



**Clinical Practice of Occupational Therapists in the
Assessment and Intervention of the Upper Limb in Children
and Adolescents with Unilateral Cerebral Palsy: A Cross-
Sectional Study.**

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Abstract:	<p>Introduction: Occupational therapy is essential in supporting children with unilateral cerebral palsy, particularly in improving upper limb function and promoting participation. Despite strong evidence supporting specific assessment tools and interventions, their integration into clinical practice remains uncertain. Method: A cross-sectional online questionnaire was distributed to occupational therapists working with children and adolescents with neurological conditions. The survey included 32 questions across three sections: demographics, assessment practices, and intervention strategies. Responses were collected over a six-week period using convenience sampling. Findings: A total of 130 occupational therapists participated. While 57.7% reported using standardised assessment tools, only a minority were aware of their validation status. Somatosensory processing was assessed in fewer than half of the children by 32.3% of therapists. Intensive therapies were used by 30.77%, but only 12.5% followed recommended dosage guidelines. Conventional approaches such as bimanual activities, play, and re-education of daily living activities were widely used. Emerging therapies were also incorporated by some respondents. Conclusion: There is a clear gap between evidence-based recommendations and current clinical practices. Greater emphasis on professional development is needed to support the consistent use of validated assessment tools and structured intervention strategies in occupational therapy for children with unilateral cerebral palsy.</p>

Abstract

Introduction: Occupational therapy is essential in supporting children with unilateral cerebral palsy, particularly in improving upper limb function and promoting participation. Despite strong evidence supporting specific assessment tools and interventions, their integration into clinical practice remains uncertain. **Method:** A cross-sectional online questionnaire was distributed to occupational therapists working with children and adolescents with neurological conditions. The survey included 32 questions across three sections: demographics, assessment practices, and intervention strategies. Responses were collected over a six-week period using convenience sampling. **Findings:** A total of 130 occupational therapists participated. While 57.7% reported using standardised assessment tools, only a minority were aware of their validation status. Somatosensory processing was assessed in fewer than half of the children by 32.3% of therapists. Intensive therapies were used by 30.77%, but only 12.5% followed recommended dosage guidelines. Conventional approaches such as bimanual activities, play, and re-education of daily living activities were widely used. Emerging therapies were also incorporated by some respondents. **Conclusion:** There is a clear gap between evidence-based recommendations and current clinical practices. Greater emphasis on professional development is needed to support the consistent use of validated assessment tools and structured intervention strategies in occupational therapy for children with unilateral cerebral palsy.

Keywords: Intervention, Assessment, Upper Limb, Unilateral Cerebral Palsy, Clinical Practice, Occupational Therapy

Introduction

Unilateral cerebral palsy (UCP) is the most common subtype of cerebral palsy, accounting for over 30% of cases (Stanley et al., 2000). It results from early brain injury and typically leads to motor impairments predominantly on one side of the body, with the upper limb (UL) more severely affected than the lower limb. These impairments often hinder the child's ability to perform essential tasks such as reaching, grasping, and manipulating objects, which in turn limits autonomy in daily activities and reduces participation and quality of life (Sakzewski et al., 2009).

In addition to motor impairments, sensory deficits—particularly somatosensory dysfunction—are increasingly recognised as significant contributors to the functional limitations experienced by children with UCP. Recent studies indicate that over 75% of these children present with somatosensory processing dysfunction in the UL (McLean et al., 2021; Jovellar-Isiegas et al., 2022), which has a substantial impact on motor performance (Auld et al., 2012) and participation in everyday activities (Parham and Mailloux, 2010).

Occupational therapy plays a pivotal role in addressing these challenges, particularly within transdisciplinary neurorehabilitation teams where it contributes to setting and achieving goals aimed at enhancing participation (Karol, 2014). Given that the performance of the more affected UL is often the principal limiting factor for successful engagement in activities of daily living (ADLs) (Fedrizzi et al., 2003), targeted interventions are essential. Occupational assessment is fundamental to guiding these interventions and monitoring progress (2020).

Despite the availability of validated outcome measures and evidence-based interventions, there is limited understanding of how these are applied in clinical practice, particularly in Spain. The absence of national data on the use of assessment tools and the integration of sensory-focused approaches in occupational therapy highlights a gap in current knowledge.

This study aims to describe the clinical practices of Spanish occupational therapists in the assessment and treatment of children with UCP, focusing on the tools and intervention strategies used to address UL function and participation.

Literature Review

The clinical profile of children with UCP is characterised by asymmetrical motor impairments, with the UL typically more affected than the lower limb. These impairments compromise the child's ability to perform functional tasks, leading to reduced independence and quality of life (Graham et al., 2016). Occupational therapy is widely recognised as a key discipline in the rehabilitation of children with UCP, particularly within transdisciplinary teams that prioritise participation-based goals (Karol, 2014).

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3 A range of outcome measurement tools with strong psychometric properties have been
4 identified for assessing UL capacity in children with UCP (Gilmore et al., 2010; Lemmens
5 et al., 2012). However, tools specifically designed to evaluate participation remain limited
6 (Morris et al., 2005). Despite the availability of these instruments, their use in clinical
7 practice is often inconsistent, with studies reporting widespread underutilisation among
8 paediatric therapists (King et al., 2011). In Spain, the routine practices of occupational
9 therapists remain undocumented due to a lack of prior studies.
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13 Among the most effective interventions for improving UL function are intensive therapies
14 such as constraint-induced movement therapy (CIMT) and bimanual training, both of
15 which are supported by a robust body of evidence (Novak and Honan, 2019; Ouyang et
16 al., 2020). Furthermore, the contribution of somatosensory processing to motor function
17 has led to growing interest in sensory-based interventions. Although relatively few studies
18 have focused specifically on this domain, some have reported promising outcomes (Auld
19 et al., 2017; McLean et al., 2017). Nevertheless, it remains unclear whether these
20 approaches are being integrated into occupational therapy practice.
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26 **Materials and Methods**

27 *Participants*

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29 Participants included occupational therapists who had previously worked or were
30 currently working with children or adolescents diagnosed with neurological disorders
31 within Spain.
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35 *Instrument*

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37 A cross-sectional questionnaire was developed specifically for this study, drawing upon
38 previous research (Walmsley et al., 2018; Auld and Johnston, 2018) and adhering to the
39 Cherries guidelines (Eysenbach, 2004). The questionnaire was open-ended in format and,
40 once drafted by the study authors, was reviewed by an occupational therapist with over
41 15 years of experience in neurorehabilitation. Minor modifications were made based on
42 their feedback.
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46 The final version of the questionnaire comprised 32 questions divided into three sections:
47 the first section collected demographic data from the participants, the second section
48 gathered information regarding the routine clinical practices of occupational therapists in
49 the assessment of children and adolescents with UCP. Finally, the third section focused
50 on the intervention programmes implemented by therapists for this population.
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53 Response formats included dichotomous options (e.g., yes/no), frequency scales (e.g.,
54 always to never), and multiple-choice items (e.g., “Which standardised tool(s) do you
55 use?”). Completion of all questions was mandatory to proceed through the questionnaire.
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57

58 *Procedure*

The online version of the questionnaire was disseminated via the occupational therapy professional associations in Spain and the Spanish Society of Occupational Therapy for Children and Adolescents (TOP-es). An explanatory letter detailing the study, along with a web link to the questionnaire, was sent to these organisations, who then distributed it to their members via email.

The introduction to the questionnaire included information about the study's objectives, the researchers and their contact details, the estimated time required for completion, and assurances regarding anonymity and data confidentiality. The study complied with the provisions of Organic Law 3/2018 of 5 December on the Protection of Personal Data and Guarantee of Digital Rights.

The survey was open for responses from 10 May to 20 June 2021. A convenience sampling method was employed. No direct contact was made with potential participants, and participation was entirely voluntary. Informed consent was obtained at the beginning of the questionnaire and was required to access the survey.

This research received ethical approval from the xxxxxx (CSEULS-PI-031/xxxxxx).

Statistical Analysis

Data coding and analysis were conducted using SPSS software (version 25, SPSS Inc., Chicago, IL, USA). Descriptive statistical procedures were applied. As all variables were qualitative (nominal and ordinal), frequency distribution tables were generated, and results were presented as n and %.

Results

Sample Characteristics

A total of 130 occupational therapists participated in this study, of whom over 90% were women aged between 21 and 30 years. The sample was drawn from 15 different Autonomous Communities across Spain.

Regarding the professional profiles of the participants, only 26.7% reported working with all paediatric age groups up to 18 years. Furthermore, just 11.5% indicated having received specific training in the assessment and treatment of the UL in children and/or adolescents with neurological disorders. Detailed demographic information is presented in Table 1.

Table 1. Demographic characteristics of participating occupational therapists (n = 130).

Characteristic	n	%
<i>Age</i>		
21–30 years	59	45.4

31–40 years	54	41.5
41–50 years	14	10.8
51–60 years	3	2.3
Over 60 years	0	0
<i>Gender</i>		
Male	7	5.4
Female	123	94.6
<i>Educational background</i>		
Diploma in Occupational Therapy	63	48.46
Bachelor's Degree in Occupational Therapy	67	51.54
Diploma in Physiotherapy	2	1.54
Bachelor's Degree in Physiotherapy	2	1.54
Dual Degree in Occupational Therapy and Physiotherapy	1	0.77
Master's Degree	72	55.38
Doctorate	2	1.54
<i>Years of clinical experience with children/adolescents</i>		
Less than 1 year	23	17.7
1–2 years	17	13.1
3–5 years	38	29.2
6–10 years	20	15.4
More than 10 years	32	24.6
<i>Age groups served</i>		
Children aged 0–6 years	122	93.85
Children aged 7–11 years	99	76.15
Adolescents aged 12–15 years	60	46.15
Adolescents aged 16–18 years	41	31.54
<i>Employment sector</i>		
Public	25	19.2
Private (for-profit)	40	30.8
Foundation/Association (non-profit)	20	15.4
Both public and private	45	34.6
<i>Specialised training in paediatric occupational therapy</i>		
Yes	115	88.5
No	15	11.5
<i>Training in upper limb assessment and intervention in neurological populations</i>		
Yes	15	11.5
No	115	88.5

Note: Not all items in the questionnaire add up to 100%, as participants were able to select more than one answer for some questions (multiple choice). Percentages were calculated on the number of total participants to more accurately reflect the proportion of respondents within the total sample.

Evaluation Practices

In the second section of the questionnaire, which addressed assessment procedures (see Table 2), 72.3% of occupational therapists reported being unaware of whether the standardised assessment tools they used were validated for the Spanish population. Nevertheless, 57.7% indicated that they employed such tools in their clinical practice.

Regarding somatosensory processing, 95.4% of respondents believed that children and adolescents with UCP exhibited difficulties in UL somatosensory processing, and 88.5% considered that these difficulties had a direct impact on functional performance. However, 32.3% of therapists reported assessing somatosensory processing in fewer than 50% of the children they treated, and 45.16% stated that they either never or only occasionally re-evaluated this aspect. Figure 1 shows in more detail the aspects of somatosensory processing that they assess and the standardised procedures that therapists implement to measure these aspects.

Table 2. Clinical practice of occupational therapists regarding assessment procedures (n = 130).

Question/Answers	n	%
<i>Do you use standardised tools for UL assessment in children with UCP?</i>		
Yes	75	57,7
No	55	42,3
<i>If yes, what standardised tools do you use?</i>		
Shriners Hospital Upper Extremity Evaluation	14	18,67
Jebsen Taylor Hand Function Test	16	21,33
Box and Blocks	28	37,33
Quality of Upper Extremity Skills Test	42	56
Assisting Hand Assessment	28	37,33
Pediatric Evaluation of Disability Inventory (PEDI/PEDI-CAT)	48	64
Habilhand-Kids	28	37,33
Children's Hand-use Experience Questionnaire	34	45,33
Canadian Occupational Performance Measure	27	36
Modified Ashworth or Modified Tardieu Scale	28	37,33
<i>Do you know if these assessment tools are validated in Spain in this population?</i>		
Yes, I know they are validated	23	17,7
Yes, I know they are not validated	13	10
I don't know	94	72,3
<i>Do you consider that children and/or adolescents with UCP have difficulties in processing somatosensory information (tactile and proprioceptive sensitivity) of the UL?</i>		
Yes	124	95,4
No	6	4,6
I don't know/not sure		
<i>If you answered YES, how often do you think they are present?</i>		
I do not know	22	16,92
In less than 20% of cases	1	0,77

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2			
3	Between 21-50% of cases	18	13,85
4	Between 51-75% of cases	38	29,23
5	More than 75% of cases	51	39,23
6			
7	<i>Do you think that UL somatosensory processing difficulties significantly affect arm/hand movement</i>		
8	<i>for functional activities?</i>		
9	Yes, definitely	115	88,5
10	Maybe, sometimes	13	10
11	No	0	0
12	I don't know/I'm not sure	2	1,5
13			
14	<i>In what percentage of children do you assess UL somatosensory processing/sensitivity?</i>		
15	All children and/or adolescents	64	49,2
16	75-50% of children and/or adolescents	24	18,5
17	Between 25-50% of children and/or adolescents	17	13,1
18	Less than 25% of children/adolescents	19	14,6
19	Never	6	4,6
20			
21	<i>How often do you re-evaluate somatosensory processing after implementing an UL treatment?</i>		
22	Always	18	14,52
23	Frequently	50	40,32
24	Sometimes	47	37,9
25	Never	9	7,26
26			
27	<i>What is the main reason why you do not implement somatosensory/sensory assessments?</i>		
28	I do implement somatosensory assessments	60	46,15
29	Lack of knowledge about what to assess	26	37,14
30	Lack of confidence about how to assess (implement appropriate procedure(s))	17	24,29
31	Lack of access to materials/equipment needed to assess	50	71,43
32	Lack of time to assess	29	41,43
33	Children are very young and sometimes you don't get their cooperation.	2	2,86
34	Other	4	5,71

UL: upper limb; UCP: unilateral cerebral palsy.

Note 1: Not all items in the questionnaire add up to 100%, as participants were able to select more than one answer to some questions (multiple choice). Percentages were calculated on the number of total participants to more accurately reflect the proportion of respondents within the total sample.

Note 2: Not all participants accessed all items in the questionnaire because some questions closed access to others. In these cases, percentages were calculated based on participants who accessed each question.

[Insert Figure 1 here]

Figure 1. Aspects of somatosensory processing assessed and standardised procedures implemented.

Intervention Practices

As shown in Table 3, 30.77% of the occupational therapists surveyed reported using intensive therapies, although only 8.5% selected them as their primary treatment approach for children with UCP. Among these, the most implemented intervention (60%) was a combination of CIMT and Hand-Arm Bimanual Intensive Therapy (HABIT). However, only 12.5% of therapists reported adhering to the recommended dosage protocols based

on current scientific evidence. The most frequently cited barrier to implementation (54.44%) was a lack of knowledge and understanding of how to apply these therapies.

In terms of conventional approaches aimed at improving UL functional performance, the most commonly employed were: bimanual activities (91.54%), play-based interventions (89.23%), re-education of ADLs (85.38%), somatosensory stimulation (73.85%) and adaptations and assistive devices (67.69%).

Regarding somatosensory or sensory stimulation approaches, 29 open-ended responses were collected. Of these, 60% indicated the use of materials with various textures without following a standardised protocol, while the remaining 40% described a range of different interventions. Finally, 51.5% of respondents reported incorporating emerging approaches into their clinical practice.

Table 3. Clinical practice of occupational therapists regarding implemented interventions (n = 130).

Question/Answers	n	%
<i>Do you use intensive therapies?</i>		
Yes	40	30,77
No	90	69,23
<i>Are intensive therapies generally your first choice of treatment for children and/or adolescents with UCP?</i>		
Yes	11	8,5
No	119	91,5
<i>Do you consider that intensive therapies have a negative emotional impact on the children or the family?</i>		
Yes	10	7,7
No	39	30
Sometimes	75	57,7
I don't know	6	4,6
<i>If you implement intensive therapies, which ones do you carry out with children and/or adolescents with UCP?</i>		
CIMT or mCIMT	22	55
HABIT	19	47,5
CIMT and HABIT combined	24	60
<i>If you implement intensive therapies on a regular basis, do you apply a protocol to apply the required dose (from 36 to 90 hours, depending on age and modality) in the indicated time?</i>		
Yes, I carry out the protocol 100%.	5	12,5
No	8	20
Sometimes I modify the protocol, depending on the needs	27	67,5
<i>If you do not implement intensive therapies, what is the reason?</i>		
I lack the training to carry them out and therefore I do not know how to do it.	49	54,44
Despite having training, I do not feel able to carry them out.	3	3,33
The family is not committed to carrying out the activities at home to achieve the	31	34,44
I feel that it is not a good choice for children with	5	5,56

Other	16	17,78
<i>What kind of approach do you take in the intervention of children and/or adolescents with UCP in order to improve the functional performance of the UL?</i>		
None in particular	0	0
Unimanual activities targeting the most affected UL	85	65,38
Bimanual activities	119	91,54
Neuromuscular taping	35	26,92
Functional splints	54	41,54
Rest splints	35	26,92
Adaptations and assistive devices	88	67,69
Re-education of ADL activities	111	85,38
Somatosensory approach/ sensory stimulation of the UL	96	73,85
Rehabilitation technology	25	19,23
Play	116	89,23
<i>If you use any kind of somatosensory approach/sensory stimulation of the UL, could you briefly describe what and how you do it?</i>		
Materials with different textures	17	58,62
Other (Bobath, Le Meteyer, Sensory Integration, Carey's SeNSE Protocol, basal stimulation)	12	41,38
<i>Do you incorporate some of the emerging approaches, such as mirror therapy, action observation therapy or motor imagery, into your clinical practice?</i>		
Yes	67	51,5
No	63	48,5

UCP: unilateral cerebral palsy; CIMT: Constraint Induced Movement Therapy; mCIMT: Modified Constraint Induced Movement Therapy; HABIT: Hand Arm Intensive Bimanual Therapy; UL: upper limb; ADLs: Activities of Daily Living.

Note 1: Not all items in the questionnaire add up to 100%, as participants were able to select more than one answer to some questions (multiple choice). Percentages were calculated on the number of total participants to more accurately reflect the proportion of respondents within the total sample.

Note 2: Not all participants accessed all items in the questionnaire because some questions closed access to others. In these cases, percentages were calculated based on participants who accessed each question.

Discussion

This study is the first to examine the current clinical practices of Spanish occupational therapists in relation to the assessment and intervention of the UL in children and adolescents with UCP.

Regarding standardised assessment tools, more than half of the surveyed therapists reported using them, although only 17.7% were aware of their validation status in Spain. Despite the well-established importance of standardised tools in guiding intervention, their underutilisation appears to be a widespread issue, also affecting other paediatric professionals such as physiotherapists and speech and language therapists (Jette et al., 2009; Hanna et al., 2007). A lack of confidence in selecting, administering, and interpreting these tools may contribute to this trend (Ketelaar et al., 2008).

Among the tools used to assess activity domain, 37.33% of respondents reported using the Assisting Hand Assessment and another 37.33% used the Abilhand-Kids—both of

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3 which have been identified as highly appropriate in a recent mega-review (Thomé
4 Teixeira da Silva et al., 2022). Regarding tools that assess participation, 36% of therapists
5 reported using the Canadian Occupational Performance Measure, which is recognised for
6 its validity, reliability, and clinical utility (Carswell et al., 2004). Given that a child's
7 maximum capacity does not always reflect their actual performance in daily life (Smits
8 et al., 2010), occupational therapists are encouraged to incorporate this tool into routine
9 practice.
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13 In terms of somatosensory processing, nearly all therapists acknowledged that a
14 significant proportion of children with UCP experience difficulties, and 88.5% believed
15 these difficulties contribute to functional impairments. which is in line with current
16 literature (Kuo et al., 2016). However, only 14.52% of respondents reported consistently
17 conducting somatosensory assessments. This is consistent with findings by (Auld and
18 Johnston, 2018) who reported that 90% of Australian therapists assessed somatosensory
19 function in fewer than 23% of cases. Despite the availability of best practice
20 recommendations, current clinical practice does not yet seem to reflect these guidelines
21 (Walmsley et al., 2018).
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26 Although intensive therapies have the strongest evidence base for improving UL function
27 in children with UCP, only 30.77% of therapists reported using them, and just five
28 adhered to the recommended dosage. This may impact the effectiveness of interventions,
29 as evidence suggests that more than 30–40 hours of practice are required to achieve
30 functional improvements (Jackman et al., 2020).
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33 On a positive note, the most frequently used conventional approaches are supported by
34 evidence. Bimanual activities, used by 91.54% of respondents, are considered the most
35 effective for improving both unimanual capacity and bimanual performance (Hoare et al.,
36 2019). However, to achieve optimal outcomes, these activities should be delivered
37 intensively—something that remains challenging within the current healthcare model.
38 Similarly, 85.38% of therapists reported using ADL re-education, which requires 14–25
39 hours of practice to achieve individual goals (Jackman et al., 2020). Context-focused
40 interventions, such as adaptations and assistive devices, were used by 67.69% of
41 therapists and represent a promising approach (Novak et al., 2020).
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46 Interestingly, 73.85% of therapists reported using somatosensory stimulation, despite
47 only 14.51% consistently assessing this domain. The 29 open responses describing
48 somatosensory approaches were generally vague, suggesting that while sensory elements
49 are included in interventions, they are not implemented in a structured, evidence-based
50 manner (Auld and Johnston, 2018).
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53 Encouragingly, 51.5% of therapists reported incorporating emerging therapies—such as
54 mirror therapy, action observation, and motor imagery—into their practice. These
55 cognitive-based interventions may offer valid therapeutic options when integrated with
56 conventional rehabilitation (Demeco et al., 2024).
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3 This study has several limitations. Not all Spanish regions were represented, which may
4 limit the generalisability of the findings. Additionally, some questions did not allow for
5 open-ended responses, limiting the detail captured regarding specific procedures. Future
6 research should explore the perceived barriers and facilitators to implementing evidence-
7 based assessment tools and interventions in clinical practice, with the aim of developing
8 strategies to support this process.
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13 **Conclusion**

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15 More than half of the occupational therapists surveyed reported using standardised
16 outcome measures, and among those, several tools were aligned with current evidence-
17 based recommendations. However, only a small proportion consistently assessed
18 somatosensory processing of UL.
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21 Intensive therapies were rarely implemented in accordance with the recommended
22 dosage, despite their strong evidence base. Conversely, the most commonly used
23 conventional approaches were supported by literature, although their effectiveness may
24 be limited by insufficient intensity or duration. While most therapists incorporated
25 sensory elements into their interventions, these were not typically delivered following
26 structured, evidence-based protocols.
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29 Finally, emerging therapies are increasingly being integrated alongside conventional
30 rehabilitation, reflecting a growing interest in innovative approaches.
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33 These findings highlight the need for targeted professional development to support the
34 integration of evidence-based practices into routine clinical care for children with UCP.
35 They also invite reflection on the future direction of the profession in aligning clinical
36 practice with the best available evidence in both assessment and intervention.
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42 **Key findings**

- 43 • Standardised assessments are underused, with limited awareness of tool
44 validation.
- 45 • Somatosensory processing is rarely assessed despite its recognised impact on
46 upper limb function.
- 47 • Intensive therapies are infrequently applied and often not delivered at
48 recommended dosages
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56 **What the study has added**

57 This study highlights discrepancies between recommended and actual occupational
58 therapy practices, emphasizing the need for improved integration of evidence-based
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assessment and intervention strategies for upper limb rehabilitation in children with unilateral cerebral palsy.

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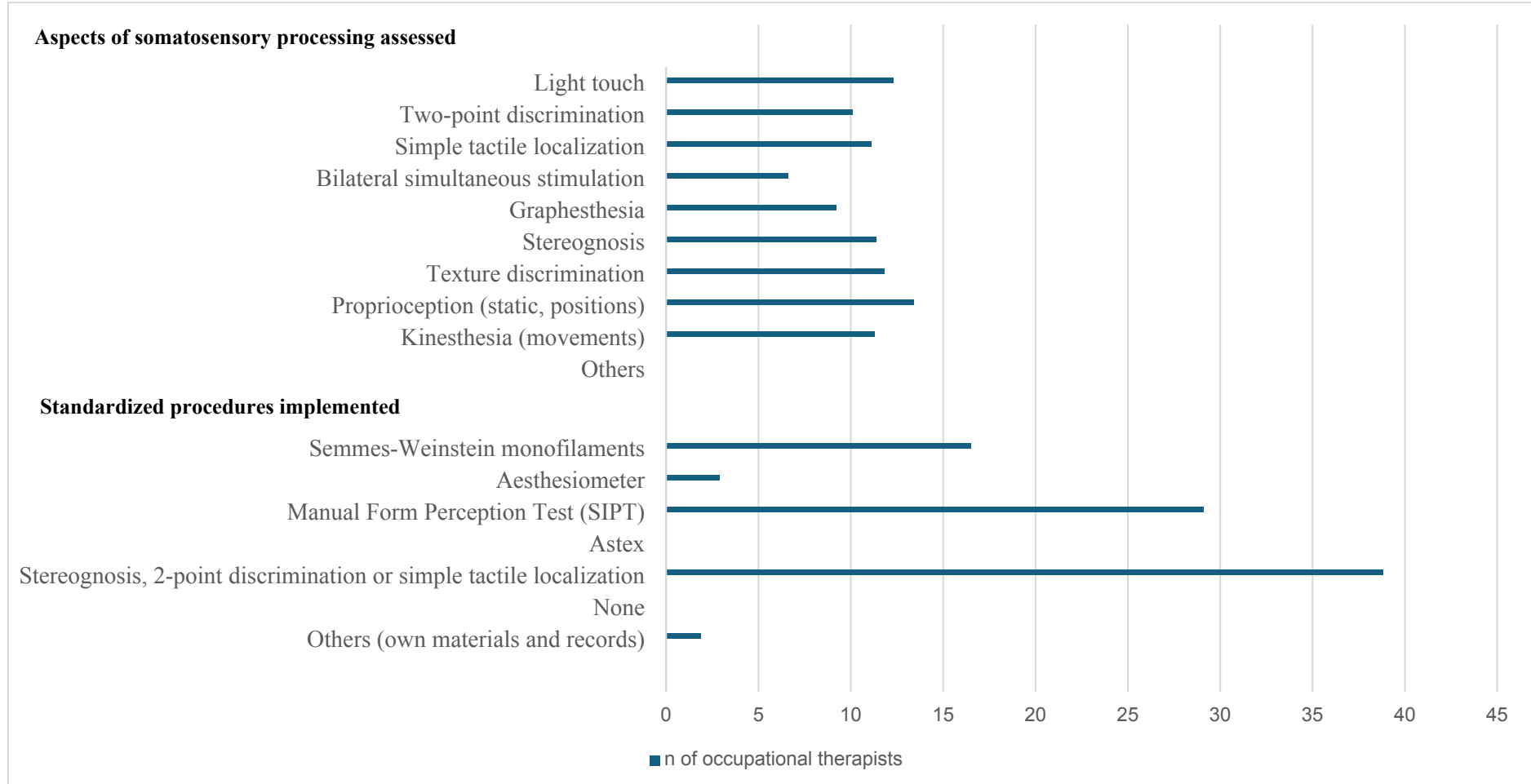
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For Peer Review

Figure 1. Aspects of somatosensory processing assessed and standardised procedures implemented.



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