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Comparative study of the imitation ability in Specific Language Impairment and Autism Spectrum Impairment

Estudo comparativo da habilidade de imitação no Transtorno Específico de Linguagem e no Transtorno do Espectro do Autismo

ABSTRACT

Purpose: To compare abilities of imitating generic and sequential motion gesture schemes in family routines among children with Autism Spectrum Disorder (ASD) and Specific Language Impairment (SLI) and to analyze the relation between imitation index and verbal production in the ASD group. **Methods:** The sample was constituted by 2:1 pairing of 36 children, according to gender and age. All of them were diagnosed by a multidisciplinary team as belonging to the ASD group (n=24) or SLI group (n=12) and were under direct and indirect intervention in a school clinic. We have used the stage of imitation of the Assessment of Symbolic Maturity, which entails the imitation of nine generic and three sequential motion gesture schemes. **Results:** There was a tendency to a better performance of the SLI group at imitating both generic and sequential gesture schemes. As we have related the ability of imitation to the verbal production in the ASD group, a direct relation between the production of phrases and the imitation of sequential schemes was detected. **Conclusion:** The ability to imitate gesture and sequential schemes could be compared, and a more prominent impairment was identified in children with autism. Among them, a direct significant relationship between the ability of imitating sequential gesture schemes in family routine and verbal production of words and sentences was verified.

RESUMO

Objetivo: Comparar as habilidades de imitação de esquemas gestuais simples e de sequências de ações em rotinas familiares de crianças com Transtorno do Espectro do Autismo (TEA) e com Transtorno Específico de Linguagem e Fala (TEL) e analisar a relação entre o índice de imitação e a produção verbal das crianças do Grupo TEA. **Métodos:** A amostra foi constituída pelo pareamento 2:1 de 36 crianças, de acordo com gênero e faixa etária. Todas foram diagnosticadas por equipe multidisciplinar como pertencentes ao Grupo TEA (n=24) ou grupo TEL (n=12) e atendidas em intervenção direta e indireta em clínicaescola. Utilizamos a etapa de imitação da Avaliação da Maturidade Simbólica, que compreende a imitação de nove esquemas gestuais simples e de três esquemas gestuais sequenciais. **Resultados:** Observamos tendência de melhor desempenho do Grupo TEL na imitação de esquemas gestuais tanto simples como sequenciais. Ao relacionarmos a habilidade de imitação à produção verbal do Grupo TEA, verificamos relação direta entre produção de frases e imitação de esquemas sequenciais. **Conclusão:** Foi possível comparar a habilidade de imitação gestual e de esquema sequencial e verificar maior comprometimento de desempenho nas crianças com diagnóstico compatível com o Espectro do Autismo. Dentre estas, verificouse relação direta significativa entre a habilidade de imitação de sequências de rotinas familiares e a produção verbal de palavras e frases.

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Conflict of interests: none.

INTRODUCTION

Imitation plays a central role in motor, language, and social development of children[1-3]. It is closely related to language development, especially with regard to the development of social communication skills[1-3].

The ability to imitate is known to be fundamentally responsible for the production and variance of expressive and receptive vocabulary in the early years of life[3].

Children with disorders that affect development, such as Autism Spectrum Disorder (ASD) and Specific Language Impairment (SLI), have major flaws as to this skill.

In the case of ASD, a condition characterized by severe and persistent impairments in social interaction and communication and a restricted range of activities and interests[4-7], the inability related to imitation results from impairments in social cognition, especially the lack of reciprocity and social engagement and difficulty in attribution of mental states. Therefore, this inability cannot be explained by factors such as memory, spatial reasoning, or motor control failures.

In cases of SLI, a condition in which verbal modes of comprehension and expression are compromised regardless of neurological, sensory, cognitive, and/or environmental abnormalities[4,8-11], failure to imitate does not result from the lack of basic social interaction and communication but from poor performance of working memory, attention, and visual-spatial orientation[8-11].

Thus, the hypothesis of this study is that there is a difference in the ability to imitate as related to these developmental disorders. Children whose performance is affected by ASD present disadvantage compared to those with SLI, for this is a condition whose primary manifestation is deficit of social cognition. We also considered that there is a relationship between imitation skills and verbal production among children diagnosed with ASD.

The objectives of this study were to compare abilities of imitating generic motion gesture schemes and sequential gestures in family routines of children with ASD and with SLI, and to analyze the relationship between imitation index and verbal production among children with ASD.

METHODS

This is a case-control study (CEP No. 110442). All parents or guardians were aware of the methodological procedures of the study and signed the informed consent, complying with the rules of the Research Ethics Committee.

Sample

The sample was formed by 2:1 pairing of 36 children, according to gender (male and female), age group (6–10 years), and speech therapy intervention time.

All children were diagnosed by a multidisciplinary team — composed of a child psychiatrist, a clinical neuropsychologist, and a speech language pathologist, according to ICD-10[4] and DSM RTVI criteria, and compatible with the DSM-5[5] — with ASD (group ASD, n = 24) or SLI (group SLI, n = 12) assisted at the Center for Investigation of Children and Adolescents with Global Developmental Disorders (NIFLINC-TGD) and at the Outpatient Clinic for Child Language Therapy, both pertaining to the Speech Language Pathology and Audiology Department, Universidade Federal de São Paulo (UNIFESP).

Group ASD comprised 22 boys and 2 girls aged 6–10 years. These children had been in a speech therapy intervention program for 2 years and 6 months, on average, and regularly enrolled in a child or elementary public school.

Group SLI comprised 11 boys and 1 girl aged 6–10 years. These children had also been in a speech therapy intervention program for 2 years and 6 months, on average, and regularly enrolled in a child or elementary public school.

Inclusion criteria were multidisciplinary diagnosis of both disorders (ASD and SLI), age, and length of therapeutic intervention. Exclusion criteria were the presence of associated malformations or genetic syndromes, as well as motor, physical, and sensory (auditory or visual) impairment, for both groups.

Rates of intelligence quotient (IQ) were obtained by applying the Brazilian version of the Wechsler Scale (WISC)[12] by the team of psychologists.

Among 24 children with ASD, 10 were classified with unspecified degree of mental retardation, a term used when there is strong presumption of mental retardation but the individual cannot be adequately tested by the usual intelligence measurement instruments. The other individuals in this group had a score of 50–70, average 61, and were classified with mild mental retardation.

The IQ indices of 12 children in group SLI, obtained in psychological assessment, were more than or equal to 85, with an average of 87, were classified as normal.

All subjects were evaluated by speech language pathologists at NIFLINC-TGD. To characterize oral language, as to the presence of isolated words and phrases in expressive language, we used the information obtained through *Lista de Avaliação do Vocabulário Expressivo* (LAVE)[13], an adaptation for the Brazilian Portuguese language of the Language Development Survey[14]. Parents or caregivers were interviewed by the language pathologist so they could sign the words their children spoke spontaneously in their daily lives, among the 307 from the list, and were asked to provide examples of spontaneous phrases used by children in everyday life at the time of the survey. To classify phrases, we considered the issuing of two or more words combined and produced systematically, not echolalic[13,14].

Of the children with ASD, 10 issued vocalizations only (vowel sounds, sometimes decontextualized and without naming function) and 2 single words (identified as naming function and containing at least 75% of the Brazilian Portuguese phonemes). Other 12 children issued spontaneous phrases.

As for verbal production, all children diagnosed with SLI systematically issued spontaneous phrases (two or more words combined and produced systematically).

Procedures

To assess the ability to imitate, we used the imitation stage of the Symbolic Maturity Assessment[9-11], which comprises the imitation of nine generic motion gesture schemes (e.g., drinking and smelling) and three sequential gesture schemes in family routine (feeding a doll, putting it to bed, and bathing it) (Appendix 1).

The children were evaluated individually during a session of 45 minutes by a language pathologist from NIFLINC-TGD and at the Outpatient Clinic for Child Language Therapy, both pertaining to the Speech Language Pathology and Audiology Department of UNIFESP. They were all familiar with the material and cases studied. The recordings were made in the presence of an adult familiar with children (language pathologist) and/or their mothers to avoid interaction with a stranger to interfere with children's performance during the activity.

Initially, nine generic motion gesture schemes were presented to children, as they should be reproduced by them immediately at the language pathologist's orientation. The maximum score was 9, each imitated gesture being considered right or wrong only.

The nine generic motion gesture schemes were drinking using a toy, eating using a toy spoon, putting a hat, pushing a cart, making a toy airplane fly, brushing teeth, hugging a doll, washing hands with soap, and smelling a plastic flower.

They were then presented three sequential motion gesture schemes composed of four actions. Each action reproduced by the child scored 1 point; therefore, the maximum score was 12.

The sequential motion gesture schemes present in family routines were the following:

· feeding a doll: putting the doll in a toy chair, putting a bib on it, feeding it, and cleaning its mouth;
· putting a doll to sleep: putting the doll in a toy crib, covering it, reading it a story, and kissing it;
· bathing a doll: taking off the doll's clothes, putting it in the tub, washing it with soap, and wiping it with a towel.

For data analysis, scores obtained in the imitation tasks of generic motion and sequential motion gesture schemes in each group were considered.

Finally, we analyzed the correlation between imitation index and verbal production of isolated words and phrases by children in group ASD. Significance level was set at 5%, especially in the analysis of variance.

RESULTS

Figure 1 shows the comparison of performances by both groups at imitating generic and sequential motion gesture schemes present in family routines.

The performances at imitating generic schemes were very similar in both groups (p = 0.382). We noticed better performance with sequential schemes present in family routines in group SLI (p = 0.053).

Figure 2 shows the distribution of performances related to verbal production in both groups.

Sentence production was predominant in group SLI (p = 0.003) and vocalization, in group ASD (p = 0.009).

Table 1 shows the relationship between imitation of schemes and verbal production in group ASD.

We found a significant direct relationship between imitation of sequential schemes and verbal performance. That is, children who performed better in sequential schemes presented verbal production of words and phrases (p = 0.007).

DISCUSSION

Looking at each group individually, group SLI performed better in imitation tasks of sequential schemes compared to generic motion gestures. Previous studies have pointed out that the context of everyday actions in this population can be a facilitator and booster of the development of the ability to imitate because it allows integration of relevant information to the child's context[8-11].

Children with SLI present social interaction abilities and preserved shared attention, which can further facilitate observation
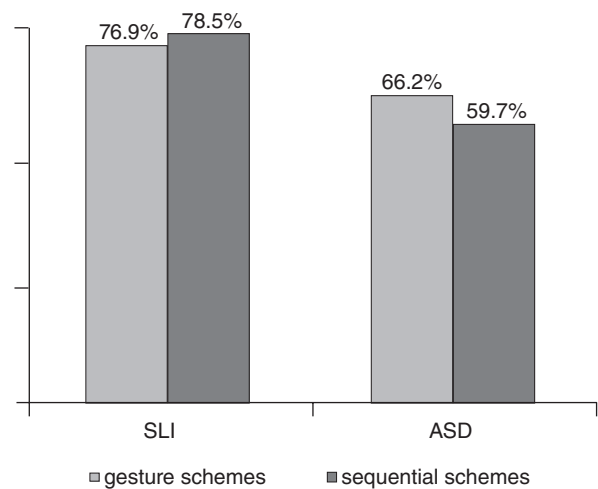
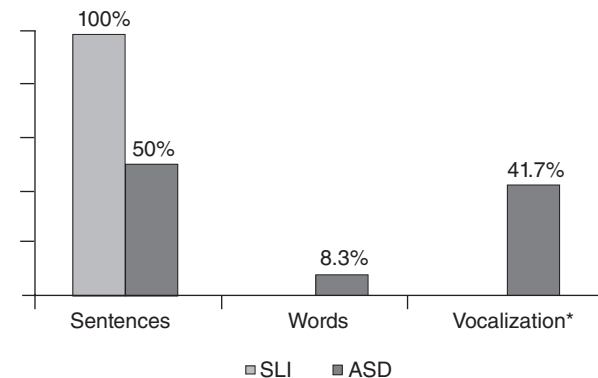**Caption:** SLI = specific language impairment; ASD = autism spectrum disorder
Figure 1. Percentage of correct imitation of generic and sequential motion gesture schemes in both groups

*Statistical significance
Caption: SLI = specific language impairment; ASD = autism spectrum disorder
Figure 2. Verbal production in both groups

of symbolic action and their sequential and contextualized reproduction[8-11].

Furthermore, group ASD showed better performance in imitation tasks of generic compared to sequential gestures. This finding suggests that children with autism have difficulties in integrating actions comprising sequences not only due to their difficulty of short- and long-term memory but also due to the difference in their information-processing system. These children have difficulty in processing information to form a whole structure with meaning, that is, they lack central coherence, one of the most striking features in autism spectrum[15-17].

Other studies have also indicated a significant relationship between imitation deficit and social interaction deficit, especially when it comes to social reciprocity and shared attention, which are evident in children with autism[15-17].

When comparing the groups, children with SLI had a tendency to perform better in both isolated and sequential actions, which confirmed our hypothesis that the skill of imitation is more preserved in this group compared to those in ASD group.

We know that the ability to imitate is a predictor of social relations, communication, and learning throughout life. Some studies have suggested that the difficulty of motor planning and motor is also intrinsically related to the inability to imitate in ASD[18-21]. Therefore, this inability may also be a reflection of the primary difficulty in formulating and executing an intentional motor plan, although these individuals have preserved motor skills [18-25].

Regarding verbal production, all children in group SLI were able to produce sentences, whereas only half of the children from group ASD were able to do it.

Interestingly, we found significant correlation between the ability to imitate and verbal production among children with ASD. That is, children in this group had better performance in testing the imitation of sequential schemes and also more prominent sentences in verbal production, which confirm the intrinsic relationship between these skills.

Several studies had already pointed imitation as predictor of social and cognitive-linguistic skills[1-3,6,17,18]. Directed and motor imitation without the use of objects can be responsible for the variance in production of expressive and receptive vocabulary[3,17,18].

The results of this study provided important contribution as to the ability to imitate in SLI and ASD; nevertheless, it is important to point out some limitations of one study. The influence of IQ on verbal and motion performances seems evident, especially among children with ASD; however, we could not confirm this premise because some of the children did not obtain IQ index and were classified with unspecified mental retardation.

Therefore, we suggest that further studies with larger samples should be carried out, aiming at analyzing the effect of IQ in the ability to imitate and verbal production.

Interestingly, the speech pathologist maintains, repairs, complements, and extends the meaning of verbal and nonverbal communication used by children. Thus, when assessing performance and managing therapeutic intervention, one must consider the relationship between verbal and nonverbal skills.

The Language Pathology Clinics is aimed at achieving goals through mediation, verbal, and nonverbal strategies in contextualized activities where spontaneous or directed imitation is part of resources for the expansion of the repertoire of exploration activities, including games and social communication skills.

CONCLUSION

We were able to compare the ability to imitate motion gesture schemes present in family routine of children with ASD and SLI, and to check impaired performance among children with autism.

A significant relationship was also observed between imitation of family routine gestures and verbal production of words and phrases among children with ASD.

REFERENCES

1. Piaget J, Inhelder B. A psicologia da criança. Rio de Janeiro: Bertrand Brasil; 1993.
2. Bates E, Thal D, Fenson L, Whitesell K, Oakes L. Integrating language and gesture in infancy. Develop Psych. 1989;25(6):100419.
3. Smith V, Mirenda P, ZaidmanZait A. Predictors of expressive vocabulary growth in children with Autism. J Speech Lang Hear Res. 2007;50(1):14960.
4. Organização Mundial da Saúde. Classificação Internacional de Doenças – CID 10. 10ª edição. São Paulo: Edusp; 1998.
5. American Psychiatric Association. DSMV: diagnostic and statistical manual of mental disorders. . 5th edition. Arlington: American Psychiatric Association; 2013.

Table 1. Relationship between imitation of schemes and verbal production in autism spectrum disorder

Verbal production (AS)	Generic			Sequential		
	Phrases	Words	Vocalization	Phrases	Words	Vocalization
Mean	7.25	9.00	3.80	8.67	7.50	5.30
Median	8.5	9.0	4.5	10.0	7.5	4.5
Standard deviation	2.77	0.00	2.53	3.14	2.12	3.37
IA	1.57	–	1.57	1.78	2.94	2.09
p-Value		0.007*			0.070**	

*Statistical significance; **tendency to statistical significance

AS = autism spectrum; IA = index of agreement

6. Tamanaha AC, Perissinoto J, Pedromonico MRM. Considerations about echolalia in children with Asperger Syndrome: proposing an approach for language therapeutics. Rev Bras Psiquiatr. 2004;26(4):2789.

7. Tamanaha AC, Perissinoto J. Comparação do processo evolutivo de crianças do espectro autístico em diferentes intervenções terapêuticas fonoaudiológicas. J Soc Bras Fonoaudiol. 2011;23(1):812.

8. Thal D, Bates E. Language and gesture in late talkers. J Speech Hear Res. 1988;31(1):11523.

9. Marton K. Visuospatial processing and executive functions in children with Specific Language Impairment. Int J Lang Commun Disord. 2008;43(2):181200.

10. BefiLopes DM, Takiuchi N, Araújo K. Avaliação da maturidade simbólica nas alterações do desenvolvimento da linguagem. J Bras Fonoaudiol. 2000;3:615.

11. BefiLopes DM. Avaliação diagnóstica e aspectos terapêuticos nos Distúrbios Específicos de Linguagem. In: Fernandes FDM, Navas AL. Tratado de Fonoaudiologia. São Paulo: Roca; 2010. p. 31422.

12. Wechsler D. WISCIII: Escala de Inteligência Wechsler para Crianças: Manual. São Paulo: Casa do Psicólogo; 2002.

13. Capovilla FC, Capovilla AGS. Desenvolvimento lingüístico na criança dos dois aos seis anos: tradução e estandardização do *Peabody Picture Vocabulary Test* de Dunn & Dunn, e da Language Development Survey de Rescorla. Ciência Cognitiva: teoria, pesquisa e aplicação. 1997;1(1):35380.

14. Rescorla L. The language development survey: a screening tool for delayed language in toddlers. J Speech Hear Disord. 1989;54:58799.

15. Berger NO, Ingersoll B. An exploration of imitation recognition in young children with Autism Spectrum Disorder. Autism Res. 2013;6(5):4116.

16. Shiha P, Shena M, Öttl B, Keehna B, Gaffreya MS, Müllera R. Atypical network connectivity for imitation in Autism Spectrum Disorder. Neuropsychologia. 2010;48(10):29319.

17. Marteleto MRF, Lima CGM, Tamanaha AC, Chiari BM, Perissinoto J. Administration of the Autism Behavior Checklist: agreement between parents and professional's observations in two intervention context. Rev Bras Psiquiatr. 2008;30(3):2038.

18. Tamanaha AC, Machado GM, Loebmann C, Perissinoto J. Process of speech acquisition and development of autistic children with or without autistic regression. CoDAS. 2014;26(4):2659.

19. Dowell LR, Mahone EM, Mostofsky SH. Associations of postural knowledge and basic motor skill with dyspraxia in Autism: implication for abnormalities in distributed connectivity and motor learning. Neuropsychology. 2009;23(5):56370.

20. Vanvuchelen M, Roeyers H, De Weerdt W. Do imitation problems reflect a core characteristic in autism? Evidence from a literature review. Res Autism Spectr Disord. 2011;5(1):8995.

21. De Giacomo A, Portoghese C, Martinelli D, Fanizza I, L'Abate L, Margaril L. Imitation and communication skills development in children with pervasive developmental disorders. Neuropsych Dis Treat. 2009;5:35562.

22. Cossu G, Boria S, Copioli C, Bracceschi R, Giuberti V, Santelli E, et al. Motor representation of actions in children with Autism. PLoS One. 2009;7(9):18.

23. McEwen F, Happe F, Bolton P, Rijsdijk F, Ronald A, Dworzynski K. Origins of individual differences in imitation: links with language, pretend play, and socially insightful behavior in twoyearold twins. Child Develop. 2007;78(2):47492.

24. Mundy P, Block J, Delgado C, Pomares Y, Van Hecke AV, Parlade MV. Individual differences and the development of joint attention in infancy. Child Dev. 2007;78(3):93854.

25. Ingersoll B. Brief report: effect of a focused imitation intervention on social functioning in children with Autism. J Autism Dev Disord. 2012;42(8):176873.

26. Hubbard AL, Mcnealy K, Zeeland AAS, Callan DE, Bookheimers Y, Dapretto M. Altered integration of speech and gesture in children with autism spectrum disorders. Brain Behav. 2012;2(5):60619.

APPENDIX 1. PROTOCOL USED FOR THE ASSESSMENT OF THE ABILITY TO IMITATE GENERIC AND SEQUENTIAL MOTION GESTURE SCHEMES

1. Situação dirigida / Imitação de esquemas gestuais
a. Imitação de esquemas gestuais simples
Ensaio prático: ( ) Sim ( ) Não

GESTO	ADEQUADO	INADEQUADO	DESCRIÇÃO DA AÇÃO DA CRIANÇA
Beber			
Escovar os dentes			
Colocar na cabeça			
Empurrar			
Comer			
Abraçar			
Lavar as mãos			
Cheirar			
PONTUAÇÃO			

b. Imitação de esquemas gestuais sequenciais em rotinas familiares
Ensaio prático: ( ) Sim ( ) Não

GESTO	Número total de esquemas	Esquemas diferentes	DESCRIÇÃO DA AÇÃO DA CRIANÇA
Alimentar o bebê			
Colocar o bebê na cama			
Dar banho no bebê			
PONTUAÇÃO TOTAL			
MÉDIA			

I) Situação Dirigida/Imitação de Esquemas Gestuais
1) Imitação de esquemas gestuais simples
Ensaio prático: (   )sim   (   )não

Gesto	Adequado	Inadequado	Descrição da ação da criança
Beber			
Escovar os dentes			
Empurrar			
Comer			
Abraçar			
Lavar as mãos			
Cheirar			
Pontuação			

2) Imitação de esquemas gestuais sequenciais em rotinas familiares
Ensaio prático: (   )sim   (   )não

Gesto	Nº total de esquemas	Esquemas diferentes	Descrição da ação da criança
Alimentar o bebê			
Colocar o bebê na cama			
Dar banho no bebê			
Pontuação total			
Média			