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ORIGINAL RESEARCH

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Oral health profiles in patients with autism spectrum disorder and Down syndrome in Romania: a caregiver-reported comparative study

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Abstract

Background: Autism spectrum disorder (ASD) and Down syndrome are among the most common neurodevelopmental conditions encountered in pediatric dentistry patients, yet direct comparative data on their oral health profiles remain scarce. This study compared caregiver-reported oral health problems, home oral hygiene difficulties, and barriers to dental care access among individuals with ASD versus Down syndrome. **Methods**: This study was conducted between March and June 2025 in five specialized educational institutions and Non-Governmental Organizations (NGOs) in Oradea, Romania. A structured 15-item questionnaire was administered to caregivers of individuals with ASD (n = 55) or Down syndrome (n = 22). Data were analyzed using Fisher's exact test and the Mann-Whitney U test (with statistical significance set at $p < 0.05$). **Results**: Dentist-diagnosed dental problems were more prevalent in the ASD group (90.90% *vs.* 68.18%, $p = 0.031$, Odds Ratio (OR) = 4.67, 95% Confidence Interval (CI) 1.29–16.87), as were tooth/jaw pain (72.72% *vs.* 40.90%, $p = 0.010$, OR = 3.85), parafunctional oral habits (72.72% *vs.* 45.45%, $p = 0.034$, OR = 3.20), and sensitivity to oral touching/cleaning (63.64% *vs.* 36.36%, $p = 0.042$, OR = 3.06). Cooperation difficulties during dental visits were more common in the ASD group (70.91% *vs.* 36.36%, $p = 0.005$, OR = 4.08), and most ASD caregivers reported visiting the dentist only when a problem arose (65.45% *vs.* 13.64%, $p < 0.001$). Difficulties ensuring correct toothbrushing were greater in the Down syndrome group (45.45% *vs.* 9.09%, $p = 0.001$, OR = 7.71). **Conclusions**: These findings suggest that ASD and Down syndrome are associated with differing oral health profiles. Given the largely unadjusted nature of the comparisons and the small sample size, the results should be regarded as hypothesis-generating, pending confirmation in larger, multivariable-adjusted studies.

Keywords

Autism spectrum disorder; Down syndrome; Oral health; Pediatric dentistry; Caregiver-reported; Neurodevelopmental disorders; Special healthcare needs; Dental care access

1. Introduction

Individuals with neurodevelopmental disabilities represent a vulnerable population, with an increased risk of oral health problems and multiple barriers to accessing dental care [1]. Cognitive and motor limitations, communication difficulties, sensory hypersensitivities, and a high level of dependence on caregivers may affect both the ability to perform daily oral hygiene effectively and the use of preventive and therapeutic dental services [1, 2]. Therefore, these individuals require adapted preventive strategies and individualized clinical approaches tailored to their functional and behavioral needs [3].

Among neurodevelopmental disorders, ASD is one of the most common conditions, with an increasing global prevalence [4]. ASD is characterized by deficits in communication and social interaction, repetitive behaviors, and sensory processing differences [5, 6]. In the dental setting, these features may be associated with increased anxiety, hypersensitivity to auditory, visual, or tactile stimuli, and reduced tolerance of clinical procedures [7]. Children and young people with ASD frequently experience difficulties cooperating during dental visits, which may limit access to treatment and complicate clinical management [8].

Down syndrome is the most common chromosomal condition associated with intellectual disability, with an estimated prevalence of approximately 1 per 700–1000 live births worldwide [9]. In contrast to ASD, this condition is primarily characterized by cognitive and motor limitations that may affect self-care abilities [9]. Muscle hypotonia, delayed motor development, and reduced manual dexterity can impair effective

oral hygiene practices, increasing dependence on caregivers for maintaining oral health [10]. Maintaining adequate oral hygiene at home and ensuring the effective implementation of preventive measures represent major challenges for children and young people with Down syndrome and their caregivers in terms of oral health [10, 11].

Although the oral health status and management characteristics of individuals with ASD and Down syndrome have been widely investigated in separate studies [8, 10], direct comparative data between these two groups remain limited. Both conditions are among the most common neurodevelopmental disorders encountered in pediatric dental practice and are associated with increased care needs and substantial caregiver dependence [12, 13]. However, the clinical profiles of these patients differ: ASD is predominantly characterized by behavioral and sensory challenges, whereas Down syndrome is mainly associated with functional limitations and difficulties with self-care [6, 9]. In this context, barriers related to oral hygiene, prevention, and access to dental care may differ between these groups. Identifying these differences is essential for developing tailored preventive strategies, improving caregiver education, and optimizing the clinical management of these patients.

Thus, the present study aimed to compare caregiver-reported oral health problems, difficulties related to home oral hygiene, and barriers to accessing dental care in children and young people with ASD and Down syndrome.

2. Materials and methods

2.1 Study design and setting

An observational cross-sectional study was conducted using a questionnaire administered to parents and caregivers of children and young people with neurodevelopmental disorders, specifically ASD and Down syndrome. The study was carried out between 01 March and 01 June 2025, in five educational institutions and non-governmental organizations located in Oradea, Bihor County, Romania, that provide educational and support services for individuals with ASD and/or Down syndrome. Some of these institutions also included young adults, allowing the inclusion of participants across a broader age range.

Data collection was performed during oral health education sessions for parents and caregivers, organized in collaboration with the participating institutions. The study was designed and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies.

2.2 Participants and eligibility criteria

The study population consisted of children and young people aged between 6 and 26 years diagnosed with ASD or Down syndrome.

Participants were eligible if they were enrolled in institutions dedicated to individuals with ASD and/or Down syndrome and had a parent or caregiver willing to complete the questionnaire. The diagnosis was considered based on the institutional records and the specific educational placement within specialized programs.

Exclusion criteria encompassed incomplete questionnaires, lack of written informed consent, and the reported presence of other major genetic or neurological conditions outside the study groups.

Participants were recruited using a convenience sampling approach, as the study targeted a specific population with neurodevelopmental disorders primarily accessible through specialized educational and support institutions. Given the relatively limited availability of eligible participants and the exploratory nature of the study, no formal a priori sample size calculation was performed. The final sample size was determined by the number of caregivers who agreed to participate during the data collection period. All parents and caregivers attending the educational sessions were invited to participate. A total of 77 completed questionnaires were included in the final analysis, comprising 55 participants with ASD and 22 participants in Down syndrome group.

2.3 Data collection instrument

Data were collected using a structured questionnaire developed by the authors based on relevant literature and previously used instruments addressing oral health problems and caregiving challenges in individuals with special healthcare needs. The questionnaire was designed to obtain essential information regarding caregiver-reported oral health problems, functional difficulties, and barriers related to home oral care and access to dental services.

The instrument was developed in Romanian and intentionally designed to be concise and easy to complete, considering the high caregiving burden experienced by parents and caregivers of individuals with neurodevelopmental disorders and to increase participation.

The questionnaire included a total of 15 items organized into four domains:

- Child demographic characteristics (age, sex, place of residence);
- Oral function and orofacial characteristics;
- Caregiver-reported oral health problems;
- Oral hygiene and access to dental care.

Most items had binary response options (yes/no), while several items included ordinal response categories. The full questionnaire, including all 15 items and their complete response options, is provided as **Supplementary material**.

Before implementation, the questionnaire was reviewed by the authors for clarity, clinical relevance, and ease of completion and was informally tested on a small number of parents/caregivers to assess comprehensibility and completion time. Given the exploratory and descriptive nature of the study, formal psychometric validation was not performed.

Questionnaires were completed on paper during the educational sessions. The data were subsequently entered manually into an electronic database (Microsoft Excel for Microsoft 365, Microsoft Corp., Redmond, WA, USA). Participation was voluntary and anonymous, and no financial or material incentives were provided.

2.4 Variables

Demographic variables included age, sex, and place of residence (urban/rural). Age was analyzed both as a continuous variable and as a categorical variable (<18 years and ≥18 years).

The main variables of interest included caregiver-reported oral health problems, difficulties related to performing oral hygiene at home, cooperation during dental visits, oral habits, functional limitations, and access to dental care.

Each questionnaire item was analyzed individually, and no composite scores were constructed.

2.5 Statistical analysis

Data analysis was performed using Microsoft Excel (Microsoft Corporation, 2018) and the open-source software R (version 4.3.1). Data were summarized using tables and figures; continuous variables with a normal distribution were presented as the mean ± standard deviation (SD), whereas variables without a normal distribution were expressed as median and interquartile range (M (IQR)). Comparison of unpaired categorical variables was performed using the Chi-square test and Fisher's exact test. The independent samples *t*-test and the Mann-Whitney U test were used for between-group comparisons of quantitative variables. A p-value < 0.05 was considered statistically significant. Given the exploratory nature of the study and the multiple between-group comparisons performed, p-values were not adjusted for multiplicity. Results are therefore reported as nominal/unadjusted findings and should be interpreted as hypothesis-generating rather than confirmatory. For key binary outcomes, effect sizes are additionally reported as crude (unadjusted) odds ratios (OR) with 95% confidence intervals (CI), calculated using the Wald method on the log-odds scale, with the Haldane-Anscombe correction (addition of 0.5 to each cell) applied where applicable. As a sensitivity analysis, multivariable logistic regression models adjusted for age (treated as a continuous standardized variable) and sex were fitted for the eight binary outcomes showing nominal between-group differences, in order to assess whether these associations persisted after accounting for the marked age and sex imbalance between groups. Adjusted odds ratios (aOR) with 95% Wald confidence intervals are reported alongside the corresponding crude estimates.

3. Results

A total of 77 caregivers completed the questionnaire and were included in the final analysis: 55 caregivers of participants with ASD group and 22 caregivers of participants with Down syndrome.

3.1 Demographic characteristics

The demographic characteristics of the two study groups are presented in Table 1. The ASD group was predominantly composed of participants younger than 18 years of age (69.09%, n = 38), while in the Down syndrome group those aged 18 years or older represented the majority (54.55%, n = 12); however, this between-group difference did not reach nominal significance (unadjusted $p = 0.053$). When analyzed as a continuous variable, participants in the ASD group had a median age of 10 years, compared with a mean of 16 years in the Down syndrome group (Mann-Whitney U test, nominal $p = 0.017$, unadjusted for multiplicity). A nominally significant difference in sex distribution was also observed (unadjusted $p = 0.020$), with males predominating in the ASD group (65.45%) and females predominating in the Down syndrome group (63.64%). Place of residence was similarly distributed in both groups, with approximately 82% of participants residing in urban areas ($p = 1.000$). Given the exploratory nature of these comparisons and the absence of correction for multiple testing, these demographic differences, together with the marked imbalance in age and sex distribution between groups, should be interpreted as descriptive rather than confirmatory findings and are addressed further as potential confounding factors in the Discussion.

3.2 Oral function and orofacial characteristics

The results related to oral function and orofacial characteristics are presented in Table 2. Regarding dietary habits, the majority of caregivers in both groups reported no difficulties with chewing or swallowing (70.91%, n = 39 in the ASD group; 63.64%, n = 14 in the Down syndrome group), with no nominally significant difference between groups ($p = 0.534$). Similarly, difficulties in mouth opening or closing were reported by a minority of caregivers in both groups (25.45%, n = 14 in the ASD group; 31.82%, n = 7 in the Down syndrome group), with no nominally significant difference ($p = 0.571$).

Parafunctional oral habits were more frequently reported in the ASD group (72.72%, n = 40) compared with the Down syndrome group (45.45%, n = 10) (nominal $p = 0.034$, unadjusted for multiplicity; OR = 3.20, 95% CI 1.14–8.94). Sensitivity to touching or cleaning the teeth or mouth was also more frequently reported in the ASD group (63.64%, n = 35) than in the Down syndrome group (36.36%, n = 8) (nominal $p = 0.042$, unadjusted for multiplicity; OR = 3.06, 95% CI 1.10–8.56).

3.3 Caregiver-reported oral health problems

The caregiver-reported oral health problems are presented in Table 3. A dental problem, including cavities, abnormal tooth positions, or dental erosion, was reported to have been diagnosed by a dentist in 90.90% (n = 50) of children in the ASD group, compared with 68.18% (n = 15) in the Down syndrome group (nominal $p = 0.031$, unadjusted for multiplicity; OR = 4.67, 95% CI 1.29–16.87).

Tooth or jaw pain was reported by 72.72% (n = 40) of caregivers in the ASD group, compared with 40.90% (n = 9) in the Down syndrome group (nominal $p = 0.010$, unadjusted for multiplicity; OR = 3.85, 95% CI 1.37–10.87). Gingival bleeding or signs of gum inflammation were more frequently reported in the Down syndrome group (59.09%, n = 13) than in the ASD group (32.73%, n = 18) (nominal $p = 0.041$, unadjusted for multiplicity; OR = 0.34, 95% CI 0.12–0.93).

The use of dental appliances was rare in both groups, with only one participant in the ASD group (1.82%) reporting pre-

TABLE 1. Distribution of participants by age group, gender, and place of residence according to study group.

Variable	ASD	Down	*p**
Age Group			
<18 yr	38 (69.09%)	10 (45.45%)	0.053
≥18 yr	17 (30.91%)	12 (54.55%)	
Gender			
Female	19 (34.55%)	14 (63.64%)	0.020
Male	36 (65.45%)	8 (36.36%)	
Place of Residence			
Rural	10 (18.18%)	4 (18.18%)	1.000
Urban	45 (81.82%)	18 (81.82%)	

**Fisher's Exact Test. ASD: autism spectrum disorder.*

TABLE 2. Oral function and orofacial characteristics by study group.

Answer/Study Group	ASD		Down		*p**	OR (95% CI)
	No.	%	No.	%		
How would you describe your child's dietary habits?						
Normal	39	70.91%	14	63.64%	0.534	0.71 (0.26–1.98)
Difficulties with chewing or swallowing	16	29.09%	8	36.36%		
Does your child experience difficulties in opening or closing their mouth?						
No	41	74.55%	15	68.18%	0.571	0.72 (0.25–2.08)
Yes	14	25.45%	7	31.82%		
Does your child exhibit oral habits such as thumb sucking, mouth breathing, or teeth grinding?						
No	15	27.27%	12	54.55%	0.034	3.20 (1.14–8.94)
Yes	40	72.72%	10	45.45%		
Does your child show sensitivity to touching or cleaning their teeth or mouth?						
No	20	36.36%	14	63.64%	0.042	3.06 (1.10–8.56)
Yes	35	63.64%	8	36.36%		

**Fisher's Exact Test; OR: Odds ratio; CI: Confidence interval (ASD vs. Down syndrome); ASD: autism spectrum disorder.*

TABLE 3. Caregiver-reported oral health problems by study group.

Answer/Study Group	ASD		Down		*p**	OR (95% CI)
	No.	%	No.	%		
Has a dentist ever diagnosed your child with a dental problem (*e.g.*, cavities, abnormal tooth positions, dental erosion)?						
No	5	9.09%	7	31.82%	0.031	4.67 (1.29–16.87)
Yes	50	90.90%	15	68.18%		
Has your child experienced tooth or jaw pain recently?						
No	15	27.27%	13	59.09%	0.010	3.85 (1.37–10.87)
Yes	40	72.72%	9	40.90%		
Have you noticed gingival bleeding or signs of gum inflammation in your child?						
No	37	67.27%	9	40.91%	0.041	0.34 (0.12–0.93)
Yes	18	32.73%	13	59.09%		
Has your child ever used a dental appliance (orthodontic braces, occlusal splint, *etc.*)?						
No	54	98.18%	22	100.00%	1.000	1.24 (0.05–31.57)
Yes	1	1.82%	0	0.00%		

**Fisher's exact Test; OR: Odds ratio; CI: Confidence interval (ASD vs. Down syndrome); ASD: autism spectrum disorder.*

vious use, and no participant in the Down syndrome group reporting any use. There was no nominally significant difference between groups ($p = 1.000$).

3.4 Oral hygiene and access to dental care

The results related to oral hygiene practices and dental care access are presented in Table 4. Caregivers who reported being able to ensure correct toothbrushing accounted for 90.90% (n = 50) in the ASD group, compared with 54.55% (n = 12) in the Down syndrome group (nominal $p = 0.001$, unadjusted for multiplicity; OR = 7.71, 95% CI 2.32–25.69).

Difficulties with cooperation during dental visits were reported by 70.91% (n = 39) of caregivers in the ASD group, compared with 36.36% (n = 8) in the Down syndrome group (nominal $p = 0.005$, unadjusted for multiplicity; OR = 4.08, 95% CI 1.47–11.36).

Regarding the frequency of routine dental check-ups, the majority of caregivers in the ASD group reported visiting the dentist only when a problem arises (65.45%, n = 36), while in the Down syndrome group the majority attended every six months (40.91%, n = 9) or once a year (45.45%, n = 10). This difference was nominally significant (unadjusted $p < 0.001$; for the dichotomized comparison of "only when a problem arises" versus routine check-ups, OR = 10.43, 95% CI 2.95–36.90).

Sensitivity to toothpaste or oral care products was reported by 20.00% (n = 11) of caregivers in the ASD group and 13.64% (n = 3) in the Down syndrome group, with no nominally significant difference between groups ($p = 0.745$).

3.5 Sensitivity analysis (age- and sex-adjusted)

To assess the influence of the observed age and sex imbalance between groups, multivariable logistic regression models adjusted for age and sex were fitted for the eight binary outcomes that showed nominal between-group differences in the unadjusted analysis. The results are presented in Table 5. Seven of the eight associations remained nominally significant after adjustment, with several demonstrating larger effect estimates compared with the crude analysis, suggesting that the observed ASD-Down syndrome differences in these outcomes were not primarily explained by the age and sex composition of the groups. In contrast, the association between study group and gingival bleeding did not remain nominally significant after adjustment (adjusted $p = 0.207$, compared with unadjusted $p = 0.041$), and the model suggested a possible contribution of sex to this association (aOR for male sex = 0.39, 95% CI 0.14–1.09, $p = 0.073$). This finding indicates that the higher prevalence of gingival bleeding observed in the Down syndrome group in the unadjusted analysis may be partly attributable to the higher proportion of female participants in this group rather than to the condition itself, underscoring the importance of considering age and sex as potential confounders when interpreting these caregiver-reported associations.

4. Discussion

This study compared caregiver-reported oral health problems, difficulties related to home oral hygiene, and barriers to accessing dental care in children and young people with ASD and Down syndrome. The findings revealed distinct caregiver-reported behavioral and oral health profiles between the two groups. According to caregiver reports, participants with ASD showed higher rates of diagnosed dental problems, tooth or jaw pain, parafunctional oral habits, and sensory sensitivity, as well as greater difficulties with cooperation during dental visits and a more reactive pattern of dental care utilization. In contrast, caregivers of individuals with Down syndrome reported greater difficulties in ensuring correct toothbrushing

TABLE 4. Oral hygiene practices and dental care access by study group.

Answer/Study Group	ASD		Down		*p**	OR (95% CI)
	No.	%	No.	%		
Are you able to ensure that your child's toothbrushing is performed correctly (with supervision or assistance when needed)?						
No	5	9.09%	10	45.45%	0.001	7.71 (2.32–25.69)
Yes	50	90.90%	12	54.55%		
Does your child experience difficulties cooperating during dental visits?						
No	16	29.09%	14	63.64%	0.005	4.08 (1.47–11.36)
Yes	39	70.91%	8	36.36%		
How often do you visit the dentist for routine check-ups?						
Every 6 months	12	21.82%	9	40.91%		
Once a year	7	12.73%	10	45.45%	<0.001	- †
Only when a problem arises	36	65.45%	3	13.64%		
Is your child sensitive to certain types of toothpaste or oral care products?						
No	44	80.00%	19	86.36%	0.745	1.44 (0.39–5.33)
Yes	11	20.00%	3	13.64%		

**Fisher's exact Test; - †: Not a 2 × 2 comparison. OR: Odds ratio; CI: Confidence interval (ASD vs. Down syndrome); ASD: autism spectrum disorder.*

TABLE 5. Age- and sex-adjusted sensitivity analysis for key binary outcomes.

Outcome	Crude OR (95% CI)	Adjusted OR (95% CI)†	Adjusted *p*
Dentist-diagnosed dental problem	4.67 (1.29–16.87)	5.56 (1.33–23.23)	0.019
Tooth or jaw pain	3.85 (1.37–10.87)	4.12 (1.33–12.81)	0.014
Parafunctional oral habits	3.20 (1.14–8.94)	4.27 (1.34–13.57)	0.014
Sensitivity to touching/cleaning	3.06 (1.10–8.56)	3.68 (1.20–11.27)	0.023
Cooperation difficulties	4.08 (1.47–11.36)	3.61 (1.22–10.74)	0.021
Gingival bleeding	0.34 (0.12–0.93)	0.49 (0.17–1.48)	0.207
Correct toothbrushing ensured (unable *vs.* able)‡	0.13 (0.04–0.43)	0.12 (0.03–0.46)	0.002
Routine check-up only when problem arises (*vs.* routine)‡	10.43 (2.95–36.90)	14.69 (3.29–65.68)	0.0004

†*Adjusted for age (continuous, standardized) and sex; Wald 95% confidence intervals.* ‡*Dichotomized comparison, as defined in Section 3.4. OR: Odds ratio; CI: Confidence interval.*

and higher rates of gingival bleeding, alongside more regular attendance for routine dental check-ups. These differences suggest that, although both conditions are associated with significant oral health needs, the underlying challenges may differ in nature, being predominantly behavioral and sensory in ASD, and more functional and hygiene-related in Down syndrome.

The comparative analysis of these two conditions was motivated by both clinical and scientific considerations. From a clinical perspective, ASD and Down syndrome are among the most frequently encountered neurodevelopmental disorders in pediatric dental practice, and both are associated with increased oral health needs and a high degree of dependence on caregiver support [14]. Despite this, the two conditions present distinct clinical challenges: ASD is predominantly characterized by behavioral and sensory difficulties that affect cooperation and tolerance to dental procedures, whereas Down syndrome is primarily associated with functional limitations that impact self-care abilities and oral hygiene performance [15, 16]. From a scientific perspective, although the oral health status of individuals with ASD and Down syndrome has been investigated in numerous separate studies, direct comparative data between these two groups remain scarce [14].

For this study, a questionnaire comprising only 15 items was developed, with response options kept as simple as possible. This approach was chosen because parents and caregivers of children with neurodevelopmental disorders face a substantial daily caregiving burden, which limits the time available for completing research instruments [17, 18]. A concise questionnaire was therefore considered more appropriate than a lengthy or psychometrically complex one, with the primary aim of maximizing participation and minimizing respondent fatigue. The relatively small sample size and the unequal distribution between the two groups reflect the real-world constraints of recruiting within specialized educational institutions serving populations with a relatively low prevalence of these conditions, and are consistent with recruitment and sample-size constraints reported in other studies involving populations with special healthcare needs recruited through specialized institutions [19, 20].

Despite the relatively small sample size, the study yielded several nominally significant, unadjusted differences between the two groups, including differences in age distribution, sex distribution, and several clinically relevant oral health variables. However, given the exploratory design and the absence of correction for multiple comparisons, these findings cannot be interpreted as evidence of definitive population-level distinctions and should instead be regarded as preliminary, hypothesis-generating observations. Given the small and unequal group sizes, the exploratory design, and the multiple comparisons performed without correction, these nominally significant findings should be interpreted with caution. The reported *p*-values were not adjusted for multiple testing, which increases the risk of type I error, and the differences in age and sex distribution between the groups may have contributed to some of the observed associations. The results should therefore be regarded as hypothesis-generating rather than confirmatory. The two groups differed markedly in terms of age distribution, with participants in the ASD group being younger than those in the Down syndrome group. This difference likely reflects the epidemiological characteristics of the two conditions: ASD is predominantly diagnosed in childhood, and specialized educational programs tend to serve younger age groups, whereas individuals with Down syndrome are more frequently integrated into long-term support services that extend into adulthood [6, 21]. The predominance of males in the ASD group (65.45%) is consistent with well-established epidemiological data showing a significantly higher prevalence of ASD in males than in females, with reported male-to-female ratios of approximately 3:1 to 4:1 in the general population [6]. This pattern was similarly observed in studies examining oral health in children with ASD, where male participants consistently represented the majority of the study samples [22, 23]. The higher proportion of females in the Down syndrome group is less straightforward to interpret and may reflect the characteristics of the specific institutions included in the study rather than a true population-level difference, given that epidemiological data indicate a slight male predominance or an approximately equal sex distribution in Down syndrome at the population level [9]. Importantly, because the groups differed in both age and sex, these factors may have confounded some of the between-group comparisons, and the corresponding findings should be interpreted in light of this limitation.

The observed higher prevalence of parafunctional oral habits

in the ASD group is consistent with findings reported in the literature. Similarly, Al-Sehaibany found that oral habits, including bruxism, object biting, and mouth breathing, were significantly more prevalent in children with ASD compared to healthy controls [24]. These habits are considered closely related to the sensory processing difficulties and repetitive behavioral patterns characteristic of ASD, and have been associated with an increased risk of malocclusion and other dental complications [25]. The higher prevalence of sensitivity to touching or cleaning the teeth in the ASD group is consistent with the well-documented role of sensory processing differences in this population. Similarly, Khrautieo *et al*. [26] found that oral sensitivity was significantly associated with reduced toothbrushing cooperation both at home and in the dental office in children with ASD. These findings are further supported by a scoping review reporting that oral sensory-related issues were unanimously identified as a significant factor influencing toothbrushing at home in children with ASD, as reported by caregivers [27]. From a clinical perspective, such sensitivities have direct implications for both home oral hygiene and the management of individuals with ASD in the dental setting.

These behavioral and sensory characteristics may have contributed to the higher burden of caregiver-reported dentist-diagnosed dental problems observed in the ASD group. Indeed, 90.90% of caregivers in the ASD group reported a dentist-diagnosed dental problem, a figure considerably higher than that recorded in the Down syndrome group. This finding is consistent with the literature, which consistently documents a high prevalence of dental problems in children with ASD. Similarly, Nagda *et al*. [28] reported that 63.3% of parents of children with ASD noted a cavity diagnosed during a dental visit, compared to 36.7% among typically developing peers, although this difference did not reach statistical significance. However, gingival bleeding and signs of gingival inflammation were nominally more frequently reported in the Down syndrome group in the unadjusted analysis; this association did not remain significant after adjustment for age and sex (Section 3.5) and appeared to be partly attributable to the higher proportion of female participants in the Down syndrome group rather than to the condition itself, so it should be interpreted with particular caution. Nevertheless, this observation is directionally consistent with the well-documented susceptibility of individuals with this condition to periodontal disease. Similarly, Amaral Loureiro *et al*. [29] found a prevalence of gingivitis of 91% among children and adolescents with Down syndrome, attributing this to a combination of impaired immune response, difficulties in maintaining oral hygiene, and anatomical oral characteristics specific to this population. This increased susceptibility to gingival inflammation in Down syndrome is further supported by a recent systematic review confirming a higher prevalence of gingivitis in children with Down syndrome compared to healthy peers, linked to elevated plaque scores and systemic immunological factors [30]. Given that the present finding did not survive adjustment for age and sex, it should be regarded as a preliminary observation warranting confirmation in future adjusted studies rather than as independent corroboration of this literature. The rare use of dental appliances in both groups likely reflects a combination of factors, including difficulties in cooperation during dental visits, the complexity of managing orthodontic treatment in patients with neurodevelopmental disorders, limited referrals to orthodontic services, and the prioritization of basic dental needs over specialized interventions. These barriers to orthodontic care in patients with neurodevelopmental disabilities have been previously described in the literature, with cooperation difficulties, previous negative dental experiences, and limited access to trained specialists identified as the main obstacles [31].

Difficulties with cooperation during dental visits were nominally more frequently reported in the ASD group, a finding consistent with the extensive literature documenting behavioral and sensory barriers to dental care in this population [32]. Of particular clinical relevance is the markedly different pattern of dental care utilization between the two groups: the majority of caregivers in the ASD group reported visiting the dentist only when a problem arose, whereas those in the Down syndrome group attended more regularly. This reactive approach to dental care in the ASD group has been previously described in the literature, with studies reporting low rates of preventive dental visits and a high frequency of emergency-based interventions in this population [33]. These findings collectively underscore the need for proactive and individualized preventive strategies for children with ASD in pediatric dental settings.

The present study has several strengths. First, it provides a direct comparison between two of the most frequently encountered neurodevelopmental conditions in pediatric dental practice, addressing a gap in the existing literature. Second, data were collected in a real-world context, during oral health education sessions organized within specialized institutions, which facilitated access to a population that is typically difficult to recruit. Third, the questionnaire was intentionally designed to be brief and easy to complete, to maximize participation among caregivers experiencing a high caregiving burden.

Several limitations should also be acknowledged. Most importantly, the two groups differed markedly in age and sex distribution, with the ASD group being younger and predominantly male, whereas the Down syndrome group was older and had a higher proportion of females. These imbalances represent a major limitation, as age and sex may independently influence oral health status, oral hygiene practices, and patterns of dental care utilization. Consequently, the observed between-group differences cannot be attributed solely to the underlying condition, and the possibility of confounding by age and sex cannot be excluded. To address this concern, a sensitivity analysis using logistic regression models adjusted for age and sex was performed for the key binary outcomes (Section 3.5); most associations persisted after adjustment, whereas the association with gingival bleeding did not, suggesting that some observed differences may be relatively robust to adjustment, while others, such as gingival bleeding, should be interpreted with particular caution. Given the small and unequal group sizes, however, the adjusted models yielded wide confidence intervals, and residual confounding or model overfitting cannot be entirely excluded; the comparative findings should therefore still be interpreted cautiously. The relatively small sample size and the unequal distribution between the

two groups may limit the statistical power and generalizability of the findings. The use of convenience sampling within a limited geographic area restricts the representativeness of the results. Data were based exclusively on caregiver reports, without objective clinical examination, which may introduce reporting bias. The cross-sectional design does not allow causal inferences to be drawn. The questionnaire was not formally psychometrically validated. Finally, the study was conducted in a single county in Romania, which limits the applicability of the findings to other cultural and healthcare contexts.

5. Conclusions

This study identified differing caregiver-reported oral health patterns in children and young people with ASD and Down syndrome, based on unadjusted, exploratory comparisons. As an exploratory study based exclusively on caregiver reports rather than direct clinical examination, the findings should be interpreted as describing caregiver-perceived oral health profiles rather than clinically measured outcomes. Given the small and unequal group sizes, the multiple unadjusted comparisons performed, and the marked imbalance in age and sex between groups, these findings should be regarded as hypothesis-generating rather than as evidence of robust, condition-specific clinical profiles. Caregivers of participants with ASD reported a higher burden of diagnosed dental problems, greater prevalence of parafunctional habits and sensory sensitivity, more frequent difficulties cooperating during dental visits, and a predominantly reactive pattern of dental care utilization. In contrast, caregivers of individuals with Down syndrome reported greater difficulties in ensuring correct toothbrushing and more regular attendance for routine dental check-ups. A higher prevalence of gingival bleeding was also observed in this group in the unadjusted analysis, although this specific association did not persist after adjustment for age and sex and should be interpreted with particular caution. These preliminary, caregiver-reported findings suggest that condition-specific preventive strategies and individualized clinical management may be warranted in pediatric dental practice, with particular emphasis on early preventive intervention and caregiver education in both populations. Confirmation in larger, adjusted studies is needed before these observations can inform definitive clinical recommendations.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of this study are available from the corresponding author upon reasonable request. The dataset is not publicly available due to privacy considerations related to the participation of individuals with neurodevelopmental disorders and their caregivers.

AUTHOR CONTRIBUTIONS

PO and AEM—conceived and designed the research study; analyzed the data; wrote the manuscript. PO, RH, MP and BIT—performed data collection. AEM and MJ—provided supervision and methodological guidance. RH, MP, BIT and MJ—critically reviewed and revised the manuscript. All authors contributed to the editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the Research Ethics Subcommittee of the University of Oradea (Approval No. 3/27.02.2025). All participants or their legal representative received information regarding the purpose of the study and provided written informed consent prior to participation. Participation was voluntary and anonymous.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at https://oss.jocpd.com/files/article/2095407733664563200/attachment/Supplementary%20material.docx.

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