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Assessment of sensory challenges encountered during oral health care practices in children with autism spectrum disorder: A questionnaire-based study

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Abstract
Background: Children with autism spectrum disorder (ASD) may experience sensory differences involving touch, taste, smell, sound and light, which can hinder the routine oral hygiene and dental care. The present study assessed sensory challenges encountered during oral health care practices in children with ASD using a caregiver-based questionnaire.
Aim: To assess sensory challenges encountered during oral health care practices in children with ASD and to identify the most common sensory modalities interfering with routine oral health care.
Materials and Methods: A cross-sectional questionnaire-based study was conducted among caregivers of children diagnosed with ASD. A 38-item electronic questionnaire was used. Of 283 submitted responses, 95 sufficiently complete responses were included in the analysis. A 12-item Sensory Reactivity Score (0–12) was calculated from tactile, gustatory/olfactory, auditory and visual challenge items. Mann–Whitney U, Kruskal–Wallis H and Pearson's chi-square tests were used as appropriate, with $p<0.05$ considered statistically significant.
Results: The children had a mean age of 8.1±3.5 years and the mean age at ASD diagnosis was 4.4±3.4 years. Visual and tactile challenges were most prominent, with mean endorsement of 62.6% and 61.1%, respectively, followed by auditory (54.2%) and gustatory/olfactory (47.6%) challenges. Chewing toothbrush bristles instead of brushing was reported in 71.6% of children, while 46.2% could not have all areas of the mouth brushed. The mean Sensory Reactivity Score was 6.5±2.9. No significant association was observed between the score and previous dental visit, gender, toothbrush acceptance, full-mouth brushing compliance or ASD severity ($p>0.05$).
Conclusion: Sensory challenges are common during home oral hygiene, particularly in the visual and tactile domains. The absence of statistically significant associations with the tested clinical and demographic variables should be interpreted cautiously because of the limited achieved sample and small severe-ASD subgroup. Sensory-adapted oral-care strategies may help improve comfort and cooperation.

Keywords: Autism spectrum disorder, sensory processing, oral hygiene, toothbrushing, pediatric dentistry, sensory challenges, caregivers

Introduction
Autism spectrum disorder (ASD) is a neurodevelopmental condition associated with differences in social communication and restricted or repetitive patterns of behaviour. Sensory processing differences are also commonly described in children with ASD and may involve responses to touch, sound, taste, smell, oral stimulation and visual stimuli [1].

Routine oral hygiene can therefore be challenging for children with ASD. The sensation of toothbrush bristles, intraoral touch, toothpaste taste or texture, unfamiliar smells, bright lights and dental equipment sounds may provoke discomfort or resistance and may make toothbrushing and dental treatment more difficult [2, 3].

Previous studies have reported increased caregiver involvement and difficulties with toothbrushing among children with ASD, while sensory-adapted approaches and structured behavioural or visual strategies have been investigated to improve cooperation and oral-care skills [4, 5, 6].

Recent evidence also supports the relevance of sensory adaptation in dental settings. Sensory-adapted dental environments have been associated with improved cooperation or reduced distress in some studies, although the magnitude and consistency of benefit vary across interventions and outcomes [7, 8].

Despite increasing interest in oral health among children with ASD, there remains a need to describe the specific sensory challenges encountered during everyday oral hygiene and to examine whether overall sensory reactivity is related to oral-care difficulties. Therefore, the present study was undertaken to assess sensory challenges during routine oral health care practices in children with ASD, identify the sensory modalities most commonly involved, and explore their association with selected oral-care and demographic variables.

Materials and Methods
Study design and setting: This was a cross-sectional, questionnaire-based study conducted using caregiver-reported information from children diagnosed with ASD. The study protocol specified recruitment through special schools, autism centres and pediatric dental clinics, with convenience sampling.

Study population: Parents or primary caregivers of children diagnosed with ASD were eligible to participate.

Children with ASD were included when the caregiver was willing to participate and provide informed consent. Incomplete questionnaires were excluded from the analytic dataset.

Questionnaire: A 38-item electronic questionnaire was used to collect demographic information, behavioural characteristics and sensory responses encountered during toothbrushing and oral hygiene. Items covered tactile, gustatory/olfactory, auditory and visual domains, as well as toothbrush acceptance and ability to brush all areas of the mouth. The source synopsis described the instrument as structured and validated; however, no accompanying reliability or validation data were available in the analysed results file.

Sample and data cleaning: A total of 283 responses were submitted. Because the questionnaire was unbranched and most incomplete responses ended after only a few items, the prespecified completeness criterion was applied. Ninety-five responses with 34–38 answered items were retained for analysis. Numeric age values were available for 92 children and age at ASD diagnosis for 67 children; non-numeric entries were treated as missing.

Sensory Reactivity Score: A composite 12-item Sensory Reactivity Score, ranging from 0 to 12, was constructed from core tactile, gustatory/olfactory, auditory and visual challenge items. Each challenge response was scored as 1 and other responses as 0. Toothbrush acceptance and full-mouth brushing compliance were kept separate as outcome variables to avoid circularity. The score was categorised using Bloom's cut-offs as low (<60%), moderate (60–80%) and high (>80%).

Statistical analysis: Descriptive statistics were used to summarise demographic, behavioural and sensory responses. Mann–Whitney U tests compared Sensory Reactivity Scores between two-level independent groups (previous dental visit, gender, toothbrush acceptance and full-mouth brushing compliance). The Kruskal–Wallis H test compared scores across mild, moderate and severe ASD groups. Pearson's chi-square test assessed associations between previous dental visit and ASD severity and between previous dental visit and gender. Analyses were performed using Python with SciPy 1.x and statsmodels 0.14. A two-sided $p<0.05$ was considered statistically significant.

Ethical considerations: The study synopsis specified informed consent from participating parents/caregivers. Details of institutional ethics committee approval were not present in the supplied study documents and should be added to the manuscript before journal submission, if applicable.

Results

Sample Characteristics

Ninety-five caregiver responses were analysed. Children's mean age was 8.1 ± 3.5 years (range 2–22; n = 92 with a valid numeric age), and the mean age at ASD diagnosis was 4.4 ± 3.4 years (n = 67). Gender was almost evenly split (male 48, 50.5%; female 47, 49.5%). ASD severity was predominantly mild (Mild 61, 64.2%; Moderate 30, 31.6%; Severe 4, 4.2%). Just under half of children (45, 47.4%) had never previously visited a dentist.

Table 1: Behavioural profile of the sample, as reported by caregivers (N = 95)

Behavioural item	Response, n (%)
Engages in stimming/handflapping/other repetitive behaviour	Stimming 37 (38.9) / Handflapping 30 (31.6) / Other 21 (22.1) / None 7 (7.4)
Difficulty maintaining eye contact	Yes 69 (73.4) / No 25 (26.6)
Becomes upset when repetitive activity interrupted	Yes 66 (69.5) / No 29 (30.5)
Strong attachment to particular toys/objects	Yes 67 (71.3) / No 27 (28.7)
Plays along with / isolates from other children	Yes 47 (49.5) / Maybe 31 (32.6) / No 16 (16.8)

Sensory Challenges by Modality

Table 2: Frequency and percentage of sensory-related challenges reported during oral hygiene at home (N = 95)

Item	Response, n (%)
Allows use of a normal toothbrush	Yes 81 (85.3) / No 14 (14.7)
Allows brushing of all areas of the mouth	Yes 49 (53.8) / No 42 (46.2)
Sensitive to intraoral stimulants (brush/finger)	Yes 48 (50.5) / No 46 (48.4)
Chews brush/bristles instead of brushing	Yes 68 (71.6) / No 26 (27.4)
Likes the texture of toothpaste	Yes 68 (71.6) / No 27 (28.4)
Likes the taste of toothpaste	Yes 52 (54.7) / No 42 (44.2)
Spits out toothpaste immediately because of taste	Yes 55 (57.9) / No 37 (38.9)
Avoids/resists brushing because of toothpaste smell	Yes 57 (60.0) / No 36 (37.9)
Uncomfortable with electric toothbrush sound	Yes 57 (60.0) / No 34 (35.8)
Requires TV/devices off during brushing	Yes 51 (53.7) / No 42 (44.2)
Uncomfortable with tap-water sound while brushing	Yes 49 (51.6) / No 45 (47.4)
Uncomfortable with rinsing/gargling sound	Yes 49 (51.6) / No 44 (46.3)
Sensitive/uncomfortable due to light while brushing	Yes 57 (60.0) / No 37 (38.9)
Covers/closes eyes because of brightness	Yes 62 (65.3) / No 33 (34.7)

Denominators vary slightly (91–95) owing to a small number of item-level non-responses even within the 95 complete questionnaires; percentages are of valid responses for that item.

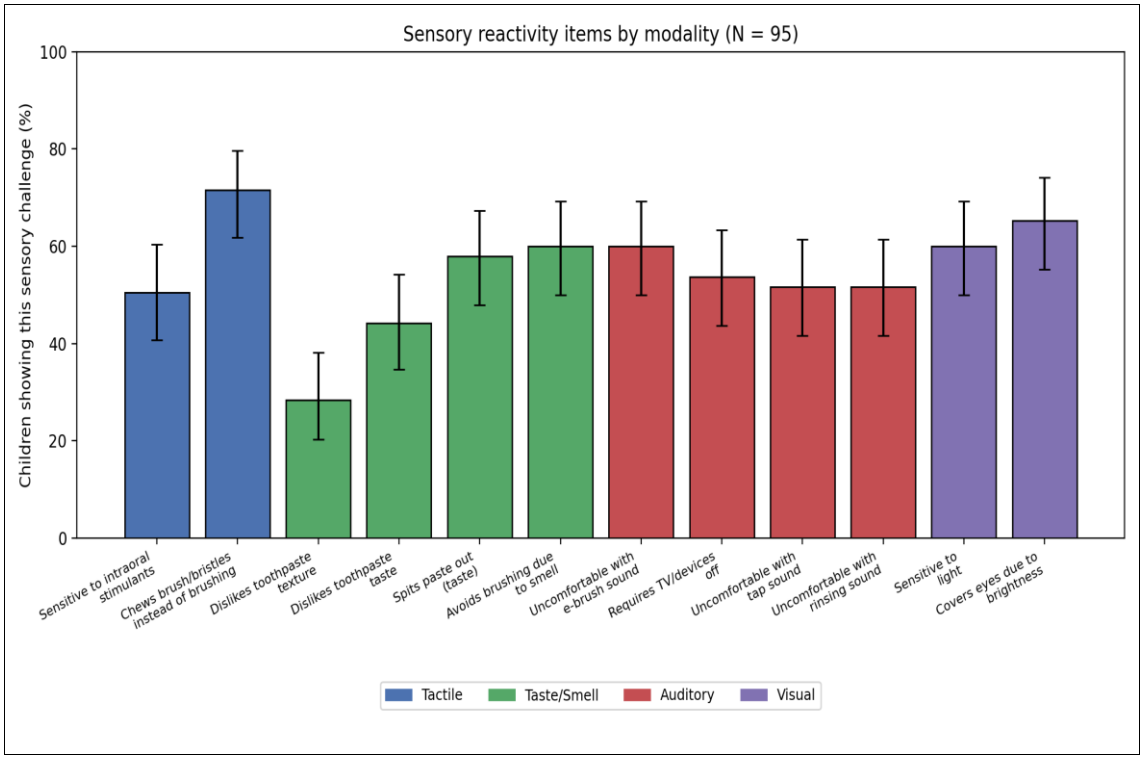


Fig 1: Percentage of children showing each sensory challenge, colour-coded by sensory modality, with 95% Wilson CI error bars (N = 95).

Averaging endorsement across items within each modality, sensory challenges were most prominent in the visual (mean 62.6% of items endorsed) and tactile (61.1%) domains, followed by auditory (54.2%) and gustatory/olfactory (47.6%) domains, addressing the study's second objective on which sensory modalities most commonly interfere with oral care.

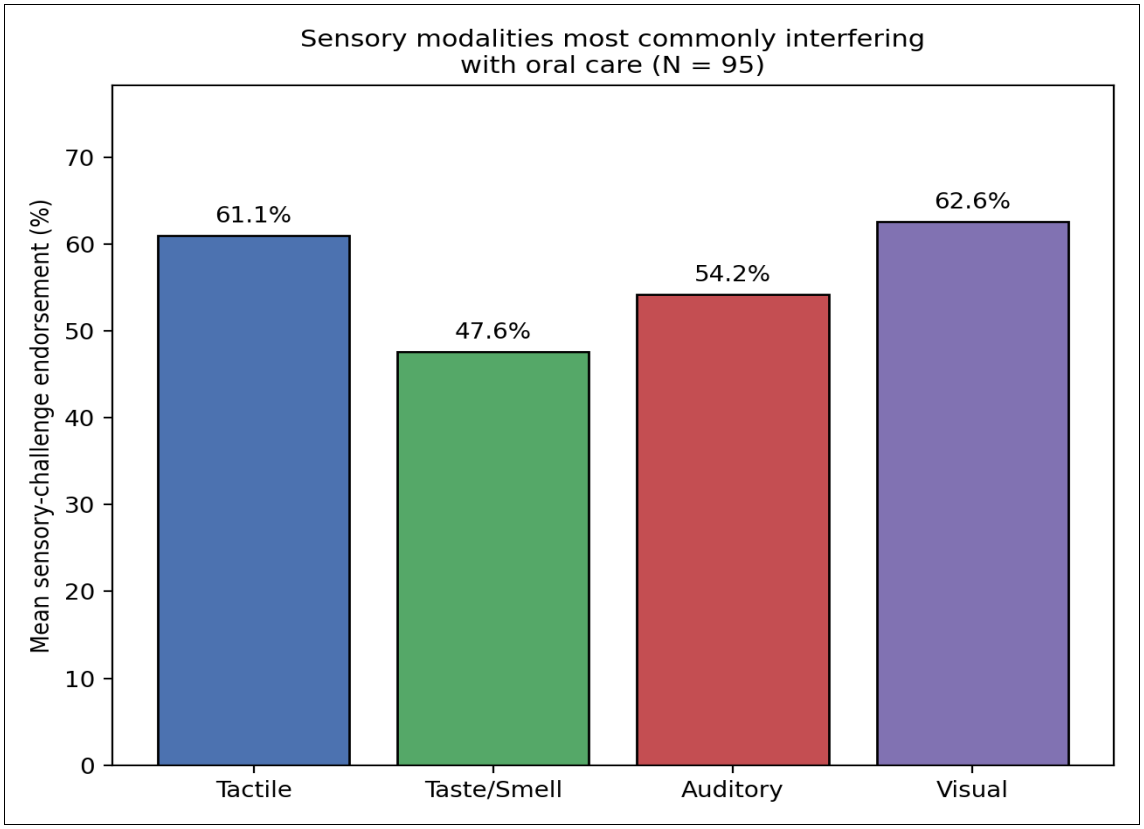


Fig 2: Mean sensory-challenge endorsement by modality — visual and tactile domains interfered most with oral care in this sample (N = 95).

Overall Sensory Reactivity

The composite Sensory Reactivity Score (0–12) had a mean of 6.5 ± 2.9 and a median of 7 (IQR 5–9). Using Bloom's cut-off, 57 children (60.0%) fell into the Low category, 26 (27.4%) Moderate, and 12 (12.6%) High

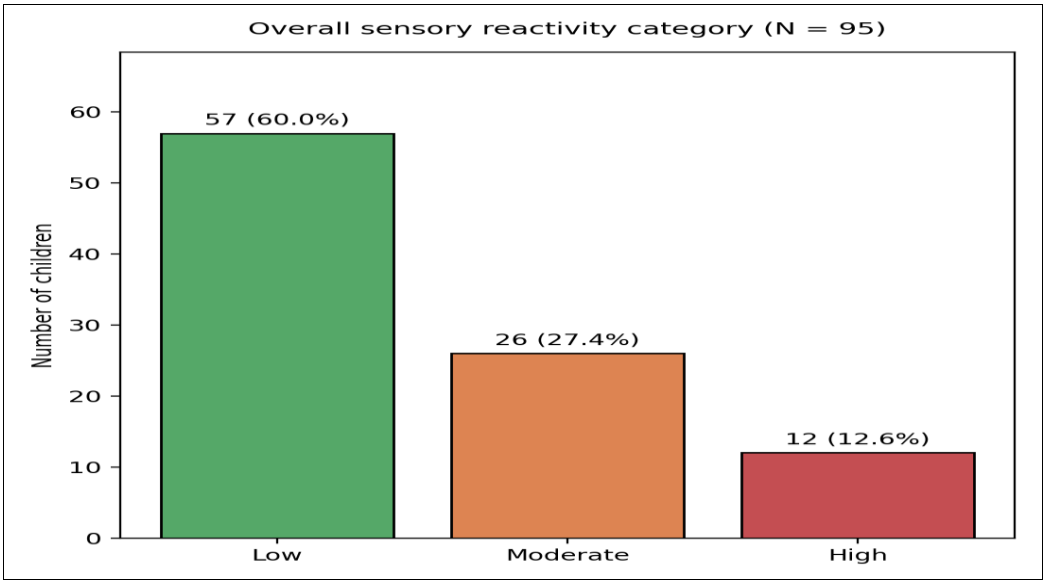


Fig 3: Distribution of children by overall Sensory Reactivity category (N = 95).

Association with Oral Hygiene and Dental-Care Outcomes

Table 3: Mann-Whitney U test comparing the Sensory Reactivity Score between groups (N = 95)

Comparison	n (group1 vs 2)	Median (1 vs 2)	U	p-value
Previous dental visit: Yes, vs No	49 vs 45	7 vs 7	1225.0	0.352
Gender: Male vs Female	48 vs 47	7 vs 7	1130.5	0.988
Allows normal toothbrush: Yes, vs No	81 vs 14	7 vs 7	546.0	0.828
Allows brushing all areas: Yes, vs No	49 vs 42	7 vs 7	1068.0	0.758

Medians were identical (7 vs 7) in every comparison; none of the four comparisons reached statistical significance (all p > 0.35).

Table 4: Kruskal-Wallis H test comparing the Sensory Reactivity Score across ASD severity groups (n = 95)

Severity group	n	Median score	Mean score	H (df=2), p
Mild	61	7.0	6.72	
Moderate	30	6.0	6.00	
Severe	4	7.5	8.00	H = 1.86, p = 0.395

The Severe group's small size (n = 4) limits the precision of its estimate; the overall test showed no significant difference in Sensory Reactivity Score across severity groups.

Table 5: Chi-square test of association between previous dental visit and ASD severity / gender (N = 95)

Association tested	χ^2	df	p-value
Previous dental visit × ASD severity	1.43	2	0.489
Previous dental visit × Gender	0.04	1	0.843

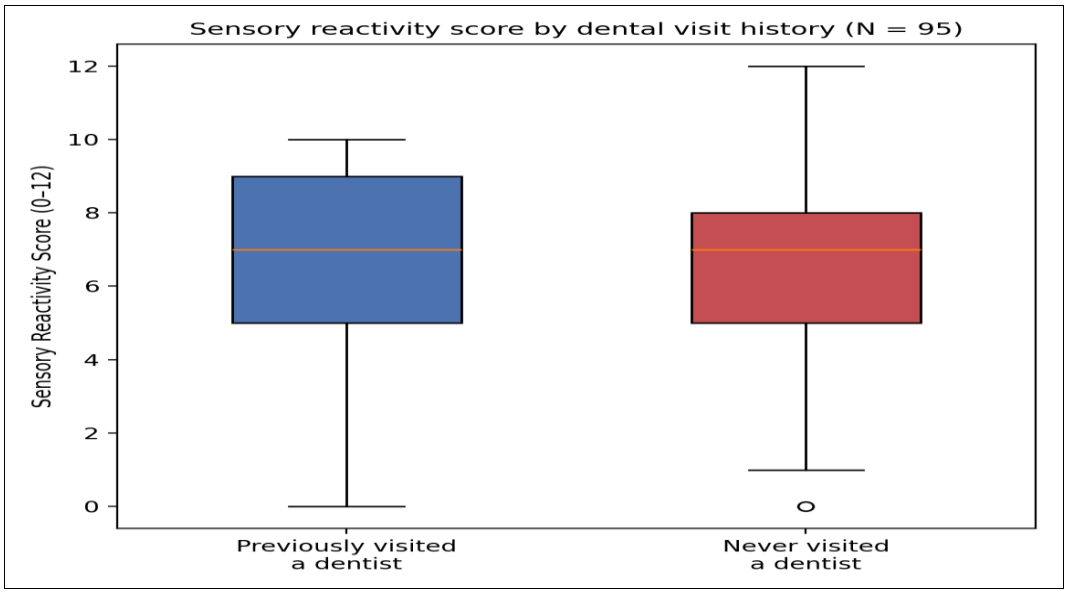


Fig 4: Sensory Reactivity Score by previous dental-visit history — no significant difference was found (N = 95).

None of the tested associations — dental-visit history, gender, toothbrush acceptance, full-mouth brushing compliance, or ASD severity — were significantly related to the Sensory Reactivity Score or to each other (all $p > 0.35$). This null result is itself informative and is discussed below.

Discussion

The present study demonstrates that sensory challenges are common during home oral hygiene among children with ASD. Visual and tactile stimuli were the most frequently reported domains, followed by auditory and gustatory/olfactory stimuli. These findings are clinically relevant because routine toothbrushing involves multiple simultaneous sensory inputs, and difficulties in tolerating these inputs may influence the child's willingness to participate in oral hygiene.

The high frequency of tactile and gustatory/olfactory difficulties in the present sample is consistent with previous reports describing sensitivity to toothbrush bristles, intraoral stimulation, toothpaste taste and texture, and unfamiliar smells as barriers to oral care [2, 3, 9].

In the present study, 71.6% of children were reported to chew the toothbrush bristles rather than brush, 57.9% spat out toothpaste immediately because of taste, and 60.0% avoided or resisted brushing because of toothpaste smell. Such findings emphasize the importance of considering individual sensory preferences when establishing home oral-care routines [2, 4].

The finding that visual challenges were particularly prominent is also relevant to dental treatment, where bright operating lights and visually unfamiliar equipment may act as additional sensory triggers. Studies of sensory-adapted dental environments have therefore targeted visual and auditory stimuli together with tactile modifications [7, 8].

The present study also found that 46.2% of children could not have all areas of the mouth brushed. This finding is compatible with literature describing greater toothbrushing difficulty and caregiver support requirements among autistic children [4, 5, 10].

In contrast to Khrautieo *et al*., who reported a significant relationship between sensory over-responsivity and toothbrushing cooperation, no significant association was observed in the present study between the overall Sensory Reactivity Score and toothbrush acceptance or full-mouth brushing compliance [9].

Several factors may explain this difference. First, the present study had an achieved analytic sample of only 95 participants compared with a planned sample of approximately 280. Second, the severe-ASD subgroup contained only four children, limiting the precision of severity comparisons. Third, the questionnaire structure and operational definitions of sensory sensitivity and oral-care cooperation differed between studies. Finally, sensory reactivity may not have a simple linear relationship with individual oral-hygiene behaviours; a child may show sensitivity in several sensory domains while still accepting a toothbrush with appropriate adaptation.

Recent intervention literature suggests that structured visual and behavioural approaches can improve toothbrushing skills and independence in autistic children, while sensory-adapted dental environments may reduce distress or improve cooperation for some children [7, 10, 11].

These findings support an individualized approach rather than assuming that all children with ASD will respond to the same sensory modification. Practical measures may include reducing unnecessary background noise, adjusting lighting, allowing choice of toothbrush texture and toothpaste characteristics, gradually introducing intraoral touch, and using visual or caregiver-mediated routines. Such measures should be tailored to the child's observed preferences and tolerances.

Limitations

The severe-ASD group contained only four children, making severity-based comparisons exploratory.

The questionnaire was electronic and unbranched; some conditional items could therefore have been presented to caregivers for whom the condition was not applicable.

Age and age-at-diagnosis fields contained inconsistent free-text entries, resulting in some missing values.

No accompanying reliability or validation data were available for the questionnaire in the analysed dataset.

The study relied on caregiver reports and was cross-sectional; direct behavioural observation during oral hygiene or dental treatment was not performed.

Conclusion

Sensory challenges during home oral hygiene were common among children with ASD in this sample, with visual and tactile stimuli reported most frequently, followed by auditory and gustatory/olfactory stimuli. Although no statistically significant association was found between the overall Sensory Reactivity Score and previous dental visits, gender, toothbrush acceptance, full-mouth brushing compliance or ASD severity, these findings should be interpreted as inconclusive because of the limited achieved sample and small severe-ASD subgroup. The findings support the use of individualized, sensory-sensitive oral-care approaches that consider lighting, sound, toothbrush texture, toothpaste characteristics and gradual intraoral desensitization. Larger studies using validated, piloted questionnaires, adequate sample sizes and direct behavioral assessment are required to clarify the relationship between sensory reactivity and oral-care cooperation.

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Competing Interests

NIL

Authors Contribution

Dr. Savitha Sathyaprasad (Guide): Provided overall guidance, supervision and critical inputs during the conceptualization, planning and execution of the study, and reviewed the manuscript.

Dr. Disha V Murthy (Postgraduate Student): Assisted in coordinating the study, contributed to the interpretation of the findings, and helped in the preparation and critical revision of the manuscript.

Risoja R S, Alet Maria (Interns, study investigators): Were actively involved in conducting the study, participant recruitment, data collection, compilation and analysis of data, and preparation of the manuscript.
All contributors reviewed and approved the final manuscript. give the same thing in orther way

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