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Evaluation of Parental Acceptance and Plaque Reduction Using an Omniclean Easygrip Toothbrush in Children with Cerebral Palsy: A Questionnaire-Based Clinical Study

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Abstract: ***Children with Cerebral Palsy face considerable challenges in maintaining oral hygiene due to impaired neuromuscular coordination, reduced manual dexterity, and dependence on caregivers, leading to increased plaque accumulation and a higher risk of oral diseases. Toothbrush modifications that enhance both grip and cleaning efficiency may help overcome these limitations. The present study aimed to evaluate the parental acceptance and plaque reduction efficacy of the OmniClean EasyGrip Toothbrush in children with cerebral palsy. A clinical and questionnaire-based interventional study was conducted among 11 children, where baseline plaque scores were recorded using the Löe and Silness plaque index. Parents were trained in a standardized brushing technique using the OmniClean EasyGrip Toothbrush, which combines a triple-headed design with a silicone easy-grip strap. The intervention was carried out over one week, after which post-intervention plaque scores were recorded, and parental acceptance, ease of use, and handling were assessed using a structured questionnaire. The results demonstrated a statistically significant reduction in plaque scores, with median values decreasing from 3 at baseline to 1 post-intervention (p = 0.001586), with consistent improvements observed across both genders and no significant gender-based differences. Additionally, a majority of parents (72.72%) reported good acceptance and ease of use, indicating high caregiver satisfaction and usability. The study concludes that the OmniClean EasyGrip Toothbrush is effective in achieving significant plaque reduction while maintaining high parental acceptance, suggesting that the integration of ergonomic (easy-grip strap) and functional (triple-headed) design enhances oral hygiene practices in children with cerebral palsy, offering a simple, cost-effective, and clinically effective solution for improving oral health outcomes in this population.***

Keywords: Cerebral palsy, Special needs dentistry, Plaque control, Triple-headed toothbrush, Oral hygiene aids

1. Introduction

Oral health maintenance in children with Cerebral Palsy (CP) remains a significant challenge due to impaired neuromuscular coordination, reduced manual dexterity, and dependence on caregivers for daily oral hygiene practices. These children are at increased risk for plaque accumulation, dental caries, and periodontal disease due to ineffective plaque removal and difficulty in performing routine tooth brushing. Effective plaque control depends not only on brushing technique but also on the individual's motor ability and the design of the toothbrush. Young children and individuals with neuromuscular disabilities often fail to adequately clean all tooth surfaces, particularly lingual and posterior regions, resulting in persistent plaque accumulation.

Several authors have explored modifications in toothbrush design to overcome these limitations. Telma Bordin et al.[1] reported that adapted toothbrush handles significantly improved caregiver grip and ease of use in children with CP; however, their study primarily focused on parental perception and did not include objective plaque score evaluation. Similarly, S. N. Desai et al.[2] demonstrated that customized handles enhanced brushing compliance but highlighted the limitation of lacking standardized clinical outcome measures. In contrast, studies by Anna Pizzo et al.[3] evaluated triple-headed toothbrushes and found significantly greater plaque reduction compared to conventional brushes, particularly in children with limited motor skills; however, these designs did not address issues related to grip and handling. Furthermore, G. R. Williams et al.[4] emphasized that while multi-surface toothbrushes improved cleaning efficiency, their bulkier design sometimes reduced caregiver comfort and adaptability during use.

Despite these advancements, existing literature reveals a gap in integrating both ergonomic modifications for improved grip and clinically validated plaque reduction outcomes, particularly in children with CP. Therefore, the present study was undertaken using an OmniClean EasyGrip Toothbrush, a triple-headed toothbrush modified with a silicone easy-hold strap, designed to address both mechanical limitations (poor grip) and functional limitations (inefficient plaque removal).

2. Aim and Objectives

The aim of this study is to evaluate the parental acceptance and plaque reduction efficacy of the Omni Clean Easy Grip Toothbrush in children with cerebral palsy. The objectives include assessing parental acceptance through a structured questionnaire, evaluating plaque reduction using the Löe and Silness plaque index, determining the ease of use and handling of the modified toothbrush, and comparing pre- and post-intervention plaque scores to establish its overall effectiveness.

3. Materials and Methodology

This study was designed as a clinical and questionnaire-based interventional study conducted among 11 children with cerebral palsy. At baseline, plaque scores were recorded for all participants using a standardized index. Parents or caregivers were then trained in the appropriate brushing technique using the Omni Clean Easy Grip Toothbrush to ensure uniformity in oral hygiene practices. The intervention was carried out over a period of one week, during which parents assisted their children with daily toothbrushing using the modified toothbrush. Following the intervention period, post-intervention plaque scores were recorded to assess changes in oral hygiene status. Additionally, a structured questionnaire was administered to parents to evaluate their acceptance of the toothbrush, as well as its ease of use and handling.

Description of the Modified Toothbrush
The toothbrush used in this study was the OmniClean EasyGrip Toothbrush (Fig 1), consisting of a triple-headed toothbrush combined with a silicone easy-hold modification. The triple-headed toothbrush is designed with three bristle heads arranged to simultaneously contact the buccal, lingual, and occlusal surfaces, enabling efficient plaque removal in a single brushing motion. To improve handling, a silicone easy-grip strap (EasyHold type) was attached to the handle, forming a D-shaped loop. This modification enhances grip by allowing the toothbrush to be held using gross motor movements rather than fine finger control. The silicone strap is soft, flexible, reusable, and adaptable to different handle sizes, making it suitable for children with impaired hand function.

Figure 1: Omni-clean Easy grip tooth brush

Rationale for Modification: Children with Cerebral Palsy commonly exhibit poor grasp reflex, spasticity, and reduced fine motor control, which significantly hinder their ability to perform effective toothbrushing. The easy-grip modification of the toothbrush is designed to compensate for these limitations by stabilizing the brush during use, minimizing the reliance on precise finger dexterity, and enabling caregivers to achieve better control during assisted brushing, thereby facilitating more efficient plaque removal and improved oral hygiene.

Brushing Protocol: Parents were instructed and trained to brush the child's teeth twice daily using fluoridated toothpaste with a standardized brushing technique.

Questionnaire Assessment: A structured questionnaire was administered to parents after the intervention to assess:
- Ease of use
- Child acceptance
- Grip and handling
- Cleaning efficiency (perceived)
- Preference over previous toothbrush

Since children with cerebral palsy are dependent on caregivers, parental perception plays a crucial role in determining compliance and long-term effectiveness of oral hygiene practices.

No.	Question	Yes	No
1	Was the modified toothbrush easy for you to use? / [illegible]	☐	☐
2	Did the toothbrush reduce the time required for brushing your child's teeth? / [illegible]	☐	☐
3	Was your child comfortable while using the modified toothbrush? / [illegible]	☐	☐
4	Did your child show better cooperation during brushing? / [illegible]	☐	☐
5	Did the silicone easy-hold strap improve your grip? / [illegible] easy-hold [illegible]	☐	☐
6	Did the toothbrush provide better control during brushing? / [illegible]	☐	☐
7	Do you feel this toothbrush cleaned your child's teeth effectively? / [illegible]	☐	☐
8	Did you notice less food debris/plaque after brushing? / [illegible]	☐	☐
9	Do you prefer this modified toothbrush over the previous one? / [illegible]	☐	☐
10	Would you like to continue using this toothbrush? / [illegible]	☐	☐

Figure 2: Questionnaire given to the mothers of cerebral palsy children

Plaque Assessment: Plaque scores were recorded using the Löe and Silness Plaque Index.
- Provides a sensitive and reliable measure of plaque accumulation
- Allows site-specific evaluation
- Widely accepted in clinical research
- Enables objective assessment of intervention effectiveness

4. Results

The present study included 11 children with cerebral palsy, comprising 7 males (63.6%) and 4 females (36.4%). The mean age of male participants was 7.00 ± 0.81 years, while that of female participants was 6.75 ± 0.95 years. There was no statistically significant difference in age distribution ($p = 0.6773$) or gender distribution ($p = 0.5488$), indicating comparable baseline characteristics across groups.

Table 1: Comparison of Age distribution among male and female participants of the study assessed using unpaired t test

Parameter	Males	Females	p-value
Age distribution (in terms of mean years)	7.00±0.81	6.75±0.95	0.6773

P<0.05 is considered as statistically significant

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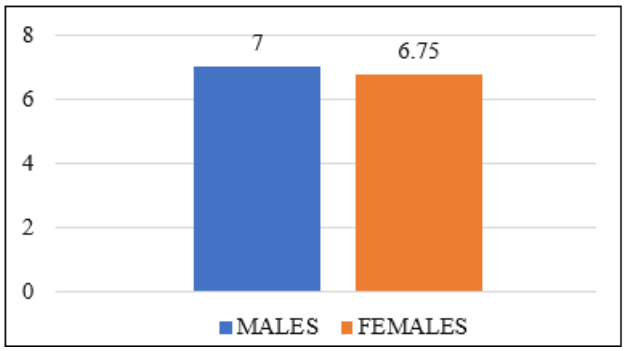
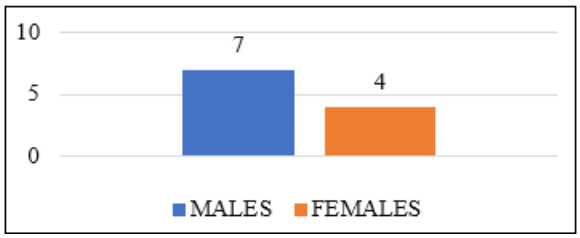


Graph 1: Comparison of age distribution among the two genders of the study

Table 2: Comparison of Gender distribution among participants of the study assessed using Binomial test

Parameter	Males	Females	p-value
Gender distribution (in terms of frequency & percentage)	7 (63.6%)	4 (36.4%)	0.5488

P<0.05 is considered as statistically significant

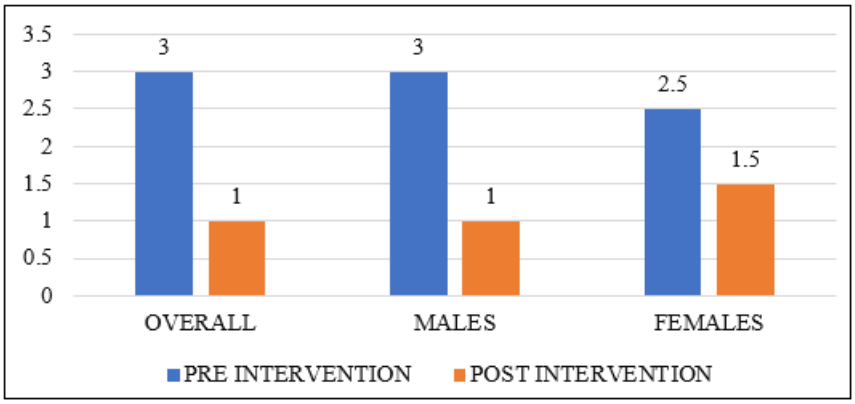


Graph 2: Comparison of Gender distribution among the participants of the study

Table 3: Comparison of Plaque scores between pre and post intervention assessed using Wilcoxon signed rank test

Parameter assessed	Pre-intervention	Post-intervention	p-value
Plaque score Overall	2.54± 0.52 Median – 3, IQR - 1	1.45± 0.52 Median – 1, IQR - 1	0.001586
Plaque score among males	2.57± 0.53 Median – 3, IQR - 1	1.42± 0.53 Median – 1, IQR - 1	0.01471
Plaque score among females	2.50± 0.57 Median –2.5, IQR - 1	1.50± 0.57 Median –1.5, IQR - 1	0.04186

P<0.05 is considered as statistically significant

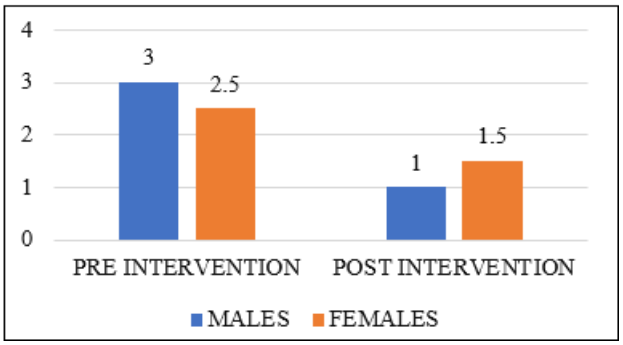


Graph 3: Comparison of median Plaque scores between pre and post intervention among study participants

Table 4: Comparison of Plaque scores between males and females (Gender wise variation) assessed using Mann Whitney U test

Parameter	Males	Females	p-value
Pre-intervention plaque scores	2.57± 0.53 Median – 3, IQR - 1	2.50± 0.57 Median –2.5, IQR - 1	0.9131
Post-intervention plaque scores	1.42± 0.53 Median – 1, IQR - 1	1.50±0.57 Median –1.5, IQR - 1	0.9131

P<0.05 is considered as statistically significant



Graph 4: Comparison of median Plaque scores between males and females (Gender wise variation) among participants at two time intervals of the study

Plaque Reduction

A statistically significant reduction in plaque scores was observed following the intervention. The overall plaque score decreased from a median of 3 (IQR = 1) at baseline to a median of 1 (IQR = 1) post-intervention (p = 0.001586), demonstrating effective plaque control using the OmniClean EasyGrip Toothbrush.

Gender-wise analysis showed:

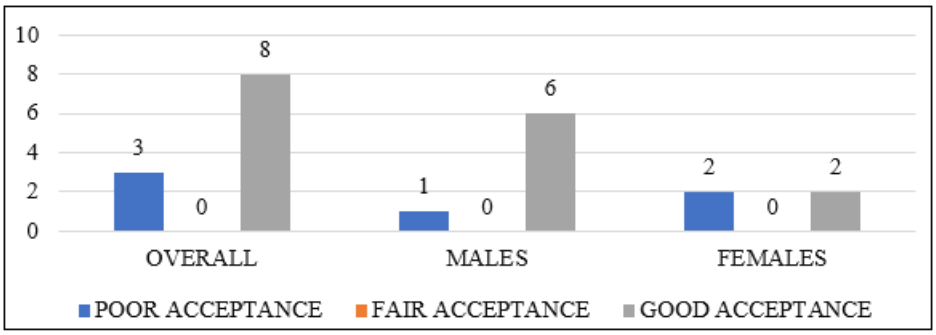
- Males: significant reduction from median 3 to 1 (p = 0.01471)
- Females: significant reduction from median 2.5 to 1.5 (p = 0.04186)

No statistically significant difference was observed between males and females in either pre- or post-intervention plaque scores (p = 0.9131), indicating uniform effectiveness across genders.

Table 5: Comparison of Parental acceptance of Omni Clean Easy Grip tooth brush among study population assessed using Exact Multinomial test

Parameter	Poor acceptance	Fair acceptance	Good acceptance	p-value
Parental acceptance overall	3 (27.27%)	0	8 (72.72%)	0.0097
Parental acceptance among parents of male patients	1 (14.3%)	0	6 (85.7%)	0.0206
Parental acceptance among parents of female patients	2 (50%)	0	2 (50%)	0.5556

P<0.05 is considered as statistically significant

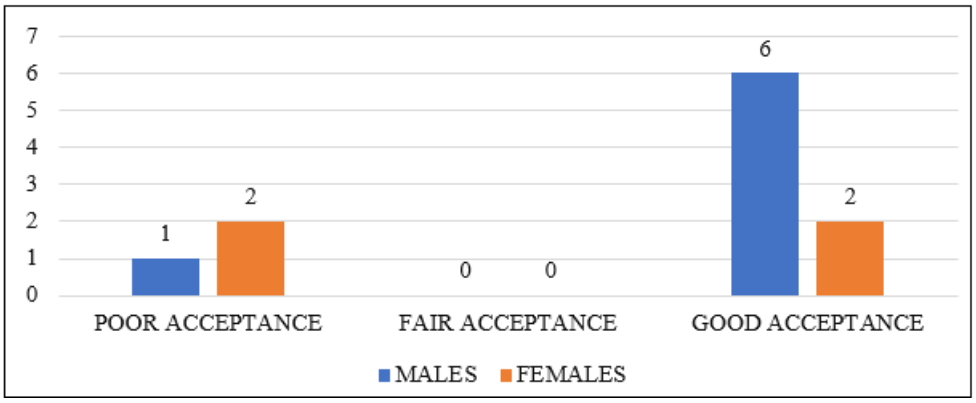


Graph 5: Comparison of Parental acceptance of Omni Clean Easy Grip tooth brush among study population

Table 6: Comparison of children's Gender wise variation in relation to Parental acceptance of Omni Clean Easy Grip tooth brush assessed using Fishers exact test

Gender of children	Poor acceptance	Fair acceptance	Good acceptance	p-value
Males	1 (14.3%)	0	6 (85.7%)	0.4909
Females	2 (50%)	0	2 (50%)	

P<0.05 is considered as statistically significant



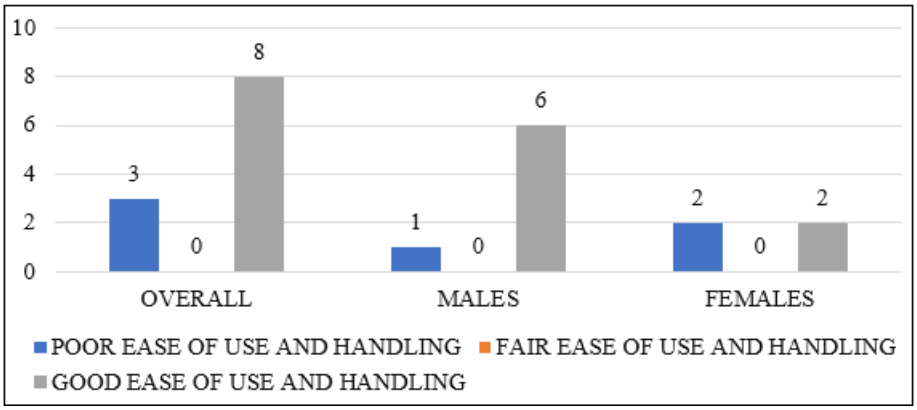
Graph 6: Comparison of children's Gender wise variation in relation to Parental acceptance of Omni Clean Easy Grip tooth brush

Parental Acceptance: A majority of parents (72.72%) reported good acceptance of the toothbrush, while 27.27% reported poor acceptance, with no fair responses. This distribution was statistically significant (p = 0.0097), indicating strong positive parental acceptance. Among parents of male children, 85.7% reported good acceptance (p = 0.0206), whereas among parents of female children, responses were equally distributed (50% good, 50% poor; p = 0.5556). No significant gender-based difference in parental acceptance was observed (p = 0.4909).

Table 7: Comparison of Ease of use and handling Omni Clean Easy Grip tooth brush among study population assessed using Exact Multinomial test

Parameter	Poor Ease of use and handling	Fair Ease of use and handling	Good Ease of use and handling	p-value
Ease of use and handling overall	3 (27.27%)	0	8 (72.72%)	0.0097
Ease of use and handling among male patients	1 (14.3%)	0	6 (85.7%)	0.0206
Ease of use and handling among female patients	2 (50%)	0	2 (50%)	0.5556

P<0.05 is considered as statistically significant

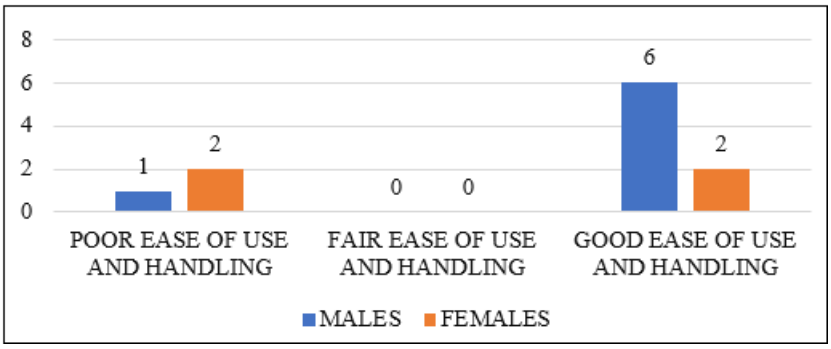


Graph 7: Comparison of Ease of use and handling Omni Clean Easy Grip tooth brush among study population

Table 8: Comparison of children's Gender wise variation in relation to Ease of use and handling of Omni Clean Easy Grip tooth brush assessed using Fishers exact test

Gender of children	Poor Ease of use and handling	Fair Ease of use and handling	Good Ease of use and handling	p-value
Males	1 (14.3%)	0	6 (85.7%)	0.4909
Females	2 (50%)	0	2 (50%)	

P<0.05 is considered as statistically significant



Graph 8: Comparison of children's Gender wise variation in relation to Ease of use and handling of Omni Clean Easy Grip tooth brush

Ease of Use and Handling: Most parents (72.72%) reported good ease of use and handling, while 27.27% reported poor ease, with no fair responses. This finding was statistically significant (p = 0.0097), indicating favorable usability of the toothbrush. Among males, 85.7% reported good ease of use (p = 0.0206), while among females, responses were equally split (50% good and 50% poor; p = 0.5556). No significant gender-wise difference in ease of use was observed (p = 0.4909).

Overall Findings: The results demonstrate that the OmniClean EasyGrip Toothbrush is effective in significantly reducing plaque scores and is associated with high parental acceptance and ease of use, with consistent outcomes across genders.

5. Discussion

The present study evaluated both the clinical effectiveness and parental acceptance of the OmniClean EasyGrip Toothbrush in children with Cerebral Palsy. Children with cerebral palsy face significant challenges in maintaining oral hygiene due to impaired motor skills, poor hand coordination, and dependence on caregivers, which has been well documented in previous literature.[1,2] The findings of the present study demonstrated a statistically significant reduction in plaque scores following the use of the modified toothbrush, thereby confirming its clinical effectiveness. The reduction in plaque scores from a median of 3 to 1 highlights the ability of the combined design to achieve substantial plaque control within a relatively short intervention period. Importantly, this improvement was observed in both male and female participants, with no statistically significant gender-based differences, indicating that the effectiveness of the toothbrush is independent of gender.

These results are in accordance with previous studies evaluating modified toothbrush designs. A study by Savitha et al[13] reported high parental and child acceptance of a novel toothbrush with a modified handle using a cartoon stress ball, which improved grip and ease of use. Their findings showed that 100% of parents reported better handling, accessibility, and debris removal with the modified toothbrush, attributing this to improved ergonomics and child-friendly design . However, their study primarily focused on subjective outcomes such as parental perception and acceptance, without incorporating objective plaque index measurements. The present study extends these findings by demonstrating not only high parental acceptance but also statistically significant clinical plaque reduction, thereby providing stronger evidence of effectiveness.

Previous literature has consistently emphasized the importance of handle modifications in improving oral hygiene in children with neuromuscular disabilities. Reeson and Jepson[4] demonstrated that customized toothbrush handles improve grip in individuals with restricted hand movement, while Williams and Shuman[5] highlighted that specially designed toothbrushes facilitate easier handling in physically challenged populations. Similarly, Pasiga[6] reported that special grip toothbrushes significantly improve brushing ability in children with cerebral palsy. However, these studies primarily evaluated usability and did not consistently correlate these modifications with clinical plaque reduction outcomes, representing a limitation addressed in the present study.

The significant plaque reduction observed can be attributed to the dual design of the toothbrush. The easy-grip strap enhances stability by converting fine motor movements into gross motor control, thereby compensating for spasticity and poor dexterity. This is supported by Bozkurt et al.[7], who reported that improving brushing mechanics in neuromuscularly disabled individuals leads to better plaque control. Furthermore, Nallegowda et al.[8] emphasized that compromised manual dexterity is a major contributor to poor oral hygiene in children with cerebral palsy, reinforcing the importance of assistive devices.

In addition to ergonomic improvement, the triple-headed design plays a crucial role in enhancing plaque removal. Studies by Grover et al.[9] and Battaglia[10] have shown that toothbrush designs that increase surface coverage significantly improve plaque removal efficiency. The ability of the triple-headed toothbrush to simultaneously clean buccal, lingual, and occlusal surfaces reduces the dependence on precise brushing technique, which is particularly beneficial in children with limited motor skills. This explains the significant reduction in plaque scores observed in the present study.

Parental acceptance observed in this study (72.72% good acceptance) further supports its clinical applicability. Caregiver compliance is a critical determinant of oral hygiene maintenance in children with cerebral palsy, as highlighted by Ashkenazi et al.[11], who demonstrated that caregiver oral hygiene practices directly influence patient outcomes. The high acceptance rate in the present study can be attributed to improved grip, reduced effort, and enhanced child cooperation, which are consistent with findings from the referenced novel toothbrush study[13].

The use of the Löe and Silness plaque index adds strength to the methodology, as it is a well-established and reliable tool for assessing plaque accumulation and gingival health.[12] By combining subjective (questionnaire-based acceptance) and objective (plaque score) measures, the present study provides a more comprehensive evaluation compared to previous studies.

Overall, the present study introduces the OmniClean EasyGrip Toothbrush as a combined ergonomic and functional innovation that improves grip and handling, enhances caregiver-assisted brushing, enables simultaneous cleaning of multiple tooth surfaces, reduces brushing time and effort, improves plaque removal efficiency, and increases child cooperation and parental acceptance. These findings support the concept that integrating ergonomic adaptations with functional toothbrush design results in superior clinical outcomes compared to single-modification approaches.

6. Conclusion

The use of the OmniClean EasyGrip Toothbrush, integrating a triple-headed design with an easy-grip silicone adaptation, offers a comprehensive approach to overcoming both motor and functional limitations. The study demonstrated statistically significant plaque reduction along with high parental acceptance and ease of use, indicating that this modification is both clinically effective and caregiver-friendly. Thus, the OmniClean EasyGrip Toothbrush represents a promising oral hygiene aid for children with cerebral palsy, facilitating improved oral health outcomes and long-term compliance.

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