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The Effect of ABA Therapy Based on Discrete Trial Training (DTT) on Knowledge, Attitudes, and Brushing Skills in Parents of Autistic Children

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ABSTRACT: Background: Children with autism spectrum disorder (ASD) frequently experience difficulties with self-care routines, including toothbrushing, because sensory sensitivities, communication differences, and behavioral challenges can interfere with effective oral hygiene. Parents therefore play a central role in establishing and maintaining daily oral-care behaviors.

Objective: This study evaluated the effect of an Applied Behavior Analysis (ABA) intervention based on Discrete Trial Training (DTT) on parents' knowledge, attitudes, and skills related to toothbrushing for children with ASD.

Methods: A quasi-experimental one-group pretest-posttest design was conducted among 80 parents of elementary-school-aged children with ASD attending several special schools in Semarang City, Central Java, Indonesia. Participants received structured dental and oral-hygiene education and practical training using DTT principles, including stepwise instruction, repetition, and positive reinforcement. Knowledge, attitudes, and toothbrushing-guidance skills were assessed before and after the intervention using structured instruments. Because the outcome data were not normally distributed, pretest and posttest scores were compared using the Wilcoxon signed-rank test at a significance level of 0.05.

Results: Marked improvements were observed across all three outcomes. Good knowledge increased from 5.0% before the intervention to 56.2% after the intervention; good attitudes increased from 7.5% to 90.0%; and good skills increased from 10.0% to 73.8%. Wilcoxon signed-rank testing demonstrated statistically significant pretest-posttest differences for knowledge, attitudes, and skills (all $p < 0.001$).

Conclusions: DTT-based ABA education and training was associated with substantial short-term improvements in parents' oral-health knowledge, attitudes, and practical toothbrushing-guidance skills. These findings support structured parent-focused behavioral training as a promising strategy for strengthening home-based oral hygiene support for children with ASD. However, the absence of a control group and long-term follow-up limits causal inference and assessment of sustained effects.

1. INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental condition characterized by persistent differences in social communication and interaction, together with restricted or repetitive patterns of behavior, interests, or activities that vary

substantially in presentation and support needs. The condition may also involve sensory-processing differences that affect participation in everyday routines, including personal hygiene and health care. Recent Global Burden of Disease estimates indicate that approximately 61.8 million people worldwide were on the autism spectrum in 2021, equivalent to about 1 in 127 people. The broad heterogeneity of ASD means that health-promotion strategies should be individualized, structured, and responsive to communication, sensory, and behavioral needs rather than assuming a uniform approach for all children [1,2].

Oral health is an important component of general health for children with ASD, yet many children and families encounter substantial barriers to effective daily oral hygiene and dental care. Evidence does not support treating ASD itself as a simple biological cause of dental disease; instead, risk is shaped by factors such as diet, inadequate oral-hygiene practices, communication difficulties, sensory sensitivities, medication-related effects, and access to appropriate dental services. A systematic review found that several oral-health outcomes in children and adolescents with ASD were comparable with those of neurotypical peers, whereas an umbrella review reported high pooled prevalence ranges for dental caries and periodontal disease across ASD studies. These findings emphasize both the clinical importance of oral care and the heterogeneity of the available evidence [3-5].

Maintaining toothbrushing routines can be particularly challenging when children experience hypersensitivity to taste, texture, sound, touch, or changes in routine, or when they have difficulty understanding multistep verbal instructions. Consequently, oral-health interventions for autistic children often use structured visual and behavioral supports rather than conventional verbal education alone. Systematic reviews and intervention studies have described benefits from picture-based instruction, video modeling, digital applications, social stories, and Picture Exchange Communication System-based toothbrushing programs. Although the magnitude and certainty of effects vary across studies, these approaches share an emphasis on making the task predictable, breaking it into manageable steps, and supporting repeated practice in familiar environments [6-10].

Parents and other caregivers are central to the success of home-based oral-health routines because they organize daily schedules, provide prompts and reinforcement, model toothbrushing, and determine when professional dental care is sought. Their knowledge can shape recognition of oral-health risks and appropriate preventive practices, while attitudes and confidence may influence the consistency with which those practices are implemented. A systematic review specifically examining autistic children concluded that parental knowledge and attitudes are relevant to children's oral and dental health, although the available studies remain heterogeneous. More broadly, parent-mediated interventions in ASD show that caregivers can be trained to deliver structured strategies, but outcomes depend on training quality, fidelity, child characteristics, and the certainty of the supporting evidence [11,12].

Applied Behavior Analysis (ABA) provides a systematic framework for identifying environmental variables associated with behavior and for teaching new skills through observable, measurable procedures. Discrete Trial Training (DTT), one structured ABA teaching format, typically divides a target skill into small learning units and uses clear instructions, repeated opportunities, prompts when required, consequences, and reinforcement to strengthen correct responding. Meta-analytic evidence indicates that ABA-based interventions can support selected developmental outcomes in children with ASD, although effects differ across domains and intervention formats. Importantly for family-based programs, studies have also shown that parents and caregivers can acquire DTT or discrete-trial instruction skills when they receive structured instruction, demonstration, practice, and performance feedback, including through remotely delivered training [13-16].

Behavioral principles have increasingly been incorporated into oral-hygiene interventions for children with ASD. Parent-inclusive behavioral toothbrushing programs, ABA-oriented dental health education, visual pedagogy, and technology-assisted training have all shown promising improvements in toothbrushing performance or oral-hygiene outcomes in selected samples. Recent reviews nevertheless stress that many studies use small samples, short follow-up periods, or designs without adequate control conditions, resulting in low or very low certainty for some conclusions. This combination of promising practical findings and methodological limitations indicates a need for studies that examine not only child outcomes but also the capability of parents to deliver structured oral-hygiene support in everyday settings [7,17-20].

The Indonesian context is especially relevant because effective home-based programs must be feasible within local family routines, educational settings, and available special-needs services. Existing Indonesian evidence has reported improvement in toothbrushing-related knowledge and efficacy after ABA-based dental health education among autistic children, but evidence focused specifically on parents' knowledge, attitudes, and practical guidance skills remains limited. Evaluating parent-focused

outcomes is important because improvements in a child's daily routine may depend on whether caregivers understand the procedure, accept its use, and can implement the teaching sequence consistently outside formal therapy sessions. A structured DTT-based approach therefore offers a theoretically coherent method for strengthening caregiver capacity while remaining compatible with individualized behavioral teaching [14,15,20].

Based on these considerations, this study aimed to analyze changes in the knowledge, attitudes, and toothbrushing-guidance skills of parents of autistic children after receiving dental and oral-hygiene education and training based on ABA principles using DTT. The study was conducted among parents of elementary-school-aged children attending special schools in Semarang City, Indonesia. By focusing on parental outcomes, the study seeks to contribute context-specific evidence on a caregiver-mediated strategy that may strengthen home oral-hygiene support. Because the design used a single group measured before and after the intervention, the findings are interpreted as pretest-posttest changes associated with the intervention rather than definitive proof of causality, and they should be considered alongside evidence from controlled and longitudinal studies [7,18,19].

2. MATERIALS AND METHODS

2.1 Research Design and Setting

This study used a quasi-experimental one-group pretest-posttest design without a control group. The sample consisted of 80 parents of elementary-school-aged autistic children. The research was conducted in several special schools (Sekolah Luar Biasa/SLB) serving autistic students in Semarang City: SD SLB Autis Negeri Semarang, SLB C Putra Mandiri, SLBC Swadaya Semarang, SLB BC Widya Bakti, SLB Pelita Ilmu, SLB Talenta Autisma Semarang, SLB BCF Pejuang Mandiri, and SLB Negeri Semarang.

2.2 Intervention and Outcome Measures

The intervention consisted of education and training on dental and oral-hygiene behaviors based on Discrete Trial Training (DTT) and was delivered over several sessions. A structured questionnaire was used to assess parents' knowledge, attitudes, and skills before and after the intervention. The source manuscript did not report additional psychometric properties or scoring details for these instruments; therefore, no unverified information has been added in this revision.

2.3 Statistical Analysis

Before inferential analysis, distributional normality was assessed using the Kolmogorov-Smirnov test because the sample included more than 50 respondents. The pretest and posttest outcome data were not normally distributed ($p < 0.05$); therefore, paired pretest-posttest differences were analyzed using the Wilcoxon signed-rank test. All statistical tests used a significance level of $\alpha = 0.05$. Exact software details and effect-size estimates were not available in the source manuscript and should be added by the authors if available.

2.4 Ethical Considerations

The study protocol was reviewed and approved by the Health Research Ethics Committee, Faculty of Public Health, Diponegoro University, Semarang, Indonesia. The study was conducted in accordance with the Declaration of Helsinki and applicable institutional requirements. Written informed consent was obtained from participating parents/legal guardians before data collection and intervention. The exact approval/protocol number must be inserted from the ethics certificate before submission.

3. RESULTS AND DISCUSSION

3.1 Respondent Characteristics

The basic characteristics of the respondents in this study include age, education, occupation and income.

Table 1. Characteristics of participating parents (n = 80)

Characteristic	Category	n (%)
Age (years)	<20	4 (5.0)
	20-35	64 (80.0)

Characteristic	Category	n (%)
	>35	12 (15.0)
Education	Elementary school	4 (5.0)
	Junior high school	11 (13.75)
	Senior high school	54 (67.5)
	Diploma/Bachelor	11 (13.75)
Occupation	Housewife	37 (46.25)
	Civil servant	10 (12.5)
	Self-employed	15 (18.75)
	Private employee	10 (12.5)
	Laborer	8 (10.0)
Income	Below regional minimum wage (UMR)	43 (53.75)
	Above regional minimum wage (UMR)	37 (46.25)

Based on the results of the study on 80 respondents, most of the respondents were in the age group of 20-35 years, which was 64 people (80%). This shows that the majority of respondents are of productive age, who generally have good cognitive and physical abilities in receiving information and implementing health behaviors, including in the care and maintenance of children's dental and oral hygiene. Meanwhile, respondents aged <20 years amounted to 4 people (5%), and 12 people (15%) aged >35 years, which showed a smaller proportion than the productive age group.

Judging from the level of education, the majority of respondents had the last high school education, which was 54 people (67.5%). This condition indicates that most of the respondents have a relatively adequate level of secondary education to understand health information if it is delivered in the right method. Respondents with elementary education amounted to 4 people (5%), junior high school as many as 11 people (13.75%), and D3/S1 also as many as 11 people (13.75%), which shows variations in education levels among respondents.

Based on work, almost half of the respondents were housewives (IRT), namely 37 people (46.25%). This shows that most of the respondents have a direct and intensive role in daily childcare, including in the formation of children's dental and oral hygiene habits. Respondents with self-employed jobs amounted to 15 people (18.75%), civil servants and the private sector 10 people each (12.5%), and workers as many as 8 people (10%).

In terms of income, more than half of the respondents had an income below the UMR, namely 43 people (53.75%), while respondents with an income above the UMR amounted to 37 people (46.25%). This condition shows that most of the respondents are at the middle to lower economic level, which has the potential to affect access to dental and oral health services and the availability of supporting facilities for children's dental hygiene.

3.2 Changes in Parental Knowledge

Table 2. Pretest-posttest comparison of parental knowledge after the DTT-based ABA intervention

Category	Pretest n (%)	Posttest n (%)	p-value
Good	4 (5.0)	45 (56.2)	<0.001
Sufficient	6 (7.5)	35 (43.8)	
Low	70 (87.5)	0 (0)	

Note: Kolmogorov-Smirnov normality: pretest $p < 0.001$ and posttest $p < 0.001$; Wilcoxon signed-rank test: $p < 0.001$.

Table 2 shows a marked shift in parental knowledge between pretest and posttest. At pretest, 70 respondents (87.5%) were classified as having low knowledge, 6 (7.5%) as having sufficient knowledge, and 4 (5.0%) as having good knowledge. The Kolmogorov-Smirnov test indicated that the pretest distribution departed from normality ($p < 0.001$).

After the intervention, 45 respondents (56.2%) were classified as having good knowledge and 35 (43.8%) as having sufficient knowledge, while no respondent remained in the low-knowledge category. The posttest distribution was also non-normal (Kolmogorov-Smirnov $p < 0.001$). The Wilcoxon signed-rank test demonstrated a statistically significant pretest-posttest

difference in parental knowledge ($p < 0.001$), indicating substantial improvement after the DTT-based ABA education and training within this one-group design.

3.3 Changes in Parental Attitudes

Table 3. Pretest-posttest comparison of parental attitudes after the DTT-based ABA intervention

Category	Pretest n (%)	Posttest n (%)	p-value
Good	6 (7.5)	72 (90.0)	<0.001
Moderate	68 (85.0)	8 (10.0)	
Poor	6 (7.5)	0 (0)	

Note: Kolmogorov-Smirnov normality: pretest $p < 0.001$ and posttest $p < 0.001$; Wilcoxon signed-rank test: $p < 0.001$.

Table 3 shows a pronounced change in parental attitudes from pretest to posttest. Before the intervention, 68 respondents (85.0%) were in the moderate-attitude category, while 6 (7.5%) had good attitudes and 6 (7.5%) had poor attitudes. The Kolmogorov-Smirnov test indicated a non-normal pretest distribution ($p < 0.001$).

Following the intervention, 72 respondents (90.0%) were classified as having good attitudes and 8 (10.0%) as having moderate attitudes, with no respondents remaining in the poor-attitude category. The posttest distribution was also non-normal (Kolmogorov-Smirnov $p < 0.001$). The Wilcoxon signed-rank test showed a statistically significant pretest-posttest difference in parental attitudes ($p < 0.001$), demonstrating improvement after the intervention while recognizing that the absence of a comparison group limits causal attribution.

3.4 Changes in Toothbrushing-Guidance Skills

Table 4. Pretest-posttest comparison of parental toothbrushing-guidance skills after the DTT-based ABA intervention

Category	Pretest n (%)	Posttest n (%)	p-value
Good	8 (10.0)	59 (73.8)	<0.001
Moderate	13 (16.2)	21 (26.2)	
Low	59 (73.8)	0 (0)	

Note: Kolmogorov-Smirnov normality: pretest $p < 0.001$ and posttest $p < 0.001$; Wilcoxon signed-rank test: $p < 0.001$.

Table 4 shows a substantial improvement in parents' toothbrushing-guidance skills. At pretest, 59 respondents (73.8%) were classified as having low skills, 13 (16.2%) as having moderate skills, and 8 (10.0%) as having good skills. The Kolmogorov-Smirnov test showed that the pretest distribution was non-normal ($p < 0.001$).

At posttest, 59 respondents (73.8%) were classified as having good skills and 21 (26.2%) as having moderate skills, while no respondents remained in the low-skill category. The posttest distribution was also non-normal (Kolmogorov-Smirnov $p < 0.001$). The Wilcoxon signed-rank test identified a statistically significant pretest-posttest difference in parents' toothbrushing-guidance skills ($p < 0.001$), supporting a meaningful within-group improvement after the DTT-based ABA intervention.

3.5 Discussion

3.5.1 Interpretation of Key Findings

The principal finding of this study is that parents demonstrated substantial improvements in knowledge, attitudes, and toothbrushing-guidance skills after receiving DTT-based ABA education and training. Good knowledge increased from 5.0% to 56.2%, good attitudes from 7.5% to 90.0%, and good skills from 10.0% to 73.8%, with statistically significant pretest-posttest differences for all three outcomes. The pattern is consistent with the broader rationale for caregiver-mediated interventions, in which parents are trained to deliver structured support within the child's everyday environment. Nevertheless, these results represent within-group change rather than a controlled treatment effect; therefore, the size of the observed improvement should be interpreted in conjunction with the limitations of a one-group pretest-posttest design [11,19].

The improvement in knowledge is plausible within the learning structure of DTT because information and procedures are presented in small, clearly defined units and practiced repeatedly with immediate feedback and reinforcement. These features can reduce ambiguity and help caregivers discriminate the relevant steps in a target routine. Research on parent and caregiver training has shown that DTT or discrete-trial instruction procedures can be learned with high implementation accuracy when training includes explicit instruction, modeling, rehearsal, and performance feedback. The current findings extend that logic to oral-health education by showing that parents moved from predominantly low baseline knowledge to sufficient or good knowledge after training, although the present study did not measure treatment fidelity or retention over time [13-15].

The strong shift toward positive parental attitudes may reflect more than the acquisition of factual information. Structured practice can provide repeated experiences of successful task completion, which may strengthen perceived competence, reduce uncertainty, and increase willingness to guide a child through a challenging self-care routine. This interpretation is compatible with evidence that caregiver knowledge and attitudes are important components of oral-health support for autistic children and with the wider literature on parent-mediated interventions in ASD. However, attitude improvement should not be assumed to translate automatically into sustained home behavior; longitudinal observation is needed to determine whether more favorable attitudes are maintained and consistently expressed in daily toothbrushing support [11,12].

The largest practical shift was observed in toothbrushing-guidance skills, for which the proportion classified as good increased from 10.0% to 73.8%. Behavioral teaching is well suited to procedural skills because a complex routine can be separated into smaller observable actions, practiced repeatedly, and strengthened through feedback and reinforcement. Parent-inclusive behavioral toothbrushing interventions have reported improvements in children's independent brushing steps, while caregiver training studies have shown that adults can acquire structured teaching procedures with high accuracy. Picture-based toothbrushing programs likewise support the use of predictable, sequenced instruction for autistic children. Together, these findings provide a plausible behavioral explanation for the improved parental skill scores observed in the present study [8,15,17].

Taken together, the results suggest that a structured DTT-based ABA approach can be useful for strengthening caregiver capacity in oral-hygiene support. Importantly, the outcomes measured here were parental knowledge, attitudes, and guidance skills; the study did not directly demonstrate reductions in plaque, gingival inflammation, caries, or other clinical oral-health outcomes in the children. Recent systematic reviews indicate that behavioral and educational oral-care interventions for autistic individuals are promising, especially when caregivers are involved, but also emphasize heterogeneity, frequent lack of control groups, and low certainty of evidence. The present findings should therefore be viewed as supportive evidence for parent-focused training rather than proof of downstream clinical benefit for children [7,18,19].

3.5.2 Comparison with Previous Studies

The improvement in parental knowledge is consistent with research emphasizing the importance of caregiver education in the oral health of autistic children. Salmeh et al. [12] identified parental knowledge and attitudes as relevant determinants in the oral-health context, while parent-mediated intervention research has shown that structured caregiver training can improve the ability to implement intervention strategies. An Indonesian quasi-experimental study also reported improved toothbrushing-related knowledge and efficacy after ABA-based dental health education, although that study focused on autistic children rather than specifically on parent outcomes. The present study therefore adds a complementary perspective by demonstrating substantial knowledge gains among parents who are expected to support the child's daily home routine [11,12,20].

The findings on attitudes and practical skills also align with studies showing that caregivers can learn structured behavioral teaching procedures. Gauert et al. [14] reported that parents acquired and maintained DTT implementation skills following structured instruction, and Higgins et al. [15] found robust improvement when caregivers were trained to conduct discrete-trial instruction. Those studies did not address toothbrushing specifically, but they are relevant because they demonstrate that complex behavioral procedures can be transferred from professionals to caregivers. The current study applies the same general principle to dental and oral-hygiene support, where repeated practice and feedback may strengthen both confidence and implementation skill [13-15].

The oral-health literature provides further support for structured, visually organized, and behaviorally informed toothbrushing instruction. A PECS-based toothbrushing program produced improvements in plaque and gingival indices, an iPad-based program improved toothbrushing behavior, and video modeling outperformed social-story education in a quasi-randomized trial of students with ASD. A systematic review and meta-analysis of picture-based toothbrushing interventions similarly

concluded that visual teaching approaches can improve oral-hygiene outcomes, although study quality and intervention characteristics vary. These studies differ from the present research because most measured child behavior or clinical oral-hygiene outcomes rather than parental knowledge, attitudes, and skills [6,8-10].

The present results are also compatible with emerging evidence that behavioral interventions involving parents can improve toothbrushing routines. Esposito et al. [17] used a multicomponent behavioral package that included parents and documented improvements in children's independent toothbrushing steps and maintenance. In Indonesia, Youlanda and Nur [20] reported that ABA-based dental health education improved toothbrushing-related knowledge and efficacy. These findings support the practical relevance of behavioral methods in oral-hygiene training, but direct comparisons should be made cautiously because the studies differ in participants, outcomes, intervention components, duration, and research design. The current study's contribution is specifically the observed change in caregiver-level outcomes across knowledge, attitudes, and practical guidance skills [17,20].

At the same time, the broader evidence base does not justify concluding that one behavioral or educational technique is universally superior. Systematic reviews have identified promising effects from visual supports, video-based interventions, ABA components, smart-device applications, and caregiver participation, while also documenting high heterogeneity and frequent methodological weaknesses. A recent meta-analysis found improvements in plaque, oral-hygiene, and gingival indices across several intervention types, whereas another review characterized much of the evidence as low or very low certainty. Accordingly, the large pretest-posttest changes in this study should be understood as an encouraging signal that warrants confirmation through controlled designs rather than as definitive evidence of comparative superiority of DTT [7,18,19].

3.5.3 Limitations

Several limitations should be considered when interpreting these findings. First, the study used a one-group pretest-posttest design without a control or comparison group. Consequently, improvements cannot be attributed exclusively to the DTT-based ABA intervention because testing effects, maturation, exposure to other information, expectancy, or other time-related factors may also have contributed. This limitation is particularly important in the autism oral-health literature, where systematic reviews have noted that many intervention studies lack control groups and have methodological weaknesses that reduce certainty about causal effects. Future interpretations should therefore use language of association or pretest-posttest change rather than definitive treatment efficacy [7,18].

Second, the study assessed outcomes immediately after a relatively short intervention period and did not report long-term follow-up. It is therefore unknown whether gains in parental knowledge, attitudes, and skills were sustained, generalized to routine home settings, or translated into measurable improvements in the children's oral health. The study also did not report objective child-level clinical outcomes such as plaque index, gingival index, OHI-S, or caries experience. This distinction is important because recent reviews evaluate intervention effectiveness using both behavioral and clinical oral-health endpoints, and parent-inclusive studies suggest that maintenance should be assessed beyond the immediate training period [5,17,19].

Third, the source manuscript provides limited information on the psychometric properties, scoring thresholds, observer training, and inter-rater reliability of the instruments used to classify knowledge, attitudes, and skills. Knowledge and attitude measures based on self-report may also be affected by recall or social-desirability bias, while observational skill ratings can vary if assessors are not standardized or blinded. In addition, the analysis reports statistical significance but not effect sizes or confidence intervals, limiting evaluation of the magnitude and precision of change. These measurement and reporting issues should be addressed in future studies because stronger intervention evidence requires transparent, reliable outcome measurement together with clinically interpretable estimates of effect [12,19].

3.5.4 Recommendations for Future Research

Future research should test the intervention using randomized controlled, cluster-randomized, or well-matched controlled quasi-experimental designs with larger and more diverse samples. Follow-up assessments at multiple time points would help determine whether improvements in caregiver knowledge, attitudes, and skills are maintained after formal training ends. Studies should also report effect sizes and confidence intervals and should incorporate objective child-level outcomes such as plaque index, gingival index, OHI-S, toothbrushing independence, and cooperation with oral care. These design improvements would respond directly to the methodological limitations identified in recent systematic reviews and would strengthen conclusions about both behavioral and clinical effectiveness [18,19].

Comparative studies are also needed to determine when DTT-based caregiver training offers advantages over, or works best in combination with, other oral-health teaching strategies. Relevant comparators include picture-based instruction, PECS, video modeling, social stories, digital applications, and multicomponent behavioral programs. Existing trials and reviews show that each of these approaches can be useful for some autistic children, but intervention response may depend on communication ability, sensory profile, age, autism support needs, and caregiver capacity. Factorial or adaptive designs could help identify which components are necessary, for whom, and at what intensity, rather than treating all behavioral and visual interventions as interchangeable [6,8,10,21].

Finally, future studies should examine implementation fidelity, acceptability, cultural adaptation, caregiver burden, and feasibility in routine school and home settings. Recording whether parents apply DTT steps accurately outside supervised sessions would clarify the mechanism linking training to child outcomes, while qualitative feedback could identify barriers to sustained use. Research should also evaluate whether low-cost or telehealth-supported caregiver coaching can maintain fidelity when specialist access is limited. Such implementation-focused work is particularly relevant to diverse Indonesian settings and should consider socioeconomic conditions, family routines, child sensory characteristics, and available educational support when adapting intervention materials [7,11,14,15].

4. CONCLUSION

This study found statistically significant and substantial pretest-posttest improvements in parents' knowledge, attitudes, and toothbrushing-guidance skills following DTT-based ABA dental and oral-hygiene education and training. The results support the practical potential of structured, reinforcement-based caregiver training for strengthening parental capacity to support daily oral-hygiene routines for autistic children.

Because the study did not include a control group, long-term follow-up, or objective child-level oral-health outcomes, the findings should not be interpreted as definitive evidence that the intervention alone caused the observed changes or improved children's clinical oral health. Controlled studies with larger samples, validated outcome measures, fidelity assessment, clinical oral-health indicators, and longer follow-up are needed to confirm effectiveness and sustainability.

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AUTHOR CONTRIBUTIONS

Puput Ediyarsari: Conceptualization, data collection, data analysis, manuscript drafting. Zahroh Shaluhiyah: Research design, supervision, critical revision of the manuscript. Bagoes Widjanarko: Methodological validation, data interpretation, manuscript review. Henry S. Susanto: Statistical analysis, editing, and final approval of the manuscript.

CONFLICT OF INTEREST

The authors state that there are no conflicts of interest, both financial or non-financial in nature, that could unduly affect the content or results of this study.

ETHICS STATEMENT

This study was reviewed and approved by the Health Research Ethics Committee, Faculty of Public Health, Diponegoro University, Semarang, Indonesia (approval/protocol No. [AUTHOR MUST INSERT THE EXACT ETHICS APPROVAL NUMBER FROM THE CERTIFICATE]). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and applicable institutional requirements. Before enrollment, participating parents/legal guardians were informed about the study purpose, procedures, voluntary nature of participation, confidentiality, potential risks and benefits, and the right to withdraw without penalty. Written informed consent was obtained from each participating parent/legal guardian before data collection and intervention.

DATA AVAILABILITY STATEMENT

Data availability was not specified in the source manuscript. The authors should insert the journal-approved data availability statement before submission.

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DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors declare that OpenAI's ChatGPT was used during revision of this manuscript to assist with English-language editing, structural reorganization, and formatting of in-text citations and references in response to editorial screening comments. The tool was not used to generate, alter, or analyze study data and did not determine the study design, statistical analysis, interpretation of results, or scientific conclusions. All AI-assisted text, citations, and references were critically reviewed and verified by the authors, who take full responsibility for the accuracy, integrity, and final content of the manuscript.

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