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Original Article

Effectiveness of Wilbarger Protocol on Tactile Defensiveness in Children with Autism Spectrum Disorder

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ABSTRACT

Background: Tactile defensiveness may restrict self-care, play, social interaction, and participation among children with autism spectrum disorder. Evidence supporting the Wilbarger Deep Pressure and Proprioceptive Technique remains limited. Objective: To evaluate short-term changes in tactile-response classification following a three-week Wilbarger Protocol intervention. Methods: This single-group quasi-experimental pretest–posttest study included 16 children aged 3–14 years with autism spectrum disorder and tactile defensiveness recruited from two clinical settings in Lahore, Pakistan. Caregivers administered firm-pressure brushing followed by joint compressions four times daily for three weeks after therapist training. Tactile responses were assessed before and after intervention using the relevant Sensory Profile-2 classification. Changes were summarized as category transitions and analyzed using an exact two-sided sign test. Results: All participants were classified as having tactile responses "much more than others" at baseline. After intervention, five children (31.3%) moved to "just like the majority of others," five (31.3%) moved to "more than others," and six (37.5%) remained unchanged. Overall, 10 children (62.5%) improved by at least one classification level, while none worsened. The directional change was statistically significant ($p = 0.002$). Conclusion: Short-term improvement in tactile-response classification was observed among some participants, but the uncontrolled design, small sample, and ordinal caregiver-reported outcome prevent causal conclusions. Keywords: Autism spectrum disorder; tactile defensiveness; sensory over-responsivity; Wilbarger Protocol; deep pressure; occupational therapy; Sensory Profile-2.

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INTRODUCTION

Autism spectrum disorder is a neurodevelopmental condition characterized by persistent difficulties in social communication and interaction, together with restricted or repetitive patterns of behavior, interests, or activities. Atypical responses to sensory input are common among children with autism spectrum disorder and may affect functioning across home, school, clinical, and community environments (1). These sensory differences may involve hyper-responsivity, hypo-responsivity, sensory-seeking behavior, or mixed response patterns across tactile, auditory, visual, vestibular, proprioceptive, and oral sensory systems (2,3). Sensory over-responsivity is particularly relevant to clinical practice because ordinary environmental stimuli may be perceived as unusually intense, unpleasant, unpredictable, or threatening, resulting in avoidance, distress, behavioral dysregulation, and restricted participation in everyday activities (4).

Tactile defensiveness is a clinical manifestation of tactile sensory over-responsivity in which an individual demonstrates exaggerated negative behavioral or emotional responses to touch stimuli that are usually tolerated by peers. Among children with autism spectrum disorder, it may present as distress during bathing, grooming, hair cutting, dressing, handwashing, physical contact, or exposure to particular clothing and play materials (5). These responses may restrict independence in self-care, play, educational participation, and social interaction and may increase the demands placed on parents and caregivers during routine activities (6). Tactile over-responsivity has also been associated with differences in somatosensory processing, sensory gating, and cortical responses to

touch, indicating that these reactions may reflect underlying differences in sensory registration and modulation rather than simple behavioral non-compliance (7). Persistent tactile over-responsivity may consequently contribute to anxiety, withdrawal, reduced adaptive functioning, and limited participation in meaningful occupations (8).

Occupational therapy interventions for children with autism spectrum disorder frequently include strategies intended to improve sensory regulation and participation in daily activities. Sensory-based interventions use structured sensory input to support the child's ability to register, modulate, organize, and respond adaptively to environmental demands (9). Deep-pressure and proprioceptive techniques are commonly incorporated into these interventions on the proposed basis that firm tactile input and joint compression may influence arousal and sensory regulation (10). However, sensory-based interventions differ considerably in their theoretical foundations, treatment intensity, delivery procedures, fidelity, outcome measurement, and responsiveness across children. Consequently, their clinical effects require careful evaluation using clearly defined interventions and appropriate outcome measures (11).

The Wilbarger Deep Pressure and Proprioceptive Technique, commonly referred to as the Wilbarger Protocol, is a structured sensory-based intervention used by occupational therapists for individuals with sensory defensiveness. It generally consists of firm pressure applied with a therapeutic brush to selected body areas, followed by joint compressions administered at regular intervals (12). The procedure is frequently taught to caregivers for repeated implementation within the home environment, allowing sensory input to be incorporated into the child's daily routine. Despite its continued clinical use, the evidence supporting the Wilbarger Protocol remains limited. Reviews of sensory-based interventions have identified small samples, heterogeneous treatment procedures, inconsistent outcome measures, limited intervention-fidelity reporting, and frequent absence of comparison groups (13). These methodological limitations make it difficult to distinguish intervention-associated changes from caregiver expectations, repeated exposure, maturation, concurrent therapy, or changes in the child's environment.

Previous investigations of the Wilbarger Protocol and related deep-pressure or proprioceptive approaches have reported improvement in tactile tolerance or sensory-related behavior among some children, whereas others have demonstrated little or inconsistent change. Individual responsiveness may be influenced by age, baseline sensory characteristics, emotional regulation, intervention tolerance, caregiver adherence, concurrent treatment, and consistency of delivery. Moreover, the Wilbarger Protocol has frequently been combined with broader sensory diets, sensory integration interventions, or other therapeutic techniques, limiting the ability to determine the specific contribution of the protocol itself (14). Preliminary evaluation of clearly defined, short-term response patterns is therefore warranted in clinical settings where the intervention continues to be used.

The present study evaluated changes in tactile-response classification among children with autism spectrum disorder and tactile defensiveness following a structured three-week Wilbarger Deep Pressure and Proprioceptive Technique intervention. The objective was to determine whether participants demonstrated a short-term change in tactile defensiveness, as assessed using the relevant Sensory Profile-2 classification before and after the intervention.

MATERIALS AND METHODS

A single-group, quasi-experimental pretest–posttest design was used to evaluate short-term within-participant changes in tactile defensiveness following the Wilbarger Deep Pressure and Proprioceptive Technique. The study was conducted at Hope Clinic, Lahore, and LSCS, DHA Phase 1, Lahore, during the approved data-collection period from December to April. Because all participants received the intervention and no untreated, sham, or alternative-intervention group was included, each child's pre-intervention assessment served as the reference for the post-intervention comparison.

The target population comprised children with a clinical diagnosis of autism spectrum disorder who demonstrated tactile defensiveness. Children of either sex aged 3–14 years were eligible when autism spectrum disorder had been diagnosed by a qualified clinician and tactile over-responsivity was identified through sensory assessment. Autism spectrum disorder was defined according to the diagnostic characteristics described in the Diagnostic and Statistical Manual of Mental Disorders framework (15). Tactile defensiveness was defined as an exaggerated

adverse behavioral or emotional response to ordinary touch stimuli and was operationalized using the relevant tactile-response classification of the Sensory Profile-2 (16,18). Children with additional comorbid conditions, predominant sensory-seeking behavior, or an age above 14 years were excluded.

Participants were recruited from the selected clinical settings using non-probability purposive sampling. Parents or legal guardians of potentially eligible children were approached in person and provided with information regarding the study purpose, assessment procedures, intervention, anticipated benefits, and the voluntary nature of participation. Written informed consent was obtained from a parent or legal guardian before enrolment. The initial target sample was 24 participants based on the prevalence-based sample-size approach used during study planning, with an estimated prevalence of 6%, a 95% confidence level, and 5% precision (19). The final analysis included 16 children who completed the intervention and had both pre-intervention and post-intervention assessments. Analysis was therefore conducted using complete paired observations.

The Sensory Profile-2 was used to assess sensory responses before initiation of the intervention and after completion of the three-week treatment period. The instrument is a caregiver-reported measure designed to characterize how a child responds to sensory experiences relative to age-based normative patterns (18). For the present study, the relevant tactile-response classification was recorded using the categories “much less than others,” “less than others,” “just like the majority of others,” “more than others,” and “much more than others.” For statistical description, these ordered classifications were coded from 1 to 5, respectively. These numerical codes represented ordinal classification categories rather than a validated continuous severity scale. The primary outcome was the direction and magnitude of movement across these tactile-response classifications between the pre-intervention and post-intervention assessments. A change from “much more than others” toward “more than others” or “just like the majority of others” was classified as improvement, an unchanged category was classified as no change, and movement toward a more atypical classification was categorized as worsening.

The intervention consisted of the Wilbarger Deep Pressure and Proprioceptive Technique, comprising firm-pressure brushing followed by joint compressions (12). Before home implementation, the occupational therapist provided caregivers with direct instruction and demonstration of the required procedure. Caregivers were trained to apply the protocol four times daily for three weeks and to document implementation using an intervention log. Firm pressure was applied using the therapeutic brushing procedure over the arms, hands, back, legs, and feet. Sensitive body regions were avoided, and the procedure was modified or discontinued when a child demonstrated marked discomfort or intolerance. Brushing was followed by 10 compressions at each selected joint, administered in sequence at the wrists, elbows, shoulders, hips, knees, and ankles according to the child’s tolerance. Fidget toys, oral-motor items, or other distraction strategies could be used to facilitate cooperation. Caregivers were instructed to contact the treating therapist if the child demonstrated substantial distress, pain, skin irritation, or persistent intolerance.

A consistent general sequence of brushing followed by joint compression was used for all participants. Caregiver implementation was monitored through the intervention log and checklist, and the same assessment framework was used before and after treatment. The same eligibility criteria were applied across both recruitment sites. Within-participant comparison reduced the influence of fixed differences among children, although time-varying factors such as caregiver expectations, repeated tactile exposure, environmental changes, maturation, and concurrent therapy could not be fully controlled because the study did not include a comparison group or blinded outcome assessment.

Data were reviewed for completeness and consistency before analysis. Categorical variables, including sex, age group, pre-intervention classification, post-intervention classification, and response category, were summarized using frequencies and percentages. The ordinal tactile-response classifications were additionally described using the median, while coded means and standard deviations were retained only as supplementary descriptive summaries to facilitate comparison with the original analysis. The primary inferential analysis examined the direction of paired change using an exact sign-based test because the outcome consisted of ordered categories, all participants had the same baseline classification, and several paired observations were tied. Participants with no change were treated as ties and excluded from the calculation of the exact sign-test probability. A two-sided p-value below 0.05 was considered statistically significant. Parametric mean-change estimates and standardized

mean effect sizes were not treated as the primary evidence because the classification codes did not represent a continuous interval-level measure. Data were analysed using IBM SPSS Statistics version 26.0 (20).

Ethical approval was obtained from the Institutional Review Board of the University of Lahore, Lahore, Pakistan, under approval number UOL/IREB/25/08/00013. Participation was voluntary, and parents or legal guardians could withdraw their child without penalty. Participant identities were protected through confidential handling of study records, and collected information was used solely for research purposes. Caregivers were informed about the intervention procedure, its anticipated benefits, possible discomfort, and the option to discontinue the procedure if the child demonstrated intolerance. Data integrity was supported through standardized pre-intervention and post-intervention assessments, use of the same outcome-classification framework for all participants, caregiver intervention logs, structured intervention instructions, and review of completed records before statistical analysis.

RESULTS

Sixteen children with autism spectrum disorder and tactile defensiveness completed the three-week intervention and were included in the paired analysis. Twelve participants (75.0%) were male and four (25.0%) were female. Seven children (43.8%) were aged 3–6 years, five (31.3%) were aged 7–9 years, and four (25.0%) were aged 10–14 years (Table 1).

Table 1. Demographic characteristics of the participants

Characteristic	Category	n (%)
Age group, years	3–6	7 (43.8)
	7–9	5 (31.3)
	10–14	4 (25.0)
Sex	Male	12 (75.0)
	Female	4 (25.0)

Before the intervention, all 16 participants were classified as having tactile responses “much more than others.” Following the three-week Wilbarger Protocol, five children (31.3%) moved to the classification “just like the majority of others,” five (31.3%) moved to “more than others,” and six (37.5%) remained classified as “much more than others.” No participant moved toward a more atypical tactile-response classification (Table 2). Overall, 10 of 16 children (62.5%) demonstrated improvement of at least one classification level. Five children (31.3%) demonstrated a one-level improvement, and five (31.3%) demonstrated a two-level improvement. Six participants (37.5%) showed no change. After exclusion of the six tied observations, all 10 participants with a change moved in the direction of improvement. The exact two-sided sign test indicated a statistically significant directional change in tactile-response classification ($p = 0.002$). The median coded tactile-response classification decreased from 5.00 before the intervention to 4.00 after the intervention. As a supplementary descrdiptive summary, the coded mean decreased from 5.00 ± 0.00 to 4.06 ± 0.85, corresponding to a mean reduction of 0.94 classification points. Because these numerical codes represented ordered classification categories rather than a validated continuous severity scale, the categorical transition pattern and exact sign test were considered the primary findings.

Table 2. Change in tactile-response classification following the three-week Wilbarger Protocol

Outcome	Pre-intervention, n (%)	Post-intervention, n (%)
Much less than others	0 (0.0)	0 (0.0)
Less than others	0 (0.0)	0 (0.0)
Just like the majority of others	0 (0.0)	5 (31.3)
More than others	0 (0.0)	5 (31.3)
Much more than others	16 (100.0)	6 (37.5)
Median coded classification	5.00	4.00
Mean coded classification ± SD	5.00 ± 0.00	4.06 ± 0.85
Within-participant response	Classification change	n (%)
Two-level improvement	5 to 3	5 (31.3)
One-level improvement	5 to 4	5 (31.3)
No change	5 to 5	6 (37.5)
Worsening	Increase in coded classification	0 (0.0)
Any improvement	Reduction of ≥1 level	10 (62.5)

Statistical comparison: Exact two-sided sign test, excluding six tied observations; $p = 0.002$. Note: Sensory Profile-2 classifications were coded from 1 to 5 for descriptive analysis: 1, much less than others; 2, less than others; 3, just like the majority of others; 4, more than others; and 5, much more than others. Lower post-intervention coding

represented movement toward the normative classification in this sample. The coded mean and standard deviation are supplementary descriptive statistics and were not used as the primary inferential evidence.

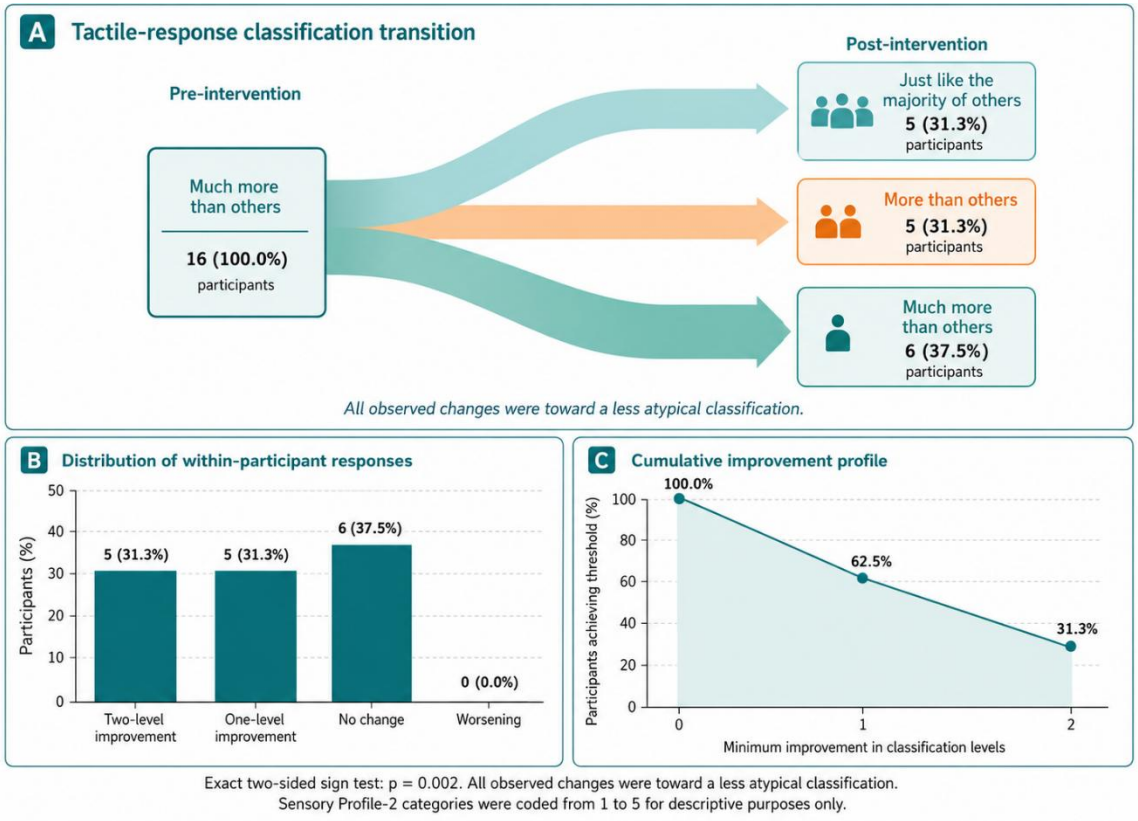

Figure 1. Short-Term Change in Tactile-Response Classification After the Wilbarger Protocol. Panel A illustrates the transition from the pre-intervention classification, in which all 16 participants (100.0%) were categorized as having tactile responses "much more than others," to the post-intervention distribution. After three weeks, five children (31.3%) moved to "just like the majority of others," five (31.3%) moved to "more than others," and six (37.5%) remained in the original classification. Panel B presents the within-participant response distribution: five children (31.3%) demonstrated a two-level improvement, five (31.3%) demonstrated a one-level improvement, six (37.5%) showed no change, and none worsened. Panel C shows the cumulative response profile, with 62.5% achieving at least a one-level improvement and 31.3% achieving a two-level improvement. Among the 10 participants with a change, all changes occurred in the direction of improvement; the exact two-sided sign test was statistically significant (p = 0.002).

DISCUSSION

The present study evaluated short-term changes in tactile-response classification among children with autism spectrum disorder following a three-week caregiver-delivered Wilbarger Deep Pressure and Proprioceptive Technique intervention. Ten of the 16 participants moved toward a less atypical tactile-response classification, including five children who improved by one classification level and five who improved by two levels. Six children showed no measurable change, and no participant moved toward a more atypical classification. The directional change was statistically significant on exact paired analysis. These findings indicate that improvement was observed in a subset of participants during the intervention period; however, the uncontrolled design does not establish that the changes were caused by the Wilbarger Protocol.

The observed classification shifts may have practical relevance because all participants entered the study within the "much more than others" classification. Following the intervention, five children were classified as "just like the majority of others," whereas another five moved to "more than others." Movement toward a less atypical classification may reflect improved tolerance of tactile experiences, but the study did not directly assess dressing, grooming, hygiene, play, school participation, adaptive functioning, or caregiver burden. The findings should therefore be interpreted as changes in caregiver-reported tactile-response classification rather than demonstrated improvement in broader occupational performance. Sensory over-responsivity has been associated with anxiety, behavioral dysregulation, and reduced participation among children with autism spectrum disorder, supporting the

clinical importance of identifying interventions that may help selected children manage tactile input more effectively (21).

The direction of the findings is broadly consistent with the proposed regulatory effects of deep-pressure and proprioceptive input. Such input has been hypothesized to influence arousal and autonomic regulation by providing structured tactile and proprioceptive stimulation (22). Sensory integration and sensory-based interventions have shown potential benefits for selected sensory and participation-related outcomes among children with autism spectrum disorder, although effects vary according to intervention type, treatment fidelity, outcome selection, and study quality (23). The present findings support a cautious interpretation: some children demonstrated measurable short-term improvement, whereas more than one-third remained unchanged, indicating that the response to the protocol was not uniform.

Previous research specifically examining the Wilbarger Protocol has similarly reported variable findings. Anwar observed improvement in sensory-processing outcomes following the Wilbarger technique among children with sensory-processing difficulties, although the study was limited by a small sample and an uncontrolled design (24). Mahendran and colleagues reported improvement when the protocol was combined with neutral warmth therapy, but the combined intervention prevented isolation of the independent contribution of the Wilbarger technique (25). Multiple-single-case research has also demonstrated inconsistent individual responses, suggesting that treatment effects may depend on child-specific sensory characteristics and implementation factors (14). Research on the immediate effects of deep pressure among young people with autism and severe intellectual disability has likewise indicated that responsiveness may differ substantially across individuals (26).

The variability observed in the present study may be related to differences in sensory thresholds, age, emotional regulation, anxiety, attention, sleep, communication abilities, intervention tolerance, caregiver technique, and consistency of application. Caregiver-delivered sensory protocols can be difficult to implement at the intended frequency, particularly when the child resists brushing or joint compression. Previous work has emphasized the importance of parental adherence, feasibility, training, and continued therapist support when the Therapressure or Wilbarger program is delivered in home settings (27,28). Surveys of occupational therapy practitioners have also demonstrated variation in how the protocol is taught and administered, indicating that real-world implementation may differ in frequency, technique, body regions treated, and monitoring procedures (29). These factors may partly explain why some participants improved while others showed no measurable change.

The findings should also be interpreted within the broader evidence on brushing and sensory-based interventions. Earlier research examining brushing procedures has not consistently demonstrated reductions in stereotypical or sensory-related behavior, and intervention effects have often been difficult to separate from accompanying therapeutic activities (30). Clinical practice commonly combines sensory techniques with broader occupational, behavioral, communication, and family-mediated interventions (31,32). Community and caregiver partnerships may improve implementation and generalization, but they also introduce potential variation in treatment delivery and outcome reporting (33). Accordingly, the Wilbarger Protocol should not be viewed as a universally effective or stand-alone treatment. Its use, where clinically indicated, should occur within an individualized occupational therapy plan that includes measurable goals, caregiver education, monitoring of tolerance, and reassessment of response.

Several neurophysiological mechanisms may contribute to tactile over-responsivity in autism spectrum disorder. Altered inhibitory processing and differences in somatosensory function have been reported among children with autism, suggesting that atypical tactile responses may reflect differences in sensory registration, discrimination, and modulation rather than voluntary avoidance alone (34). Ayres Sensory Integration and related occupational therapy frameworks emphasize individualized assessment and participation-oriented treatment planning rather than uniform application of isolated sensory techniques (35). Specific sensory techniques and environmental modifications may be useful when selected according to the child's sensory profile and functional needs, but the quality and consistency of evidence vary across interventions (36). Families may also experience substantial practical and emotional effects from autism-related sensory and behavioral difficulties, reinforcing the importance of interventions that are feasible, acceptable, and relevant to everyday routines (37).

The study had several strengths. It addressed a clearly defined sensory concern, used the same assessment framework before and after intervention, incorporated caregiver training, and described individual response patterns rather than relying solely on a group mean. Reporting one-level, two-level, unchanged, and worsening classifications provided a clinically understandable description of response heterogeneity. The use of an exact sign-based analysis was also appropriate for the revised analysis because the outcome was ordinal, baseline classifications were identical, and several paired observations were tied.

The limitations were substantial. The sample included only 16 children selected through non-probability purposive sampling, limiting precision and generalizability. The absence of a control group prevented separation of intervention-associated change from maturation, repeated assessment, caregiver expectations, increased familiarity with tactile input, environmental changes, or concurrent therapies. Outcome assessment was caregiver-reported, and neither caregivers nor assessors were blinded. The analysis was restricted to participants with complete pre-intervention and post-intervention data, while the reasons for the difference between the planned sample and analyzed sample were not available in the reported dataset. Adherence was recorded through intervention logs, but participant-level adherence and fidelity results were not reported. Concurrent occupational, behavioral, speech, educational, or pharmacological interventions were not controlled. No longer-term follow-up was performed, and adverse events or intolerance were not systematically presented.

A further limitation concerned outcome measurement. The Sensory Profile-2 classifications were coded from 1 to 5 for descriptive purposes, but these categories represent ordered normative classifications rather than a validated continuous severity scale. Consequently, parametric mean-change estimates and standardized mean effect sizes were not considered the primary evidence. In addition, all participants entered the study within the same baseline classification, creating restricted baseline variability and preventing assessment of whether initial severity predicted response. Future research should use the relevant age-specific Sensory Profile-2 forms and report raw or standardized subscale scores alongside classification categories. Larger controlled studies should prospectively document recruitment, attrition, concurrent therapies, treatment fidelity, caregiver adherence, adverse events, and follow-up outcomes. Randomized or well-matched comparative designs would provide stronger evidence regarding whether observed changes are attributable to the intervention. Future studies should also investigate potential predictors of response, including age, sensory-response pattern, communication ability, anxiety, adaptive functioning, and caregiver implementation skills.

CONCLUSION

A three-week caregiver-delivered Wilbarger Deep Pressure and Proprioceptive Technique intervention was associated with movement toward a less atypical tactile-response classification in 10 of 16 children with autism spectrum disorder, while six children showed no measurable change and none worsened. The findings provide preliminary evidence of short-term improvement among some participants but do not establish intervention effectiveness because of the small sample, uncontrolled design, caregiver-reported ordinal outcome, and absence of blinded assessment or longer-term follow-up. The protocol should therefore be considered, where clinically appropriate, as one component of individualized occupational therapy with structured monitoring of tolerance and response.

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