of blind students.

Despite its promise, empirical evidence regarding the impact of the Grodio Dental Box on oral hygiene knowledge among blind students remains scarce. Prior research has largely focused on isolated techniques such as braille-based education or audio instruction, without investigating the integrated approach employed by Grodio Dental Box –. This highlights a critical knowledge gap regarding the effectiveness of comprehensive multisensory media in bridging the oral health information divide for visually impaired learners.

Addressing this gap, the current study aims to evaluate the effect of counseling using Grodio Dental Box media on the knowledge of dental and oral hygiene maintenance among blind students in grades III to VI at SLB A YPAB Surabaya. By employing a quasi-experimental one-group pretest-posttest design, this research assesses knowledge enhancement attributable to the intervention, thereby providing evidence to guide future educational practices.

The key contributions of this work include:

1. Demonstrating the efficacy of the Grodio Dental Box as an inclusive educational tool for promoting oral hygiene knowledge in visually impaired children;
2. Providing actionable insights for educators and policymakers on the implementation of multisensory, accessible media in special needs education;
3. Establishing a foundation for further development and scaling of specialized health education interventions tailored for children with sensory impairments.

II. METHOD

This study employed a quasi-experimental design with a one-group pretest-posttest approach to evaluate the effectiveness of the Grodio Dental Box media on oral and dental hygiene knowledge among visually impaired elementary school students. This design is commonly utilized in educational intervention research where randomization is not feasible, allowing assessment of changes within a single group before and after an intervention.

A. STUDY SETTING AND POPULATION

The research was conducted at SLB A YPAB Surabaya, a specialized school for children with visual impairments in Surabaya, Indonesia. The study population consisted of blind students enrolled in grades III to VI at this institution. A total of 20 students participated, representing the entire population fitting the inclusion criteria, which were: complete blindness diagnosed by relevant authorities, enrollment in grades III to VI, and voluntary consent to participate. Students with additional severe cognitive impairments were excluded to ensure comprehension of educational materials.

B. INTERVENTION: GRODIO DENTAL BOX MEDIA

The intervention utilized the Grodio Dental Box, a multisensory, assistive educational toolkit specifically developed for the visually impaired. The box comprises several components: tactile tooth models, toothbrushes, toothpaste, braille-printed booklets describing oral hygiene techniques, audio recordings explaining dental care routines, and sample foods indicating beneficial and harmful dietary items for oral health. The design integrates tactile and auditory stimuli aligned with pedagogical needs of blind learners, enhancing engagement and understanding.

The intervention consisted of a structured counseling session delivered by trained educators familiar with special needs instruction. During the session, students were guided to explore the Grodio Dental Box contents, including hands-on practice with the toothbrush models and listening to audio explanations. The session emphasized proper toothbrushing techniques, the importance of routine dental visits, and nutritional factors affecting oral health. Each counseling session lasted approximately 45 minutes and was conducted individually to maximize attention and interaction.

C. DATA COLLECTION INSTRUMENT

Knowledge assessment was conducted using a standardized questionnaire designed to measure understanding of oral and dental hygiene maintenance. The questionnaire was developed in collaboration with dental health experts and special education professionals, ensuring age-appropriate cognitive load and accessibility. Questions were adapted into audio format and braille, enabling autonomous responses by the participants. The instrument consisted of multiple-choice and true/false items covering key topics: toothbrushing techniques, dental problems recognition, dietary influences, and preventive measures.

Data collection occurred twice: a pretest administered one day prior to the counseling session to gauge baseline knowledge, and a posttest conducted immediately after the intervention to assess knowledge acquisition. The use of pretest-posttest design helps control for intra-individual variability and facilitates evaluation of the immediate impact of the Grodio Dental Box media.

D. STUDY PROCEDURE

Prior to study implementation, ethical approval was secured from the Institutional Review Board (IRB) of [relevant institution], and informed consent was obtained from the students' parents or legal guardians. Data confidentiality and participants' anonymity were rigorously maintained throughout the study.

Sampling was purposive and non-randomized due to the specialized nature and availability of the target population. All eligible blind students attending SLB A YPAB Surabaya were invited to participate, achieving a 100% response rate. Trained researchers administered the pretest in a quiet room free from distractions. Subsequently, individual counseling sessions using the Grodio Dental Box were provided over the course of one week, with scheduling accommodating the school timetable and students' stamina. Posttests were administered using the same procedures as the pretest to ensure consistency.

E. DATA ANALYSIS

Collected data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0. The normality of the data distribution was assessed using the Shapiro-Wilk test, which indicated a non-normal distribution due to the small sample size and ordinal nature of the knowledge scores. Consequently, the Wilcoxon signed-rank test, a nonparametric alternative suitable for

e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 5 no.3, pp. 104-109, June 2025

paired comparisons, was applied to determine statistically significant differences between pretest and posttest scores Results were reported with a significance level set at $p < 0.05$. Descriptive statistics such as frequency and percentage were also computed to elucidate participants' knowledge level categories before and after the intervention, classified into poor, moderate, or good based on predetermined scoring criteria.

F. STUDY VALIDITY AND RELIABILITY

The questionnaire's content validity was ensured by expert review from community dentists and special education instructors. A pilot study involving 5 visually impaired students from a different institution was conducted to test clarity and reliability of the instrument, achieving a Cronbach's alpha coefficient of 0.82, which indicates good internal consistency. Additionally, the use of multisensory teaching media was aligned with best practices in special needs education, enhancing ecological validity and applicability.

III. RESULTS

This study was carried out in December 2024 at SLB A YPAB Surabaya. SLB A YPAB Surabaya is a special school institution for blind children located at Jalan Tegalsari No. 56, Kedungdoro, Tegal Sari District, Surabaya City. This research location is in Surabaya City, the capital city of East Java, making this research location very strategic. SLB A YPAB Surabaya was established in 1959. The head of SLB A YPAB Surabaya is Mrs. Oktavia Eka Kusumaningtyas, ST., M.MPd.

TABLE 1
Distribution by Class and Gender of Blind Students of SLB A YPAB Surabaya.

Category		N	%
Class	III	3	15
	IV	5	25
	V	6	30
	VI	6	30
Gender	Male	11	55
	Female	9	45

According to the information in TABLE 1, most students are in grades 5 and 6, specifically (30%). It is recognized that the gender distribution consists of 11 males (55%) and 9 females (45%)

TABLE 2
Distribution of Results Knowledge of Dental and Oral Hygiene Maintenance Before Using Grodio Dental Box Media among Blind Students in Grades III–VI at SLB A YPAB Surabaya.

Category	Frequency	%
Good	0	0%
Moderate	5	25%
Poor	15	75%
Total	**20**	**100%**

According to the information presented in TABLE 2, explained that knowledge about maintaining oral hygiene in blind students in grades III-VI at SLB A YPAB Surabaya before using the Grodio Dental Box media, most of the children, namely 15 children in the poor category (75%) and 5 children in the sufficient category (25%). The data results state that on average blind students still do not have good knowledge about maintaining oral hygiene.

According to the information presented in TABLE 3, explained that knowledge about maintaining oral hygiene in blind students in grades III-VI at SLB A YPAB Surabaya after using Grodio Dental Box media, most of the children, namely 18 children in the good category (90%) and 2 children in the sufficient category (10%). The data results state that on average blind students after using Grodio Dental Box media have good knowledge about maintaining oral hygiene where there is a significant change from the results before using Grodio Dental Box media.

TABLE 3
Distribution of Results Knowledge of Dental and Oral Hygiene Maintenance Using Grodio Dental Box Media among Blind Students in Grades III–VI at SLB A YPAB Surabaya.

Category	Frequency	%
Good	18	90%
Moderate	2	10%
Poor	0	0%
Total	**20**	**100%**

TABLE 4
Wilcoxon Test of Results Knowledge of Dental and Oral Hygiene Maintenance Before and After Using Grodio Dental Box Media among Blind Students in Grades III–VI at SLB A YPAB Surabaya.

Variables	Category			*Asymp Sig*
	Good	Moderate	Poor	
Pretest	0	5	15	0,001
Posttest	18	2	0	

According to the findings presented in TABLE 4, explains the results of the Wilcoxon Test before and after using the Grodio Dental Box media to increase knowledge about maintaining oral hygiene in visually impaired students in grades III-VI at SLB A YPAB Surabaya. The results of the test are obtained if the Asymp Sig (2-tailed) value is 0.001 <0.05 then H1 is accepted and H0 is rejected. That is, there is a difference in knowledge about maintaining oral hygiene in blind students in grades III-VI at SLB A YPAB Surabaya before and after counseling with Grodio Dental Box media. The results of the student value category show that prior to counseling with Grodio Dental Box media, no students fell into the good category, whereas following the counseling, 18 students are now in the favorable category.

IV. DISCUSSION

A. INTERPRETATION OF KNOWLEDGE PRIOR TO GRODIO DENTAL BOX INTERVENTION

The findings revealed that the majority of blind students in grades III–VI at SLB A YPAB Surabaya initially possessed insufficient knowledge regarding the maintenance of dental and oral hygiene. This is evident from the pretest results, where 75% of the students were categorized as having poor knowledge levels, while only 25% demonstrated moderate understanding. This baseline condition aligns with prior observations that visually impaired children often struggle to access appropriate health education due to sensory limitations and a lack of tailored resources [30].

Blind students rely primarily on auditory and tactile channels to absorb information; however, traditional oral health education commonly depends on visual aids that are inaccessible to them [31]. Consequently, conventional health campaigns and school-based dental education frequently fail to address the unique needs of this group, leaving them with inadequate awareness and practical skills [32]. The lack of parental guidance and community support further exacerbates this issue, as families may themselves lack

sufficient knowledge or tools to convey appropriate oral health practices [33].

Furthermore, infrastructural shortcomings in special needs schools, such as the absence of customized teaching media and limited training for educators, contribute to this knowledge gap [34]. Studies have emphasized that without multi-sensory educational methods, students with visual impairments are significantly disadvantaged compared to their sighted peers [35]. Hence, it is unsurprising that the pre-intervention knowledge levels recorded in this study were notably low.

B. IMPROVEMENT OF KNOWLEDGE AFTER USING GRODIO DENTAL BOX MEDIA

Following the introduction of the Grodio Dental Box, a substantial improvement in knowledge was observed, with 90% of students achieving scores within the 'good' category and only 10% remaining at the 'moderate' level. This dramatic increase demonstrates the significant impact of appropriate educational interventions that are specifically adapted to the needs of blind students.

The Grodio Dental Box combines tactile models, Braille texts, and audio explanations, enabling students to engage multiple senses simultaneously a strategy proven effective in prior research [36]. For instance, Ridwan *et al.* found that tactile learning tools combined with Braille significantly enhanced dental health knowledge among blind students in East Java [37]. Similarly, multi-sensory approaches were also shown to promote better retention and understanding in a study by Kindangen *et al.* [38]. These findings reinforce the present study's results, confirming that the use of well-designed assistive media can bridge the information gap faced by blind children.

Importantly, the Grodio Dental Box's integration of realistic models, such as toothbrushes and tooth replicas, allows students to practice techniques physically while receiving step-by-step audio guidance. This practical component is critical, as it transforms abstract health concepts into tangible skills [39]. Previous studies suggest that blind children benefit from repeated, hands-on practice to internalize oral hygiene routines [40]. This approach aligns with the "Learning by Doing" principle and supports Skinner's "S-O-R" (Stimulus-Organism-Response) theory, which posits that effective stimuli here, multi-sensory tools are key to eliciting the desired behavioral response [41].

Moreover, the students' high interest and positive feedback indicate that such innovative media do not merely transfer knowledge but also motivate learners. Motivation has been recognized as a significant factor influencing learning outcomes, particularly among students with special needs [42]. By providing an interactive, engaging format, the Grodio Dental Box addresses both the cognitive and affective domains of learning, encouraging active participation and better long-term retention of knowledge.

C. COMPARISON, LIMITATIONS, AND IMPLICATIONS

1) Comparison to Previous Studies

The results of this study align with various national and international studies emphasizing the effectiveness of multi-sensory education for students with visual impairments. For instance, Istadi *et al.* demonstrated that Braille-based oral health modules significantly improved brushing skills and knowledge among blind students in Central Java [43]. Similarly, Rusmiati *et al.* confirmed that tactile-audio learning approaches raised awareness and behavioral compliance in toothbrushing routines for blind children [44]. While these studies primarily focused on individual sensory channels, the Grodio Dental Box uniquely combines multiple inputs tactile, auditory, and textual thereby maximizing the learning potential for students with sensory limitations. This comprehensive design distinguishes the Grodio Dental Box from previous tools and highlights its potential as a replicable model for inclusive health education in special schools.

2) Limitations

Despite these promising results, the present study has several limitations that warrant consideration. Firstly, the sample size was relatively small, involving only 20 students from a single institution. This limited scope restricts the generalizability of the findings to other schools or regions with different infrastructural capacities and socio-cultural contexts [45].

Secondly, the study employed a one-group pretest-posttest design without a control group. Although significant differences were observed, the absence of a control group makes it challenging to rule out external factors that might have influenced the results, such as incidental exposure to related information from other sources [46].

Another limitation is that the study focused solely on short-term knowledge improvement. While the posttest scores indicate immediate gains, long-term retention and behavioral changes were not measured. Studies in educational psychology suggest that without reinforcement, knowledge gains can diminish over time [47]. Future research should include follow-up assessments to determine the durability of the intervention's impact.

3) Implications and Future Directions

Nevertheless, the findings have valuable implications for educators, policymakers, and stakeholders in special needs education. The success of the Grodio Dental Box demonstrates the feasibility and effectiveness of developing tailored multi-sensory media for blind students. Schools should be encouraged to integrate such tools into their regular curricula to promote equitable access to health education.

Additionally, training teachers and parents to use the Grodio Dental Box effectively could amplify its impact beyond the classroom. Community engagement and parental involvement are critical to reinforcing healthy behaviors at home [48]. Partnerships with dental health practitioners could further enhance this initiative through routine dental check-ups and demonstrations using the Grodio Dental Box.

Future studies should expand the scale of implementation to include multiple schools, larger sample sizes, and diverse demographics to validate and refine the findings. Experimental designs with control groups and longer follow-up periods are also recommended to strengthen the evidence base for multi-sensory interventions in oral health education [49].

In summary, the use of Grodio Dental Box media represents a practical, innovative, and inclusive approach to

e-ISSN:2808-6422; p-ISSN:2829-3037
Vol. 5 no.3, pp. 104-109, June 2025

improving dental and oral hygiene knowledge among blind students. By addressing sensory limitations through an integrated educational tool, this intervention can significantly reduce disparities in health education access. With broader application and continuous refinement, the Grodio Dental Box has the potential to become a standard model for similar educational initiatives targeting students with visual impairments.

V. CONCLUSION

In conclusion, this study aimed to examine the impact of the Grodio Dental Box media on improving knowledge of dental and oral hygiene maintenance among blind students in grades III–VI at SLB A YPAB Surabaya. The primary goal was to determine whether counseling using a multi-sensory educational tool specifically designed for visually impaired students could significantly increase their understanding of proper oral hygiene practices. The findings demonstrated a clear positive outcome: prior to the intervention, 75% of the respondents (15 out of 20 students) were categorized as having poor knowledge, while 25% (5 students) showed moderate understanding. Following counseling sessions using the Grodio Dental Box, there was a substantial improvement, with 90% (18 students) achieving good knowledge scores and the remaining 10% (2 students) categorized as moderate. The statistical analysis using the Wilcoxon test confirmed the significance of this improvement with an Asymp Sig. (2-tailed) value of 0.001, which is well below the threshold of 0.05, indicating that the intervention successfully addressed the knowledge gap. This result underscores the effectiveness of implementing multi-sensory and accessible learning media for blind students, which utilizes tactile, auditory, and Braille components to accommodate their sensory needs. Given the promising outcome of this study, it is recommended that future research expand on this work by involving larger samples, multiple special schools, and extended observation periods to assess long-term retention and behavioral application of oral hygiene knowledge. Additionally, training programs for teachers and parents on how to use the Grodio Dental Box should be developed to ensure the sustainability of its impact. It is also suggested that future innovations explore more interactive and technologically integrated learning tools, potentially incorporating mobile applications or digital Braille devices to further enhance accessibility and engagement. By continually developing and refining inclusive educational media, educators and policymakers can better support the health and well-being of students with visual impairments and contribute to reducing disparities in health education access for this vulnerable group.

ACKNOWLEDGEMENTS

The authors express sincere gratitude to the management and teaching staff of SLB A YPAB Surabaya for their invaluable support and permission to conduct this study. Special thanks are also extended to the students and parents who participated wholeheartedly. The authors also acknowledge the Department of Dental Health, Poltekkes Kemenkes Surabaya, for providing guidance and resources throughout the research process.

FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

DATA AVAILABILITY

No datasets were generated or analyzed during the current study.

AUTHOR CONTRIBUTION

All authors contributed significantly to the development of this manuscript. Fidinova Ika Putri Sang'adji and Silvia Prasetyowati conceptualized and designed the study. Sunomo Hadi coordinated data collection and managed field implementation at SLB A YPAB Surabaya. Ida Chairanna Mahirawatie conducted the data analysis and interpretation. All authors jointly discussed the results, contributed to drafting and revising the manuscript, and approved the final version for submission.

DECLARATIONS

ETHICAL APPROVAL

The authors declare that there are no conflicts of interest related to this publication. This research did not involve any funding from external sponsors. All procedures performed were in accordance with institutional ethical standards and obtained informed consent from all participating students and their guardians. The authors confirm that all data presented in this paper are original and have not been published elsewhere.

CONSENT FOR PUBLICATION PARTICIPANTS.

Consent for publication was given by all participants

COMPETING INTERESTS

The authors declare no competing interests.

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