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## Narrative Noun Phrase Elements in Tamil-Speaking Unilateral Cochlear Implant Users and Typically Developing Children: Findings from a Secondary Analysis

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### ABSTRACT

This cross-sectional secondary analysis investigated syntactic complexity in narrative production among Tamil-speaking children with and without hearing impairment. Narrative retellings from 30 children aged 3 to 5 years: 15 typically developing (TD) children and 15 unilateral cochlear implant users (UCCIU), matched by language age, were re-analysed for noun phrase element (NPE) usage. In a study examining eight types of noun phrase (NPE) constructions namely determiners, possessive nouns, possessive pronouns, attributive adjectives, participial adjectives, pre-modifiers, conjunctions, and personal nouns significant differences emerged between typically developing (TD) children and children with unilateral congenital conductive hearing loss (UCCIU). The TD group demonstrated notably higher usage of determiners, attributive adjectives, pre-modifiers, and conjunctions ( $p < 0.01$ ), suggesting greater syntactic elaboration in their language development. In contrast, UCCIU children showed a marked preference for personal nouns ( $p = 0.043$ ), indicating a potential reduction in their complex syntactic structures. Interestingly, no significant differences were observed in the use of possessive or participial forms between the groups. These findings elucidate how auditory deprivation may adversely affect grammatical development, particularly in morpho-syntactically rich languages like Tamil. The results also imply that limited exposure to complex noun phrases could hinder narrative cohesion among UCCIU children. This study emphasizes

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the urgent need for tailored language interventions that foster syntactic elaboration in narrative construction, particularly in low- and middle-income contexts such as India. Furthermore, future longitudinal research is recommended to assess the efficacy of these interventions and to explore the developmental trajectories of affected children.

**Keywords:** Noun Phrase Elaboration; Narrative Coherence; Prenominal Position; Influential Language; Language Development

## 1. Introduction

A noun phrase forms an essential building block in language, made up of a noun and various modifiers, such as determiners, adjectives, and pronouns. Such phrases enhance clarity and reduce repetition, improving narrative coherence. NPs serve pivotal roles as subjects, objects, or complements, which are indispensable in the construction of sentences and the progression of narratives.

The analysis of noun phrase elements (NPEs) within narratives is paramount for comprehending language development, as they facilitate the introduction and maintenance of key referents. This scrutiny enables practitioners to assess syntactic complexity, descriptive richness, and narrative proficiency, thereby elucidating developmental trajectories and challenges faced by children experiencing hearing impairments or language delays. The ability to formulate complex noun phrases signifies children's grammatical advancement and narrative adeptness. As children evolve from simple to more intricate constructions, they exhibit a profound grasp of linguistic nuances, which, in turn, bolsters their confidence and cognitive faculties. Such development enhances communicative competencies, nurturing meaningful interactions and fostering deeper relational connections.

The elaboration of noun phrases represents a significant milestone in language development, encapsulating children's capacity to construct detailed and coherent narratives. Empirical research substantiates that proficiency in employing complex noun phrases (ENPs) matures with age, substantially contributing to narrative sophistication. For instance, children commence the incorporation of post-modifiers as early as four years of age, with complexity attaining its zenith by age eleven, after which the utilisation of ENPs stabilises as the emphasis transitions from narrative to expository discourse. Furthermore, ENPs are integral to the evolution of literate language, augmenting children's capabilities to

describe, compare, and elaborate within their narratives<sup>[1,2]</sup>.

### 1.1. Cross-Linguistic Perspectives on Noun Phrase Acquisition

The acquisition of noun phrases (NP) in children adheres to universal patterns that are influenced by languages. Research illustrates that as children refine their language abilities, their employment of nouns and noun phrases transitions from simplistic labels to more intricate descriptions, thereby enhancing narrative depth. In English, children typically navigate through distinct stages of NP development: by age three, they employ basic determiners and adjectives; by age five, they integrate quantifiers and ordinal expressions; and by age seven, they consistently employ more sophisticated noun phrases incorporating relative and prepositional phrases. This trajectory reflects an amalgamation of lexical expansion, syntactic comprehension, and cognitive maturation.

Cross-linguistic investigations, particularly those examining German, Russian, and Bulgarian, unveil significant disparities in the manner in which children deploy pronouns and anaphoric references to sustain narrative coherence. German-speaking children gradually acquire anaphoric constructs, whereas Russian-speaking children exhibit an earlier proficiency in these constructs, indicating variability across languages. These findings accentuate the impact of specific linguistic frameworks on the developmental pathways of noun phrase acquisition. Collectively, the interaction between universal tendencies and language-specific factors shapes how children acquire and refine their utilisation of noun phrases, thereby enhancing their narrative capabilities as they mature. Targeted instruction in the construction of ENPs further augments linguistic complexity and narrative cohesiveness, emphasising the significance of focused interventions in the domain of language acquisition<sup>[2,3]</sup>.

## 1.2. Noun Phrases in Tamil: Structural and Typological Features

Tamil, recognised as a Dravidian language, manifests typological originality attributable to its Subject-Object-Verb (SOV) syntactic arrangement and the sole application of pre-modifiers. This linguistic arrangement requires a significant degree of syntactic exactitude, as noun-modifying expressions (NMEs) precede the noun and comprise determiners, possessives, attributive adjectives, and participial clauses. The presence of such pre-modification elevates cognitive demands, thereby impacting the complexity of narratives<sup>[4,5]</sup>.

In relation to auditory impairment, children equipped with cochlear implants frequently demonstrate delays in both syntactic and narrative development attributable to diminished auditory input. Studies indicate that those who receive early intervention services, such as speech therapy or the use of cochlear implants, demonstrate improved outcomes in their ability to produce complex noun phrases compared to peers who do not have access to similar resources<sup>[6,7]</sup>.

Investigations centred on Tamil narratives substantiate these difficulties. Tamil-speaking children with hearing impairments demonstrate significant limitations in the microstructural aspects of narratives, encompassing utterance complexity and pronoun cohesion, despite having a chronological age comparable to that of their typically developing peers. Muthu et al.<sup>[8]</sup> indicated that Tamil-speaking children possessing normal auditory abilities demonstrate a more enhanced representation of story-grammar constituents in narrative retelling tasks, which comprise characters, setting, initiating events, internal plans, attempts, outcomes, and resolutions, in contrast to young unilateral cochlear implant users with equivalent linguistic proficiency. Collectively, these investigations highlight the challenges faced in achieving coherent narrative production among children with hearing impairment. Children with hearing impairments (HI), particularly those utilising cochlear implants (CIs), encounter distinctive obstacles in mastering the intricate noun phrase (NP) structures characteristic of Tamil. The attenuation of auditory input during significant periods of language acquisition commonly results in lags in the evolution of syntactic proficiencies, particularly in the use of multiple pre-modifiers and clausal frameworks<sup>[9]</sup>.

While previous investigations have enhanced the comprehension of narrative competencies in Tamil-speaking chil-

dren utilising cochlear implants, substantial deficiencies endure regarding the microstructural facets of their narratives. The principal study conducted by Muthu et al.<sup>[8]</sup> underscored macrostructural dimensions such as story grammar; however, it did not delve into syntactic specifics such as noun phrase elements (NPEs). Likewise, antecedent research primarily focused on overarching microstructural indicators, including total word count and mean utterance length, without analysing the precise syntactic and morphological constituents that contribute to narrative elaboration<sup>[10]</sup>.

Furthermore, cross-linguistic evaluations that assess Tamil's typological characteristics, especially its unique dependence on pre-modifiers, in contrast to the evolution of noun phrases in alternative languages, are absent. This deficiency restricts the understanding of how Tamil-specific syntactic requirements influence language acquisition in children experiencing hearing impairment.

Moreover, prior studies have not adequately considered task-related variability, rendering it ambiguous how various narrative elicitation tasks affect the employment of NPEs. Notably, in lower-middle-income countries (LMICs) such as India, systemic factors including restricted access to early intervention, postponed cochlear implantation, and limitations in resources are likely to intensify the difficulties associated with acquiring intricate syntactic structures. It is essential to recognise that in lower-middle-income countries (LMICs) such as India, factors such as constrained access to early intervention services, economic limitations, and the provision of auditory-verbal therapy may further influence language development outcomes for children with hearing impairment. These socioeconomic and healthcare inequities necessitate research that explores not only linguistic outcomes but also context-specific barriers and requirements.

Prior research has documented significant deficits in narrative development among Tamil-speaking children with cochlear implants and hearing aids compared to their typically developing peers. For instance, Muthu and Venkatraman<sup>[8]</sup> found that children with hearing impairments produced narratives with fewer story grammar elements, including settings, characters, and resolutions, highlighting weaknesses in macrostructural organisation. Microstructural analyses showed that Tamil-speaking cochlear implant users told shorter stories with simpler sentences and less detailed language, even though their language skills were similar to

their peers. While such studies have pointed out the value of narrative-based assessment and intervention, they have primarily focused on general productivity measures (e.g., mean length of utterance, total word count) or global story grammar, rather than specific syntactic structures such as noun phrase elaboration. Additionally, research on narrative-based language intervention (NBLI) has shown improvements in the quality of stories and the complexity of sentences for children with cochlear implants. However, no research so far has looked closely at how specific parts of noun phrases, like determiners, premodifiers, and attributive adjectives, are used in Tamil stories by cochlear implant users compared to their peers who are the same age in language skills. This critical gap limits our understanding of microstructural syntactic development and the tailoring of culturally responsive interventions. The present study therefore seeks to address this gap through an analysis of how this population uses noun phrases<sup>[10–13]</sup>.

## 2. Materials and Methods

### 2.1. Study Design

This study is a secondary analysis of a previously conducted cross-sectional study approved by the Institutional Ethics Committee at Sri Ramachandra Institute of Higher Education and Research (IEC No.: CSP/22/DEC/119/595). The primary study explored story-grammar elements in the narratives of Tamil-speaking children with and without hearing impairment. For the present analysis, we re-evaluated the same dataset with a specific focus on microstructural components, particularly noun phrase elements (NPEs)<sup>[8]</sup>.

### 2.2. Patient and Public Involvement

Patients and the public were not directly involved in the design, conduct, reporting, or dissemination plans of this secondary analysis study. The dataset used was derived from a previously approved study, and no new data collection or participant involvement was required for this secondary analysis.

### 2.3. Participants

The dataset consisted of 30 Tamil-speaking children (**Table 1**) aged 3–5 years: 15 typically developing (TD) children with normal hearing and 15 unilateral child cochlear implant users (UCCIU). TD children had no reported hearing loss, middle ear infections, or speech-language delays and used Tamil as their primary language. UCCIU participants had prelingual severe-to-profound hearing loss diagnosed before age 3, unilateral cochlear implantation, and used Tamil as their primary mode of communication. Children with additional disabilities were excluded. Both groups were matched for language age using the Assessment of Language Development (ALD) tool. The ALD is a standardized assessment developed for Indian children that yields separate age-equivalent scores for receptive and expressive language level from birth to ten years of age. Sample size was determined based on the availability of participants in the original study and logistical constraints inherent to secondary data analysis. No formal power calculation was conducted due to the retrospective nature of the design. Socioeconomic status was not controlled in the analysis, which is a limitation for interpreting group differences<sup>[14]</sup>.

**Table 1.** Participants’ description for narrative comparison.

Groups	Number of Participants	Mean Age	Mean Language Age	Duration of Rehabilitation	Age of Implantation
Normal hearing children	15 (8 Males/7 Females)	4.5	4.5	-	-
UCCIU	15 (8 Males/7 Females)	4.5	4.3	4.2	2.4

### 2.4. Ethical Considerations

The original study was conducted following ethical guidelines, with approval from the Institutional Ethics Committee. Parents provided written informed consent. The secondary analysis used anonymised data, with mail permis-

sion from the authors of the primary study.

### 2.5. Data Collection

The primary study used the storytelling task with the Tamil-translated picture book *My Fish! No, My Fish!*, vali-

dated for use with Tamil-speaking children aged 3–6 years. After a storytelling session using visual aids, children were prompted to retell the story following a 1–2-minute break. Neutral prompts were used to facilitate retelling, and the sessions were audio-visually recorded for transcription.

*Phase 1. Re-transcription of Narrative Samples:* All

samples were re-transcribed to identify the eight NPEs: determiners, possessive nouns, possessive pronouns, participial adjectives, nouns as pre-modifiers, appositive noun phrases, attributive adjectives, and conjunctions (Table 2). These elements were extracted and examined from each child’s 20 utterances of narrative samples.

**Table 2.** Examples of Noun Phrase Elements in Tamil with English Translations.

NPE	Language	IPA Example	Translation/Explanation
Determiners	English	/wʌn/, /ðɪs/	one, this
	Tamil	/oru/	one/a
	Tamil	/inda/	this
Possessive Nouns	English	/ræms/ /kar/	Ram’s car
	Tamil	/ræm/	Ram
	Tamil	/o:da/	Ram’s (of Ram)
	Tamil	/kar/	car
Possessive Pronouns	English	/jɔ:z/, /mam/	yours, mine
	Tamil	/unno:ɖədu/	yours
	Tamil	/enno:ɖədu/	mine
Participial Adjectives	English	/flaɪɪŋ/ /bɜ:rd/	flying bird
	Tamil	/keɪtʃa/	naughty
	Tamil	/paiyan/	Boy
Nouns (Pre-modifiers)	English	/haʊs/ /rent/	house rent
	Tamil	/vi:tʃu/	house
	Tamil	/va:ɖəɖəgai/	rent
Appositive Noun Phrases	English	/maɪ/ /sʌn/, /ra:m/	My son, Ram
	English	/əvən/ /nanban/, /kɪtʃɪʃu/	His friend, Kichu
	Tamil	/en/	my
	Tamil	/paiyan/	boy/son
	Tamil	/ra:m/	Ram
	Tamil	/hɪz/	His
	Tamil	/preɪɳɖ/	friend
Tamil	/kɪtʃɪʃu/	Kichu	
Attributive Adjectives	English	/blu/ /skaɪ/	blue sky
	English	/bɪg/ /fɪʃ/	big fish
	Tamil	/nəllə/ /kəɖəj/	good shop
	Tamil	/perɪjə/ /mi:n/	big fish
Conjunctions	English	/ænd/, /so /	and, so
	Tamil	/aɖuvum/ – /iɖuvum/	that too – this too
	Tamil	/aɖuna:la/	therefore/so

### 2.5.1. Determiners

A determiner is a word that is used to modify or introduce the noun in a sentence.

English: /wʌn/, /ðɪs/

Tamil: /oru/, /inda/

### 2.5.2. Possessive Noun

A possessive noun is a noun that shows ownership,

usually identified by ‘s in English.

English: /ræms/ /kar/

Tamil: /ræm/ /o:da/ /kar/

### 2.5.3. Possessive Pronouns

Possessive pronouns indicate that something belongs to someone or has a direct relationship with someone else.

English: /jɔ:z/, /mam/

Tamil: /unno:ɖədu/, /enno:ɖədu/

### 2.5.4. Participial Adjective

Participial adjectives constitute a significant subclass of adjectives. They can be distinguished by their endings, usually “ed” or “ing.”

English: /flaɪŋ/ /bɜːrd/  
 Tamil: /ketʃa/ /paiyan/

### 2.5.5. Nouns (As Pre-Modifiers)

A premodifier is a linguistic unit that comes before a noun to classify/categorize the referent of the noun by pointing out its quality.

English: /haus/ /rent/  
 Tamil: /vi:ttu/ /va:qəgai/

### 2.5.6. Appositive Noun Phrase

An appositive is a noun or noun phrase that renames another noun beside it.

English: /maɪ/ /sʌn/, /ra:m/; /hɪz/ /frɛnd/, /kɪtʃɪʃu/  
 Tamil: /en/ /paiyan/, /ra:m/; /əvən/ /nanban/, /kɪtʃɪʃu/

### 2.5.7. Attributive Adjectives

An adjective that comes before the noun it modifies is called an attributive adjective. It is always a part of a noun phrase where it modifies the head of the noun phrase (noun).

English: /blu/ /skai/, /bɪg/ /fɪʃ/  
 Tamil: /nəllə/ /kaɖai/, /perijə/ /mi:n/

### 2.5.8. Conjunctions

A conjunction is a word used to connect words, phrases, and clauses.

English: /ænd/, /soʊ/  
 Tamil: /aɖuvum/ – /iɖuvum/, /aɖuna:la/

*Phase 2. Mapping of Noun Phrase Elements:* The transcribed data were mapped according to Rajendran’s classification of noun-modifying expressions (NMEs) in Tamil (Table 3). The NPEs were identified and coded across the different age groups to explore how these elements vary with age and hearing status<sup>[4]</sup>.

*Example:*

/ənda/ /mi:ŋ/	/o:qəndzə/ /kɔtʃɪʃi/
Determiner + Noun	Participial adjective + Noun
/əŋŋa:vum/ /pəjjənum/	/nəllə/ /irundodə/
Conjunction	Attributive adjective + Verb
/təŋŋi/ /illə/	/preŋd/ /kɪtʃɪʃu/
Pre-modifier + Noun	Appositive adjective
/jɛnno:qəɖu /	/vitʃɪʃu/ /o:qə/
Possessive Pronoun	Name + Possessive noun

**Table 3.** Example Mapping of Noun Phrase Elements.

IPA Phrase	Type	Translation
/ənda/ /mi:ŋ/	Determiner + Noun	that fish
/o:qəndzə/ /kɔtʃɪʃi/	Participial adjective + Noun	Broken stick
/əŋŋa:vum/ /pəjjənum/	Conjunction	Brother and the boy
/nəllə/ /irundodə/	Attributive adjective + Verb	was good
/təŋŋi/ /illə/	Pre-modifier + Noun	No water
/preŋd/ /kɪtʃɪʃu/	Appositive noun phrase	friend Kichu
/jɛnno:qəɖu/	Possessive pronoun	mine
/vitʃɪʃu/ /o:qə/	Name + Possessive noun	Vichu’s

*Phase 3. Statistical Analysis:* Two trained speech-language pathologists independently annotated the NPEs. Training included alignment on Rajendran’s framework and inter-rater calibration using a pilot set (Cohen’s  $\kappa = 1.00$ ). Coders were blinded to participant group during annotation to minimize bias. The frequency of each NPE across all samples was calculated, and the results were tabulated using Excel. The Mann-Whitney U test was employed to compare the NPE between the two groups using SPSS (version 28).

## 3. Results

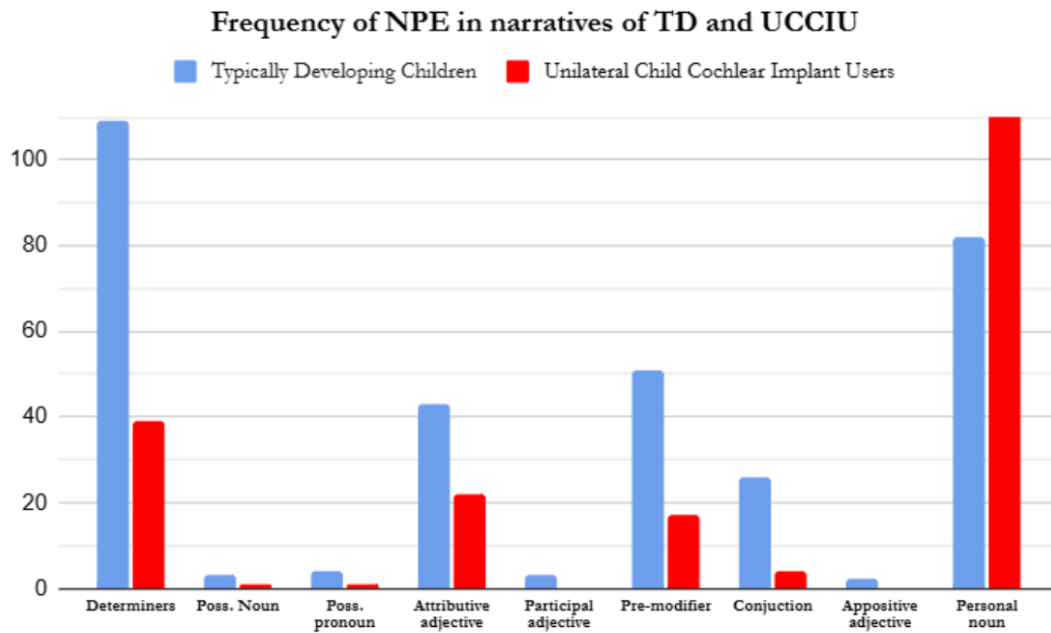
A Mann-Whitney U test (Table 4) revealed significant differences in several noun phrase elements (NPEs) between typically developing (TD) children and unilateral cochlear implant users (UCCIU). TD children produced significantly more determiners ( $U = 40.00, p = 0.002$ ), attributive adjectives ( $U = 43.00, p = 0.003$ ), pre-modifiers ( $U = 34.00, p = 0.001$ ), and conjunctions ( $U = 47.00, p = 0.003$ ), indicating

greater syntactic elaboration in their narratives. A statistically significant difference was also found for personal nouns ( $U = 64.00, p = 0.043$ ), with UCCIU children using them more frequently, suggesting a tendency toward simpler noun phrase constructions. No significant group differences

were observed in the use of possessive pronouns, possessive nouns, participial adjectives, or appositive adjectives ( $p > 0.05$ ). **Figure 1** illustrates NPE frequency: TD children showed higher use of determiners and conjunctions; UCCIU children showed increased use of personal nouns.

**Table 4.** Comparison of Noun Phrase Elements in TD Children and UCCIU.

Variables	Group	Mann-Whitney U Test	Wilcoxon's W Test	Z Value	p Value
Determiners	TD children and UCCIU	40.000	160.000	-3.024	0.002
Possessive nouns	TD children and UCCIU	97.500	217.500	-1.056	0.291
Possessive Pronouns	TD children and UCCIU	90.000	210.000	-1.445	0.148
Attributive adjectives	TD children and UCCIU	43.000	163.000	-2.953	0.003
Participial adjectives	TD children and UCCIU	90.000	210.000	-1.795	0.073
Pre-modifiers	TD children and UCCIU	34.000	154.000	-3.385	0.001
Conjunctions	TD children and UCCIU	47.000	167.000	-2.973	0.003
Appositive adjectives	TD children and UCCIU	97.500	217.500	-1.439	0.150
Personal Nouns	TD children and UCCIU	64.000	184.000	-2.027	0.043



**Figure 1.** Frequency of noun phrase elements in narratives of typically developing and Unilateral cochlear implant user.

## 4. Discussion

This study provides the first syntactically focused comparison of noun phrase elaboration in Tamil-speaking children with and without hearing impairment, highlighting how early auditory deprivation constrains grammatical development. The results revealed consistent reductions in the use of syntactic modifiers and connectives among UCCIU participants. These findings support the role of auditory input in

scaffolding complex morphosyntactic development, particularly in languages such as Tamil that rely on strict prenominal structure.

### 4.1. Theoretical Insights on Noun Phrase Development

Noun phrase development is a critical component of syntactic and narrative competence. According to Börjars

and Delsing (2008), the complexity of noun phrases reflects a child's ability to integrate grammatical and lexical knowledge. Determiners, possessive pronouns, and modifiers enhance syntactic complexity, while conjunctions improve narrative coherence. Rajendran's classification of noun-modifying expressions (NMEs) in Tamil emphasises the integral role of noun-modifying expressions (NMEs) in Tamil syntax. The strict prenominal placement of determiners, adjectives, and participial clauses in Tamil contrasts with the flexible placement in English. This structural constraint demands higher cognitive and auditory processing precision, often compromised in children with hearing impairments<sup>[4,15]</sup>.

## **4.2. Understanding Differences in Noun Phrase Elements in Language Development**

Language acquisition shows significant differences in how typically developing children (TD) and those with unilateral cochlear implants (UCCIU) use certain noun phrase elements. These differences shed light on the impact of auditory input on narrative skills and overall language development.

### **4.2.1. Determiners**

Determiners are crucial for establishing specificity and coherence in storytelling. Research shows that TD children utilise a wider range and frequency of determiners, indicating more advanced grammatical structures. In contrast, UCCIU children tend to use fewer determiners. This pattern aligns with theories suggesting that auditory deprivation during critical periods of language acquisition limits early exposure to grammatical input. More input is needed to develop essential grammatical categories, such as determiners, which are vital for constructing meaningful sentences<sup>[6]</sup>.

### **4.2.2. Possessive Pronouns and Nouns**

Both TD and UCCIU children demonstrated similar usage patterns of possessive pronouns, likely because these elements are introduced early in language development and reinforced through direct instruction. However, the analysis revealed a statistically significant difference in the use of personal nouns, with UCCIU children relying more heavily on them ( $p = 0.043$ ). This reliance reflects a simpler syntactic strategy, potentially influenced by limited access to diverse grammatical input. The preference for unmodified

or standalone nouns over possessive or embedded structures may indicate reduced exposure to complex noun phrase constructions in naturalistic language contexts<sup>[16]</sup>. Additionally, the increased use of personal nouns among UCCIU children, as shown in the present study, may reflect a compensatory strategy to simplify referential constructions, which further impacts narrative cohesion.

### **4.2.3. The Use of Adjectives**

The frequency of attributive adjectives, which describe and modify nouns, is another area where notable differences emerge. TD children use these adjectives more often, indicating advanced narrative elaboration and the ability to create rich, engaging stories. In contrast, UCCIU children's reduced use of adjectives may stem from difficulties with lexical retrieval and auditory processing, ultimately limiting their access to a broader descriptive vocabulary<sup>[1]</sup>. Lexical access and retrieval are critical for producing cohesive noun phrases. Previous have shown that children with cochlear implants face delays in lexical retrieval, particularly for adjectives and modifiers. These findings align with the reduced frequency of attributive adjectives and determiners observed in UCCIU children's narratives in this study. The reliance on simpler noun phrases reflects a compensatory strategy for lexical retrieval challenges. Without consistent auditory exposure during early language development, children with cochlear implants face difficulties in building robust mental lexicons for descriptive and functional modifiers. These challenges manifest as simpler sentence structures and limited narrative richness<sup>[17,18]</sup>.

### **4.2.4. Pre-Modifiers and Appositive Constructions**

Both pre-modifiers and appositive constructions enrich linguistic clarity and sophistication. The fact that these structures are more common in TD children fits with the idea that expressive language skills get better with age. Conversely, the limited representation of these constructions by UCCIU children may reflect challenges in integrating complex syntactic structures due to limitations in auditory input and reduced opportunities for incidental learning<sup>[19]</sup>.

### **4.2.5. Conjunctions and Narrative Coherence**

Conjunctions play a critical role in linking ideas and achieving narrative coherence. The lower frequency of conjunction use among UCCIU children highlights the struggles

those with hearing impairments face in employing cohesive devices in their narratives. This challenge may arise from difficulties in perceiving and practising connective structures typical in everyday speech<sup>[9]</sup>.

The findings suggest that typically developing (TD) children demonstrate greater use of noun modifiers and entities (NMEs) compared to children with unilateral cochlear implants (UCCIU). This difference may arise from the cognitive burden of integrating pre-nominal modifiers in Tamil, leading UCCIU children to favour simpler noun phrases. Early auditory exposure is crucial for language development; disparities in noun phrase elaboration between UCCIU and TD children may reflect variations in neural processing within hearing-impaired groups.

Regarding the morphosyntactic agreement, Tamil's requirement for modifier-noun concordance presents a challenge for UCCIU children, who often default to using unmodified nouns. Tamil's topic-prominent structure influences narrative composition, with TD children's narratives aligning well with these structures, whereas UCCIU children's narratives may deviate, indicating difficulty with topic-comment relationships.

Research indicates that language processing challenges for children with cochlear implants primarily involve lexical access for production and comprehension. Although some studies suggest that children with cochlear implants can reach similar word retrieval abilities as their normal-hearing peers, their processing of phonological information differs, often being slower. Additionally, these children tend to make more naming errors with adjectives than nouns and exhibit a higher rate of non-responses when identifying nouns<sup>[17,18]</sup>.

### **4.3. Auditory Deprivation and Age of Implantation: Indian Context**

The age of cochlear implantation and the duration of auditory exposure play a pivotal role in language development, especially in syntactic structures like noun phrases. Research highlights the importance of early implantation, preferably before two years of age, to optimise auditory input during the critical period of language acquisition. In the Indian scenario, delays in cochlear implantation are common due to financial constraints, limited awareness, and challenges in accessing specialised care<sup>[20-22]</sup>.

The present study observed that UCCIU children exhibited reduced use of determiners, attributive adjectives, and conjunctions compared to their TD peers. These findings align with previous research indicating that delayed implantation reduces the cumulative auditory input required for developing grammatical categories, including NPEs. Additionally, inconsistent access to auditory-verbal therapy and limited post-implantation support further exacerbate these syntactic delays<sup>[23]</sup>.

Regular cochlear implant wear time is equally critical for linguistic development. Literature suggests a minimum of 9–12 hours of daily implant use for optimal language outcomes. However, adherence to this recommendation is often inconsistent in the Indian context due to socio-cultural and logistical barriers. These factors collectively impact the auditory foundation for processing and integrating complex syntactic structures, including noun phrases<sup>[24,25]</sup>.

### **4.4. Cognitive Processing and Syntactic Complexity**

Integrating prenominal modifiers, determiners, and conjunctions in Tamil noun phrases imposes significant cognitive demands, particularly for children with auditory processing deficits. According to the Processing Constraints Model, cognitive resources like working memory and processing speed impact language acquisition<sup>[26,27]</sup>.

The reliance of UCCIU children on simpler noun phrases, such as personal nouns and basic determiners, reflects the cognitive burden of managing both auditory input and syntactic formulation. Tamil's SOV structure and strict modifier-noun agreement further increase this mental load. In contrast, TD children demonstrated more sophisticated syntactic integration, reflecting their ability to balance cognitive resources for auditory processing and syntactic construction.

Additionally, working memory plays a critical role in the processing and production of complex syntactic structures. Children with cochlear implants often exhibit limitations in phonological working memory, affecting their ability to integrate modifiers and determiners cohesively in their narratives. These cognitive constraints likely contribute to the reduced syntactic complexity observed in UCCIU narratives<sup>[28]</sup>.

#### 4.5. Microstructure and Macrostructure in Narratives

Narrative skills are built on an interplay between microstructural elements (e.g., noun phrases, conjunctions, adjectives) and macrostructural organisation (e.g., characters, settings, events). Previous studies have highlighted the role of noun phrases in anchoring critical narrative components, such as introducing characters and describing settings. The microstructural problems in this study were that UCCIU children didn't use enough determiners, attributive adjectives, and conjunctions, all needed to make narrative microstructures that are detailed and make sense. These microstructural limitations likely disrupted the organisation of macrostructure elements, such as character introductions, logical event sequences, and plot cohesion. The Story Grammar Theory emphasises the role of syntactic structures like noun phrases in building narrative coherence. Reduced NPE usage among UCCIU children may have impacted their ability to introduce and elaborate on narrative elements, limiting overall coherence and richness<sup>[5,9,29]</sup>.

#### 4.6. Sociocultural and Linguistic Factors in Tamil Noun Phrase Development

Tamil's unique syntactic demands, such as its word order and reliance on pre-nominal modifiers, place greater cognitive demands on auditory and working memory resources. Cultural norms in Tamil emphasise vivid descriptions and detailed character portrayals. TD children demonstrated syntactic sophistication that aligns with these expectations, while UCCIU children's simpler constructions suggest limited alignment with these cultural norms. The Social Interactionist Theory says that caregiver interaction and scaffolding are essential for language development. The fact that UCCIU children may not have had as many opportunities to be in rich narrative interactions may have made these differences even more prominent. Studies in other SOV languages, like Japanese and Korean, show that learning pre-nominal modifiers follows a similar developmental path to Tamil. Hearing these structures early on is very important for mastering them. These cultural expectations further highlight the importance of descriptive language. In Tamil cultural storytelling, vivid modifier use is essential for character portrayal, which may explain TD children's syntactic

elaboration. In contrast, UCCIU children's more straightforward narratives may indicate linguistic limitations and reduced engagement with cultural norms due to delayed or restricted language acquisition.

#### 4.7. Implications for Intervention and Rehabilitation

The study emphasises the significance of language intervention programs for Tamil-speaking children who have cochlear implants. Key strategies include early and consistent auditory exposure, explicit teaching of Tamil-specific noun phrase structures, narrative-based therapy, working memory training, and cultural adaptation. Advocacy for early implantation and consistent implant wear time is crucial for foundational auditory input. Narrative-based therapy enhances both microstructural and macrostructural narrative elements, while working memory training support the development of complex syntactic structures. The present study recommends a culturally adapted Narrative-Based Language Intervention (NBLI) program incorporating visual storytelling materials familiar to Tamil-speaking children, structured story retell and generation activities, and explicit syntactic scaffolding to target the use of pre-modifiers and determiners. Such intervention can draw on techniques such as acoustic highlighting of target structures and caregiver-supported practice, as supported by Justice et al.<sup>[11]</sup> and Ukrainetz et al.<sup>[19]</sup>.

### 5. Conclusions

This study highlights significant differences in the usage of Noun Phrase Element (NPE) between Tamil-speaking, typically developing children and unilateral cochlear implant users. These differences stem from the combined effects of auditory deprivation, cognitive processing limitations, and linguistic constraints imposed by Tamil's typology. The Indian scenario presents additional challenges, including delayed implantation, inconsistent therapy access, and socio-cultural barriers, all of which influence language outcomes. Addressing these challenges through comprehensive, culturally sensitive interventions is essential for bridging the narrative development gap between TD and UCCIU children. Future research should focus on longitudinal studies to better understand the long-term impact of early auditory

intervention and targeted linguistic therapies on narrative development in Tamil-speaking children with cochlear implants. As a secondary analysis, the study is limited by the structure of the pre-existing dataset, including lack of randomisation, absence of control for elicitation style, and no direct comparison of narrative task complexity. Future longitudinal studies are warranted to examine intervention efficacy and developmental trajectories. Key limitations include small sample size and lack of SES control, which should be addressed in future studies via stratified sampling or regression controls.

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Conceptualization, methodology, writing, data analysis, supervision: K.V. Original draft preparation, review and editing: S.L. and M.R. All authors have read and agreed to the published version of the manuscript.

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## Institutional Review Board Statement

The study was approved by the Institutional Ethics Committee of Sri Ramachandra Institute of Higher Education and Research, Chennai, India (CSP/22/DEC/119/595; Date of Approval: December 2022).

## Informed Consent Statement

Informed consent was obtained from all subjects involved in the study. Written informed consent for publication was also obtained from parents or legal guardians of the participants.

## Data Availability Statement

The data presented in this study are available on request from the corresponding author. The data are not publicly available due to ethical and privacy restrictions involving child participants.

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## Conflicts of Interest

The authors declare no conflict of interest.

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