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Effectiveness of Dog-Assisted Support to Promote Compliance and Home Oral Hygiene Activities in Disabled Patients: A Randomised Clinical Trial

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ABSTRACT

Objective: Dental anxiety is a negative emotional reaction that can have a negative impact on oral health. Structured animal-assisted services (AAS) involve trained dogs to promote positive behaviours during treatments that may otherwise cause anxiety in the patient. It has been proved that AAS used even for a short time can significantly reduce stress markers. The purpose of this study was to evaluate the effectiveness of home oral hygiene using AAS in patients with disabilities.

Methods: The study was a randomised clinical trial. The participants were randomised into two groups. In group A the oral hygiene session was performed with the presence of a trained therapy dog; in group B it was carried out in a regular dental setup. Patients included in the study were between 5 and 16 years old; disabled; non-collaborating or with limited collaboration; with scarce oral hygiene. Plaque control record (PCR) pre, post oral hygiene procedures, and the patient's feelings were recorded.

Results: Eighty patients were included in the study. Comparison of PCR at T1 between groups shows a statistically significant difference ($p < 0.001$) with a higher decrease in this index for patients in group A. Regarding the emotional state of patients, the statistical test shows a higher frequency ($p = 0.002$) of responses 'happy,' 'interested,' and 'calm' in the group of patients who performed the oral hygiene procedures with the assistance of dogs.

Conclusions: AAS can be a useful option to improve the emotional state and performance of oral hygiene in paediatric subjects with disabilities, helping to optimise patient care.

1 | Introduction

Fear of dental care is a negative emotional reaction that involves cognitive, physiological and motor responses and is referred to as dental anxiety [1]. This fear occurs in about 21% of children and 80% of adults [2] and can have a negative impact on oral health, as it may hinder dental care [1].

Dental anxiety has a multifactorial aetiology and for this reason it is difficult to choose the most effective method for its control [1].

In the literature, several methods have been proposed, both pharmacological, such as sedation with nitrous oxide and general anaesthesia and nonpharmacological, such as the

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tell-show-do technique, hypnosis, nonverbal communication and modifications of the operating environment [3, 4]. In addition to these techniques, animal-assisted services (AAS) could produce calming effects for patients [5]. AAS involves trained therapy animals for the purpose of facilitating patient compliance during treatment [5, 6].

According to the International Association of Human-Animal Interaction Organisations (IAHAIO), AAS encompass several categories, including animal-assisted therapy (AAT), animal-assisted education (AAE) and animal-assisted activities (AAA), each of which differs in objectives, level of structure and professional supervision. This study adopted a structured dog-assisted support programme animal-assisted support programme (AASP), delivered by a team of certified dog handlers during dental care procedures, to facilitate behavioural management in children with disabilities, in line with the IAHAIO framework [7].

Several studies [8–11] have shown that AASP, assisted by trained dogs, increases the attention of children with developmental disorders and promotes positive behaviours during painful treatments. During dental procedures, dogs can help break down communication barriers and create a safe relationship between patients and caregivers [12–14].

In dental practice, there are several studies [15–18] that report how dog-assisted activities can help reduce anxiety, especially in patients with intellectual or developmental disabilities. Furthermore, it has been proved that AASP, used even for a short time, can significantly reduce stress markers [19].

It is important to expand the data to make the techniques used to reduce dental anxiety more valid, improving the patient's dental experience to promote prevention and quality of life.

Studies in the literature demonstrate the potential positive effects of AASP in reducing dental anxiety. However, there are no studies evaluating the effectiveness of dental therapies with or without the aid of AASP.

The purpose of this study was to evaluate the effectiveness of a home oral hygiene intervention using AASP in patients with disabilities.

2 | Material and Methods

2.1 | Study Design

The study was a randomised clinical trial (RCT) with two parallel arms (Figure 1). The study was conducted from December 2024 to February 2025 in the disabled patients' department of the C.I.R. Dental School in Turin (Italy) and has been approved by the Ethics Committee of the A.O.U. Città della Salute e della Scienza of Turin (ref: 0000793 del 26/11/2024). The trial was registered on 27 November 2024 on clinicaltrial.gov (NCT06713928).

This investigation was conducted according to the revised principles of the Helsinki Declaration (2013) and signed informed consent was obtained from each patient or their legal

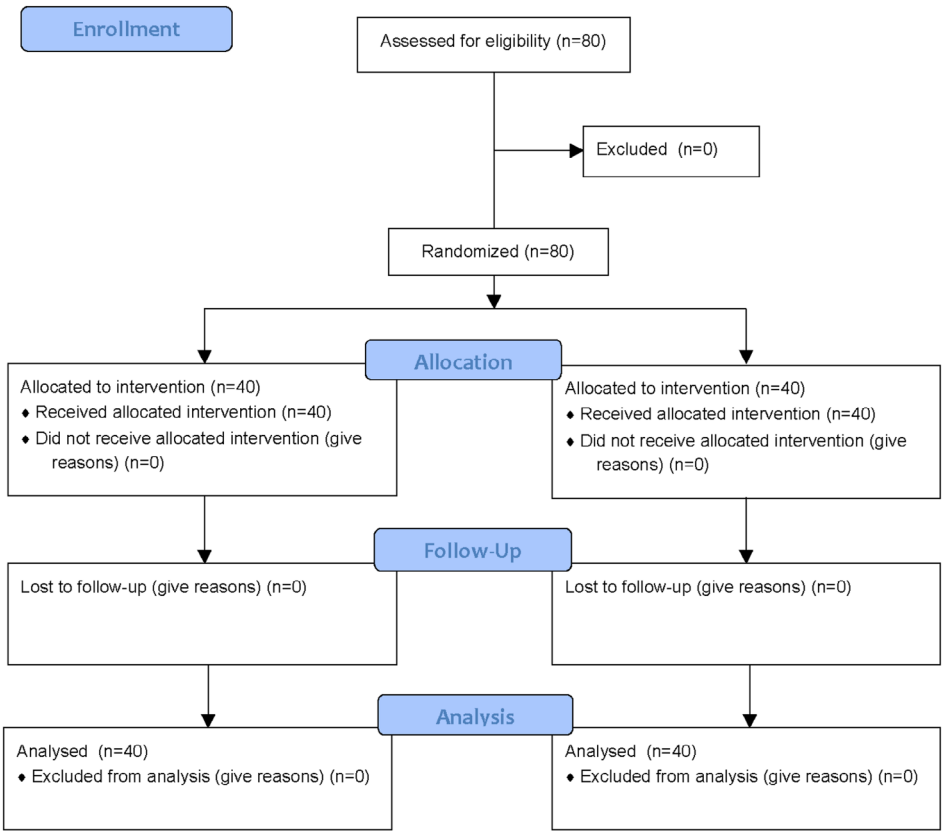

FIGURE 1 | Trial protocol flow chart.

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guardians before entering the study. Data reporting followed the CONSORT guidelines for clinical trials.

2.2 | Study Population

The sample was selected from patients in the Disabled Department of the C.I.R. Dental School in Turin. Patients had to be between 5 and 16 years old; with disability; non-collaborating or with limited collaboration (Frankl Scale [20] 1 or 2); with a Plaque control record (PCR) [21] of 40% or more and partial autonomy in home oral hygiene procedures. Patients with fear of dogs, dog hair allergy, infectious disease, tetraplegic and visually impaired subjects were excluded from the study.

2.3 | Intervention

After the recruitment, the patients and their legal guardians were informed about the study. If the patient agreed, he or his legal guardian signed the informed consent.

The study participants were randomised into two groups: patients in group A performed the oral hygiene session with the presence of a trained therapy dog, patients in group B performed the procedures without the aid of the AASP. The division into the two groups was performed by following a 1:1 block randomisation with Excel's randomisation function (version 14.4.9) from an external operator who used sealed envelopes sequentially numbered and opaque.

The dental therapy dog that participated in this study was a 4-years-old, 13 kg Lagotto (Figure 2). The dog and its trainer had completed a 1 year therapy dog training programme and have obtained the certification as a therapy dog team. The dog that participated in the AASP was selected due to its innate, sociable temperament; specifically, the dog was trained to remain still for extended periods, tolerate unpredictable movements or noises and respond to specific cues from its handler. Furthermore, it was trained to tolerate prolonged contact (e.g., being held or petted) with children. Before each AASP session, the therapy dog has undergone shower, grooming and claw cutting. The dog-trainer was constantly present and sitting next to the therapy dog.

The intervention was planned in accordance with internationally recognised principles for animal-assisted interventions, with a focus on animal welfare [7]. The team of certified dog handlers continuously monitored the dog's behavioural responses during each session. Sessions were limited in duration and the dog was provided with adequate rest periods: a maximum of two sessions per day, with at least 1 h of rest between sessions, for a total maximum of 60 min per session. The dog's participation was completely voluntary and the handler was authorised to terminate the interaction if signs of fatigue or stress appeared. These measures were implemented to safeguard the animal's physical and psychological well-being throughout the study.

The AASP session is divided into two phases: a pre-sitting phase in which the patient could interact with the dog, touching, caressing, and playing with him, under the supervision of the dog-trainer (Figure 3). This phase lasted about 15 min. The second phase was a during-sitting phase in which the dog was in the chair, next to the patient, during the entire oral hygiene procedure, under the supervision of the dog-trainer (Figure 4). The duration of this phase is relative to the duration of the dental session (approximately 30 min) during which the dog was asked to remain still and maintain physical contact with the patient, who was sitting in the dental chair. The dog was asked to lie directly

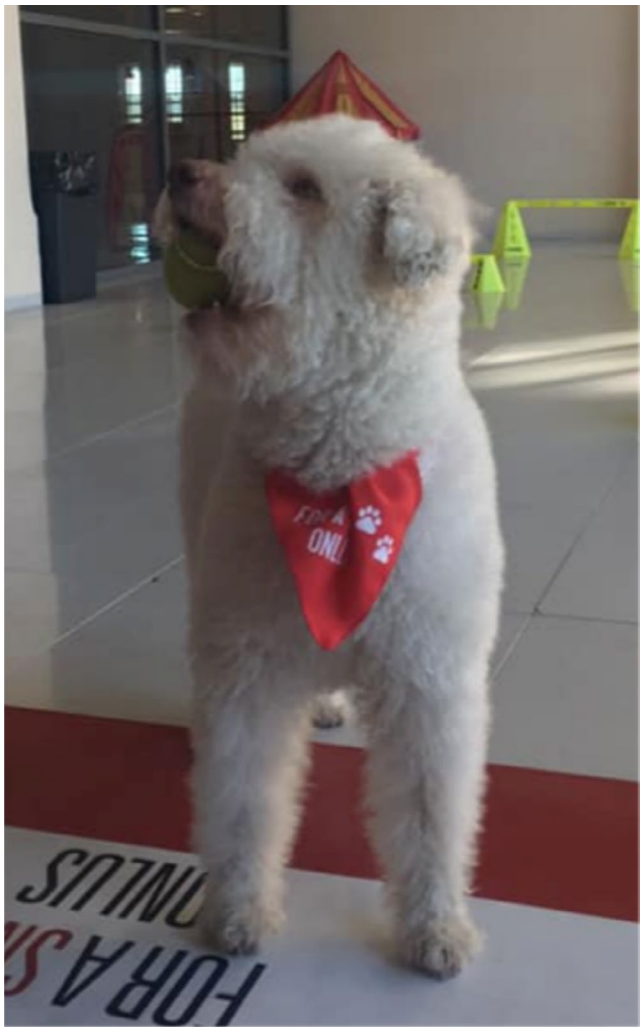

FIGURE 2 | The dog that participated in the AASP.



FIGURE 3 | The pre-sitting phase of AASP.

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on the dental chair, between the patient's legs, maintaining direct physical contact with the patient throughout the procedure.

Patients recruited into the study did not receive any other support during the dental care session other than the AASP (only for group A), such as anticipatory information, visual schemes, or pictograms. Each patient in Group A had a single session of AASP (approximately 15-min pre-session, followed by a sitting phase).

2.4 | Outcome Assessment

The dental care session included a dental visit with a dental mirror, dental and periodontal probe. The initial PCR was recorded with a plaque detector (Mira-2-Ton Solution, Hager & Werken GmbH & Co., Duisburg, Germany) and the patient was instructed in home oral hygiene. After that, the patient's teeth are brushed by the operator using a soft-bristled hand brush, using a roll- technique for 2 min, simulating the procedure that the patient will have to reproduce at home. This procedure requires good cooperation from the patient, who should remain as still as possible with his mouth open in different positions. He should also see the brushing technique used by the operator in a mirror, with the aim of learning it and reproducing it at home.



FIGURE 4 | The during-sitting phase of AASP.

After that, the patient's mood was recorded with a graphic card (Figure 5) representing the moods at the moment. Patients can choose one of the following options to describe their mood: happy, interested, calm (good mood), worried, scared and very scared (bad mood).

The graphic cards were designed as a simple visual tool based on easily recognizable facial expressions, allowing patients to communicate their immediate emotional perception with minimal cognitive effort. This approach is consistent with general recommendations in paediatric research and special care settings, where pictorial or face-based scales are often preferred because they facilitate emotional self-assessment in children and individuals with communication difficulties. Patients were asked to express their emotions independently. However, if they had difficulty expressing their emotional state, the patient's caregiver, who was familiar with the patient's communication style, was consulted for this assessment.

Before presenting the graphic card, the operator gave a standardised verbal instruction asking the child to indicate which facial expression best represented how they were feeling at that moment. The dog-face illustrations were used solely as simplified visual representations to facilitate communication in children with limited verbal or cognitive abilities and were not intended to represent the emotional state of the animal.

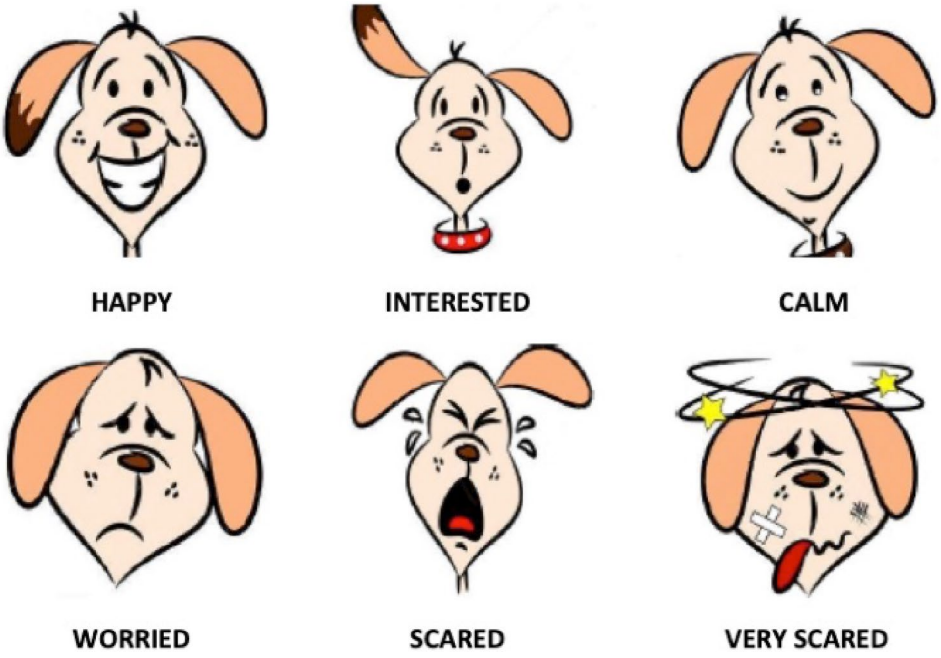

FIGURE 5 | The graphic card that represents the moods of the patient.

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After collecting data on emotions, the responses 'happy,' 'interested,' and 'calm' were clustered into the 'good' category and the responses 'worried,' 'scared,' and 'very scared' were clustered into the 'bad' category.

1 month after baseline, a second PCR is calculated.

The operator who performed the data collection was unaware of the group membership of the evaluated patient.

2.5 | Data Analysis

The sample size was performed using Jamovi (version 2.3.28.0) with a confidence level of 95%, a standard error of 5%, and an effect size of 0.67, derived from a previous study [22]. Therefore, 36 patients were required for each group. However, considering possible dropouts, 40 subjects per group were included in the study for a total of 80 patients.

The data was collected using a spreadsheet in Microsoft Excel format (version 14.4.9). Statistical analysis was performed using Jamovi (version 2.3.28.0). The Kolmogorov–Smirnov normality test was used to verify the normal distribution of data. For the comparison of the PCR between the two groups, the Student *t*-test for independent samples was used. The exact Fisher test was used to compare moods between the two groups. The moods 'happy,' 'interested,' and 'calm' were clustered into the 'good' category and the responses 'worried,' 'scared,' and 'very scared' were clustered into the 'bad' category. The moods clustered between two groups were analysed with the chi-square test. $p < 0.05$ were considered statistically significant.

TABLE 1 | Demographic characteristics of the sample.

	Overall ($N = 80$)
Gender [*N*(%)]	
F	44 (55.0%)
M	36 (45.0%)
Age	
Mean (SD)	9.4 (3.0)
Range	5.0–16.0
Frankl Scale	
Mean (SD)	1.0 (0.0)
Range	1.0–1.0

3 | Results

3.1 | Population Characteristics

A total of 80 patients were included in the study; demographic characteristics of the study population are shown in Table 1. The population had almost equal gender representation, with 44 (55%) women and 36 (45%) men. The mean age was 9.4 years and represented school-age children. Although the inclusion criteria specified Frankl scores of 1–2, all patients included in the study had a completely negative level of compliance (Frankl Scale = 1), characterised by refusal to treatment. No dropouts occurred during the study.

No significant differences were found in any demographic characteristics and plaque index in the two groups at baseline (Table 2).

3.2 | Clinical Outcome

Comparison of PCR at T1 (Table 3), after the home hygiene procedures, between groups shows a statistically significant difference ($p < 0.001$) with a greater decrease in this index for patients in group A, who were given home oral hygiene instructions with the help of AASP. Figures 6–8 show the plaque index at baseline T0 and at follow up (T1) and the difference between the two timesteps, respectively.

TABLE 2 | Demographic characteristics and plaque index in the two groups at baseline.

	A ($N = 40$)	B ($N = 40$)	Total ($N = 80$)	*p*
Gender [*N*(%)]				1.000
F	22.0 (55.0%)	22.0 (55.0%)	44.0 (55.0%)	
M	18.0 (45.0%)	18.0 (45.0%)	36.0 (45.0%)	
Age				0.282
Mean (SD)	9.8 (3.1)	9.0 (2.9)	9.4 (3.0)	
Range	5.0–16.0	5.0–16.0	5.0–16.0	
Frankl Scale				0.320
Mean (SD)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	
Range	1.0–1.0	1.0–1.0	1.0–1.0	
PCR T0				0.950
Mean (SD)	71.2 (12.7)	71.4 (12.2)	71.3 (12.3)	
Range	40.0–90.0	42.0–89.0	40.0–90.0	

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3.3 | Emotional Status

Regarding the emotional state of patients during oral hygiene procedures, a cross-table (Table 4) was compiled on which a Fisher's exact test was performed (Table 5). The statistical test shows a higher frequency ($p = 0.002$) of responses 'happy,' 'interested,' and 'calm' in the group of patients who performed the oral hygiene procedures with the assistance of dogs, compared with patients in group B where responses such as 'worried,' 'scared,' and 'very scared' are prevalent.

'Good' and 'bad' moods were shown in Table 6 and a chi-square test (Table 7) was performed. The statistical test shows even more clearly the higher frequency of positive moods in the group of patients who benefited from dog-assisted therapy with $p < 0.001$ (Figure 9).

TABLE 3 | Comparison of the plaque index of the two groups in the different timesteps.

	Group	*N*	Mean (SD)	*p*
PCR T0	A	40	71.2 (12.7)	0.950
	B	40	71.38 (12.16)	
PCR T1	A	40	53.5 (14.8)	< 0.001*
	B	40	68.97 (11.77)	
T0-T1	A	40	17.7 (10.0)	< 0.001*
	B	40	2.40 (1.63)	

*Statistical analysis carried out.

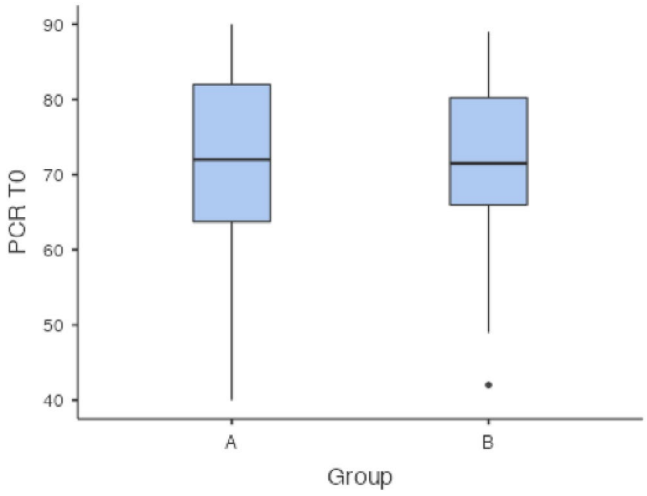

FIGURE 6 | Plaque index at baseline (T0).

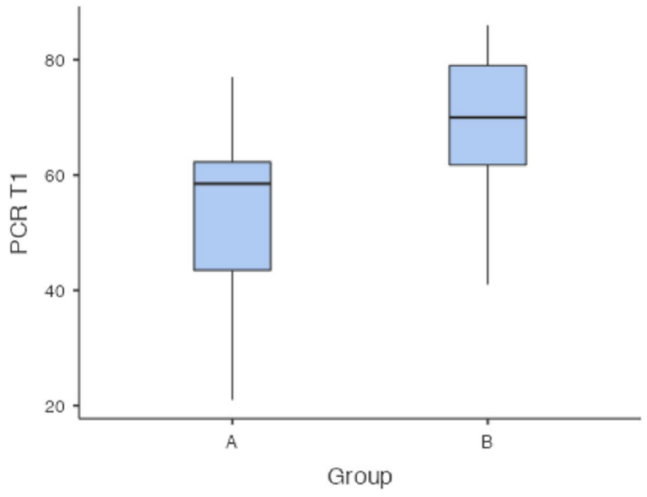

FIGURE 7 | Plaque index after home hygiene procedures (T1).

4 | Discussion

Dental procedures, even simple ones, are not pleasant experiences, especially for physically and mentally disabled children. Most of these patients do not have a good level of cooperation during treatment, which can hinder and make clinical procedures less effective [2].

In this context, the present study aimed to evaluate the effect of AASP on anxiety control in children with disabilities during oral hygiene procedures performed in the dental chair and to evaluate the effectiveness of home oral hygiene motivation performed with the help of AASP. For this reason, the recruited patients did not receive any other support during the dental care session other than the AASP.

Comparison of the PCR measured in the two groups after 1 month (T1) showed a statistically significant improvement of the plaque index in the AASP group. This can be justified by the fact that the positive experience of contact with the dog has made the patient more cooperative and, thanks to this increased cooperation, the practitioner was able to perform oral hygiene procedures more effectively. Furthermore, the presence of the dog made the patient more attentive and receptive to the information received, improving his oral hygiene at home and his compliance. A similar result was obtained by other studies [23, 24] that report that AAT can reduce patient anxiety resulting from dental care and consequently optimise it and make it more effective.

Our study also wanted to investigate the patients' state of mind during hygiene procedures. Patients in the AASP group had

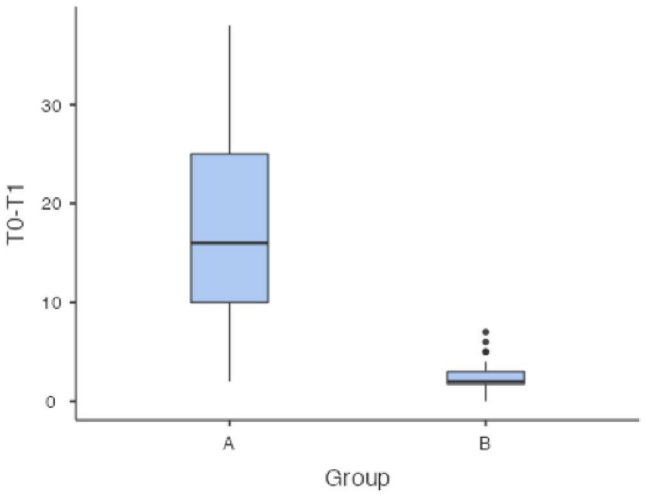

FIGURE 8 | Difference of the plaque index between the two time steps.

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TABLE 4 | Cross-table on emotional state.

Group	Happy	Interested	Quiet	Afraid	Scared	Big scared	Total
A	10	9	12	5	3	1	40
B	2	5	6	18	5	4	40
Total	12	14	18	23	8	5	80

TABLE 5 | Fisher's exact test on emotional state.

	Value	*p*
Fisher's exact test		0.002*
N	80	

*Statistical analysis carried out.

TABLE 6 | Cross-table on clustered emotional state.

Group	Good mood	Bad mood	Total
A	31	9	40
B	13	27	40
Total	44	36	80

TABLE 7 | Chi-square test on clustered emotional state.

	Value	gdl	*p*
χ^2	16.4	1	< 0.001*
N	80		

*Statistical analysis carried out.

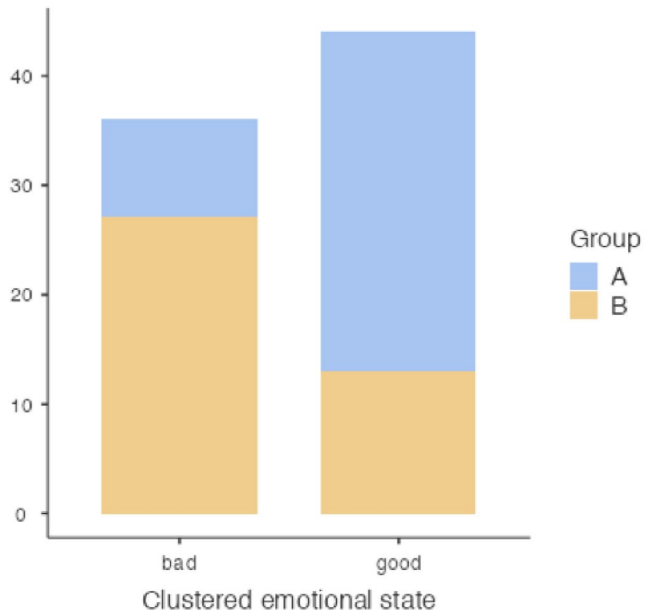

FIGURE 9 | Frequency of 'bad' and 'good' emotional state.

positive moods as 'happy,' 'interested,' and 'calm', while patients in the control group had negative moods as 'worried,' 'scared,' and 'very scared'. The difference between the two groups was statistically significant, especially when we grouped emotional states into 'good' and 'bad' categories.

This result can also be confirmed by numerous studies: in a recent cross-sectional study [2] the authors suggest that the help of therapeutic dogs in orthodontic practice could improve the patient experience. In addition, a pilot study that has the perceived discomfort and self-reported anxiety in adults undergoing dental prevention found that the support of animals during procedures led to a positive perception of the dentist [25]. In another study of 30 patients with intellectual disability, a significant reduction in anxiety, measured by the ADAMS scale, was found in patients who had interacted with the dog until the anaesthesia procedure [26].

Therefore, the results of our study demonstrate a positive effect of patient-dog interaction in the dental environment, which facilitates the reduction of anxiety, improves the patient's mental state, and allows for better clinical performance. As demonstrated in other studies, the management of the disabled child's behaviour is facilitated by the presence of a dog, which improves social interaction between the operator and the patient [27, 28].

The mechanisms underlying the beneficial effects of animal-assisted interventions are likely multifactorial. Current theoretical models suggest that interaction with a trained animal can promote emotional regulation, reduce perceived stress and increase engagement during healthcare procedures by providing a nonjudgmental social stimulus and fostering a greater sense of security and trust. In paediatric settings, the presence of an animal can also divert attention from potentially threatening stimuli, thus facilitating cooperation during clinical procedures [29].

Another theoretical perspective is offered by the biophilia hypothesis, which proposes that humans possess an innate tendency to seek connections with other living organisms. Although this hypothesis was not directly tested in the present study, it provides a plausible conceptual framework through which to interpret the calming and motivational effects observed during dog-assisted interventions. Rather than acting through a single mechanism, it is likely that emotional, motivational, attentional and social processes interact to enhance behavioural responses during dental care [29].

However, the presence of an animal in a clinical setting such as dentistry is not without risks [12, 13].

According to a study [15], these risks can be monitored through the implementation of a well-defined protocol that includes a specific space for the therapy dog and additional sanitation facilities appropriate for disinfection.

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It is important to note that the Frankl Behaviour Rating Scale was used exclusively to identify children with very poor cooperation during dental treatment and not to diagnose dental anxiety. Although anxiety may contribute to uncooperative behaviour, particularly in paediatric dentistry, these constructs are not interchangeable, especially in children with disabilities, where behavioural responses may also be influenced by cognitive, communication, or developmental deficits. Therefore, the results presented should be interpreted as referring to a population with severe behaviour management difficulties, rather than a population diagnosed with dental anxiety. Future studies including participants selected based on validated instruments for assessing dental anxiety could help clarify whether the beneficial effects of dog-assisted therapy observed in this study are also present in patients with confirmed dental anxiety.

This study has several limitations that must be considered when interpreting the results. First, although all clinical procedures and outcome assessments were performed by the same experienced operator to ensure methodological consistency, operator bias cannot be completely ruled out. Second, participants' emotional state was assessed using a simple visual chart developed specifically for this study. Although this approach was considered appropriate for children with disabilities and poor cooperation, it has not been formally psychometrically validated and therefore, the emotional state results should be interpreted with caution. Furthermore, although the inclusion criteria specified Frankl scores of 1–2, the recruited sample consisted entirely of patients with a Frankl score of 1, reflecting the severity of the lack of behavioural cooperation among the study subjects.

Furthermore, given the nature of the AASP, neither the patients nor the operator could be blinded to group assignment, introducing the possibility of performance bias. Moreover, plaque is very sensitive at the time of measurement and it would have been more useful to add Bleeding on Probing as an outcome to effectively assess whether oral hygiene improved over the long term.

An additional limitation concerns the graphic card used to assess the participants' emotional state. Although standardised verbal instructions were provided to ensure that patients understood they were selecting the facial expression corresponding to their own emotions, the use of dog-face illustrations may nevertheless have introduced some ambiguity, particularly considering the cognitive characteristics of the study population. Because the instrument was specifically developed for this study and has not undergone formal psychometric validation, the possibility of misinterpretation cannot be completely excluded. Future studies should consider validating this visual tool or adopting standardised instruments specifically designed for children with disabilities. Moreover, anxiety was assessed without complementary objective physiological parameters such as heart rate, blood pressure, or salivary cortisol, which could have provided a more comprehensive assessment of the emotional response.

A further limitation is the relatively short follow-up period of 1 month, which allows us to evaluate only the short-term effect of AASP on oral hygiene performance. It is unknown whether these behavioural improvements are sustained over time.

Finally, this is a single-centre study that included only children with disabilities who exhibited poor cooperation during dental treatment. Therefore, the results cannot be directly generalised to other paediatric populations or adult patients.

Despite these limitations, the randomised controlled design, standardised intervention protocol and lack of dropouts strengthen the internal validity of these findings. Future multicentre studies with larger samples, longer follow-up periods, validated emotion assessment tools and objective physiological markers are needed to confirm these preliminary findings.

5 | Conclusion

The results of this study support the use of AASP as an aid in controlling anxiety in children with disabilities who have non- or limited collaboration during dental care. AASP may be a useful option to improve the emotional state and oral hygiene performance in paediatric subjects with disabilities, helping to optimise patient dental care. However, further studies on the subject are needed, in particular, to standardise dental procedures.

6 | Clinical Relevance

- Scientific Rationale of the study: Fear of dental care is a negative emotional reaction that could have a negative impact on oral health. Structured dog-assisted support programme (Animal-Assisted Support Programme, AASP) can help reduce anxiety especially in patients with intellectual or developmental disabilities.
- Principal findings: Patients who were accompanied by AASP showed greater compliance, which translates into a greater reduction of the plaque index. Furthermore, AASP significantly improved the patients' experience of dental procedures.
- Practical implications: AASP may be a useful option to improve the emotional state and oral hygiene performance in paediatric subjects with disabilities, helping to optimise patient care.

Author Contributions

Carlotta Grammatico conceived the idea; Carlotta Grammatico and Jacopo Lanzetti collected the data; Jacopo Lanzetti, Umberto Gibello and Giulia Ambrogio analysed the data and contributed to the writing; Armando Crupi contributed to the writing; Francesco Pera conceived the idea and critically revised the manuscript.

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Ethics Statement

The study was approved by the Ethics Committee of the A.O.U. Città della Salute e della Scienza of Turin (ref. 0000793 del 26/11/2024). The trial was registered on 27 November 2024 on clinicaltrial.gov (NCT06713928). This investigation was conducted according to the revised principles of the Helsinki Declaration (2013) and signed informed consent was obtained from each patient or their legal guardians before entering the study.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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