Reliability, validity and normative data of a quick repetition test for Italian children

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A B S T R A C T

Objectives: A quick repetition test can be useful as a screening or preliminary investigation to select children who need to be assessed with a more specific articulation test. Schindler's repetition test lasts about 2 min and requires the repetition of a 30 words list, each word targeting a specific phoneme or cluster. The aims of the study are: to assess reliability of Schindler's repetition test; to establish normative data for speech development in Italian-speaking children; to analyse validity of this instrument.
Methods: Six-hundred-two Italian children, aged range between 3;0 and 10;8 years, were included in the study: 557 without clinical sign of speech impairment and 45 had a speech sound disorder. *Reliability.* One-hundred-five children were tested the same day by two examiners (inter-rater reliability); the administration of the repetition test to 45 children was audio-recorded (intra-rater reliability); 105 children underwent the repetition test twice, with a 2 weeks interval (test–retest reliability). Data were compared through Intraclass Correlation Coefficient (ICC). *Normative data.* Percentages of children without clinical sign of speech impairment in each age group who repeated correctly, omitted or produced distorted target phonemes of Schindler's repetition test were reported. *Validity.* To assess the ability of the test to record improvement in mean values with age (construct validity), the proportion of correct repetitions obtained by children from different age groups were compared through logistic regression. The speech abilities of 45 children were also analysed through a more comprehensive articulation test (concurrent validity). Scores were compared through Bland–Altman plot.
Results: Reliability. All ICC were superior to 0.9. *Normative data.* Despite language-specific pattern of acquisition emerged, data showed many similarities to data reported in international studies on speech sound development. *Validity.* Logistic regression demonstrated a significant effect of age groups. Bland–Altman plot showed relatively narrow limits of agreement between Schindler's repetition and Rossi's articulation test.
Conclusions: Schindler's repetition test can be considered a reliable and valid instrument for preliminary assessment of speech abilities in Italian-speaking children aged from 3 to 6 years old. Application of Schindler's repetition test is recommended in clinical practice, as a screening test or as a first clinical assessment instrument.

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1. Introduction

1.1. Assessment of speech disorder

Speech disorder is a term used to describe a speech impairment of any origin, including a range of different conditions in early childhood [1]. In fact, different causes may lead to speech impairment: hearing loss, autisms, cerebral palsy, cleft palate or other anatomical anomalies, stammering and selective mutism [2–5]. Besides, in some cases the speech impairment aetiology can be unknown, a condition also termed speech sound disorder (SSD) [6].

SSD are one of the most common communication disabilities in childhood: prevalence is estimated between 10 and 15% of preschooler and approximately 4% of 6-year-old children [7–9]. Therefore, children aged 3 to 6 years with speech disorders are frequently encountered in paediatric otorhinolaryngology practice

and represent an important cause of speech-language pathology caseload.

Picture-naming test and repetition tests are generally used in clinical practice all over the world for speech assessment in childhood [10–13]. Also in Italy picture-naming tests are generally used in clinical practice to evaluate speech abilities of Italian-speaking children [14,15]. Their purpose is to assess the uttering of all Italian phonemes and clusters in all word-position. Therefore, the administration of Italian picture-naming tests requires the elicitation of more than one-hundred words and takes at least 30 min. Considered the high prevalence of speech disorders, the administration of a quick articulation test can be useful as a screening or preliminary investigation to select children who need to be assessed with a more specific articulation test [16,17]. Screening instruments need to compare child speech ability to clear speech development standards, so the availability of normative data is essential [18]. A quick, but reliable and valid repetition test could be particularly useful in paediatric otorhinolaryngology practice in order to select patients to be referred to a complete speech pathology assessment.

To the best of our knowledge, there are no data on speech development in large cohorts of Italian-speaking children aged 3 to 6 years, while there are several studies in other languages, in particular in English-speaking children [18,19]. Furthermore, most studies including Italian children focused on earlier stages of language acquisition, considered small samples and specifically analysed the relationship between phonological skills and early lexical acquisition [20,21]. It can be generally assumed that the development of speech ability in Italian- and English-speaking children is similar; nonetheless, as each language has unique phonetic system and inventory, the need of normative data specifically from Italian-speaking children arises.

The lack of normative data for Italian-speaking children speech development aged 3 to 6 years led to the need for a standardized instrument. Therefore, Schindler's repetition test [22], based on the repetition of a 30 words list, each targeting a specific phoneme or cluster, was developed to be used with different purposes. Because its administration lasts about 2 min, Schindler's repetition test can be used as a speech screening test or in a preliminary clinical assessment; data from its administration can also be useful for epidemiologic or research studies. The standardization of this instrument could improve his clinical usefulness.

1.2. Aim of the study

The aim of the study is: (1) to assess inter-rater, intra-rater and test–retest reliability of Schindler's repetition test; (2) to establish normative data for speech development in Italian children; (3) to analyse construct and concurrent validity of this instrument.

2. Materials and methods

The study was carried out according to the Declaration of Helsinki and all parents of children enrolled in the study gave their written informed consent; all data were collected prospectively. The study consisted of 3 different phases: reliability analysis (phase 1), normative data generation (phase 2) and validity analysis (phase 3).

2.1. Participants

A total of 602 Italian children, aged between 3;0 and 10;8 years, were included in the study: 557 presented no clinical sign of speech impairment (group 1) and 45 had a SSD (group 2).

Table 1
Distribution of the sample (group 1).

Age group (years;months)	N	Male gender	Female gender	Mean age (years;month)	SD (months)	% Of the sample
3;0–3;5	77	47	30	3;2	1.7	13.8
3;6–3;11	93	38	55	3;7	1.6	16.7
4;0–4;5	92	49	43	4;2	1.9	16.5
4;6–4;11	90	49	41	4;7	1.7	16.2
5;0–5;5	95	48	47	5;2	1.8	17.1
5;6–5;11	110	51	59	5;7	1.6	19.7
Total	557	282	275	4;5	10.4	100

2.1.1. Group 1

Five-hundred-seven children (282 male and 275 female), aged between 3;0 and 6;0 years, were included. Children were recruited in Italian kindergartens and were equally distributed into 6 age groups, each representing a 6-months interval (Table 1). According to their teacher/parent, each of the participants was reported to have none of the following exclusion criteria: walking age >14 months, deafness, cleft lip/palate, cerebral palsy, mental retardation, autistic spectrum disorders, one or both parents non Italian speaking. Besides, each child underwent a clinical speech assessment by a speech and language pathologist to exclude children with SSD.

2.1.2. Group 2

Forty-five children (29 male and 16 female), with age ranging between 3;2 and 10;8 years (mean age 5;9 ± 1;6 years), were included. Children were recruited in speech and language services, according to the following inclusion criteria: normal hearing and diagnosis of SSD, according to DSM-V classification [23]. The presence of SSD was identified through the administration of Bortolini's test and thorough clinical evaluation by a team including phoniatrician, speech and language pathologist, child neurologist [15]. SSD affecting children were subdivided in articulation disorders and phonological delays/disorders (Table 2), according to Dodd's classification [24].

2.2. Materials

Children were tested and assessed by four experienced speech and language pathologists. The examiners had good knowledge on articulation testing and phonetic transcription. Schindler's repetition test was administered to each child, in order to assess articulation skills.

Schindler's repetition test is made of a 30 words list, including all Italian phonemes and 8 clusters (Appendix A). Each word includes a different target phoneme or cluster. Most of the phonemes are present both in word-initial and -medial position. The task required to the child was to repeat the target words uttered by the examiner.

2.3. Procedure

After parental consent was obtained, each child was tested individually. The assessor established rapport with the child before

Table 2
Different types of speech sound disorder in group 2; age, gender and number of children with articulation and phonological disorders are reported.

Speech sound disorder	N	Female	Male	Mean age	Mean score ± SD	% Of the sample
Articulation disorder	18	9	9	6;6	16.22 ± 3.62	40
Phonological delay/disorder	27	8	19	5;3	14.59 ± 2.62	60
Total	45	17	28	5;8	15.20 ± 3.15	100