Developing an innovative, objective, child-friendly, clinical measurement to assess speech motor skills in children who stutter

Published: 26-10-2023 Last updated: 02-12-2024

The first aim is to determine an objective acoustic measure to define SMS by comparing acoustic features of probe words to a perceptual score of speech motor movement characteristics and stuttering frequency judged by the expert (i.e., the current...

Ethical review	Approved WMO
Status	Recruiting
Health condition type	Neurological disorders NEC
Study type	Observational non invasive

Summary

ID

NL-OMON56409

Source ToetsingOnline

Brief title OSMOS

Condition

• Neurological disorders NEC

Synonym stammering, stuttering

Research involving Human

Sponsors and support

Primary sponsor: Erasmus MC, Universitair Medisch Centrum Rotterdam

1 - Developing an innovative, objective, child-friendly, clinical measurement to ass ... 7-05-2025

Source(s) of monetary or material Support: Ministerie van OC&W

Intervention

Keyword: acoustic analysis, clinical tool, speech motor skills, stuttering

Outcome measures

Primary outcome

The primary outcome measure of this study is the the envelope-based spatial temporal index (ESTI -. on a continuous scale), an acoustic outcome measure that has been recently described by the Oral Dynamics lab, University of Toronto (15). ESTI measures the spatial and temporal variability of 5 repetitions of one single target word. A total, mean ESTI score for the total set of probe words will be calculated.

Firstly, the total ESTI score will be related to two perceptual SMS judgements:

a.) total score of Oral Motor Assessment Scale - OMAS (12) and b.) % stuttered

syllables in a sample of 300-500 syllables of spontaneous speech.

Secondly, ESTI will be used to discriminate between the five participant groups.

Furthermore, scripts to automatically measure ESTI will be written in Praat,

(2) - open source software specifically developed for the acoustic analysis of speech.

Secondary outcome

Secondary outcomes will be:

1. The lip aperture variability index score, indicating the maximum movement range between the upper and lower lip, analyzed using open source opto-track software, OpenMoCap (1). The lip aperture variability index will be used as a

2 - Developing an innovative, objective, child-friendly, clinical measurement to ass ... 7-05-2025

physiologically control variable for adaptations in speech movements, such as

bigger movements in more complex target words.

2. Difference-scores between sub-scores of ESTI for different levels of

complexity of the probe words. For easy and difficult probe words on a.) the

motor level and b.) the cognitive-linguistic level ESTI scores will be

calculated and a difference-ESTI will be calculated. These difference-ESTI

scores will be used to compare participant groups as well.

Study description

Background summary

Stuttering is a neurodevelopmental disorder with an incidence rate of 5 to 11% in preschool years (3), and a prevalence of about 1% in adults. Both the (probably) multifactorial cause of stuttering, and the inter-individual differences in the pathway to unassisted recovery are still unknown. Moreover, intra-individual differences in fluency cannot yet be explained either (4). Last decades, ample research has been done on cognitive-linguistic functions, temperament and social-emotional behaviors of children who stutter, and their impact on the development of stuttering (5-7). Group differences were found, but these factors could never fully explain inter- and intra-individual differences. Furthermore, recent research studying the underlying genetic and neurological patterns of stuttering show a strong genetic involvement (2). What these patterns exactly cause, however, is not yet known. As stutters can be defined as breakdowns in the speech motor system, it is not surprising that many researchers have studied the control of speech motor movements in people who stutter, i.e., the ability to coordinate movements of tongue, lips, jaw and vocal folds. The speech motor processes underlying stuttering have been widely documented in adults, showing more variable, slower, and physiologically different speech motor movements with a worse relative timing than people who do not stutter, also during perceptually fluent speech (e.g., 8). Only few studies have assessed the speech motor dynamics of stuttering near its onset, i.e., in pre-school aged children showing that children who stutter have more variable articulatory movements than children who do not stutter (9). So far, research has almost exclusively considered speech motor control as normal or disabled, comparing persons who stutter and persons who do not stutter on a group level. In general, these studies show an overlap between cases and controls. Moreover, no studies in children have investigated SMS controlling

for compensatory behaviors.

Research theory: In contrast to these previous studies, we propose to study control of speech motor movements as a continuous outcome, from extremely weak to extremely strong control. This proposal is based on the Speech Motor Skills (SMS) theory, which explains stuttering as a result of *an innate limitation in the speech motor control system to prepare and perform complex motor actions in the presence of cognitive, linguistic, emotional and speech motor influences* (10). People who persist in stuttering are presumed to have SMS in the lower end of a continuum, while people who do not stutter are distributed across the more skilled end of the continuum. Children who recover from stuttering are presumed to have only slightly weaker or immature SMS. The SMS theory assumes that the speech motor control system of people who stutter is not abnormal as such (like with dysarthria). It predicts that this system becomes more unstable (variable) with increasing complexity on the motor level (e.g., speaking with higher speed or smaller movements), the cognitive-linguistic level (e.g., telling a complex storyline) or on the social-emotional level (e.g., speaking when highly aroused or tensed). In these situations, people with low SMS are more likely to stutter, unless speed-accuracy tradeoffs or motor control solutions (strategies) are being used as a compensation for their weaker SMS. Clinical knowledge gap: To study SMS, until now, only invasive and time-consuming methods were available, such as Electro Magnetic Articulography

time-consuming methods were available, such as Electro Magnetic Articulography (EMA), using tongue, lips and jaw electrodes. These methods are expensive and unsuitable to use in preschool children or in a clinical setting. Consequently, SMS of children who stutter can now only be rated with a perceptual scoring system, the Oral Motor Assessment Scale (1), that has insufficient inter-rater reliability. On top of this, it consists of only three probe words, which do not cover the full SMS complexity range. Lastly, it can neither discriminate between low skill and adaptation. The lack of a tool to objectively measure the full range of SMS is a major gap in diagnosing and treating stuttering, leaving speech therapists unable to adequately expose the core underlying skill of children who stutter.

Study objective

The first aim is to determine an objective acoustic measure to define SMS by comparing acoustic features of probe words to a perceptual score of speech motor movement characteristics and stuttering frequency judged by the expert (i.e., the current golden standard).

The second aim is to ascertain whether the acoustic variables of SMS can differentiate between children who do and who do not stutter, in children who recovered from stuttering and children who persist in stuttering. o ascertain whether the acoustically measured SMS of groups (i.e. children who do and who do not stutter, in children who recovered from stuttering and children who persist in stuttering) differs for low and high levels of word complexity on a) the motor and b) the cognitive-linguistic level, when correcting for lip and jaw movement adaptations.

Study design

Observational case-control study.

Children will be assessed at Erasmus MC Sophia Children*s Hospital. First, standard hearing and articulation tests will be taken to exclude children with hearing and articulation problems (other than stuttering). Then, the main, experimental speech tasks will be assessed in a sound-proof booth and children will be visually and auditory recorded. The probe task exists of words and non-words. In a child friendly presentation, the target (non-)words will be presented auditory and children will be requested to repeat every item 8 times, enabling measuring the variability in the acoustic signal between these repetitions of the same item. The first part of the task consists of non-words of an existing perceptual speech task: the Oral Motor Assessment Scale (1). The second part consists of target (non-)words in two complexity levels (simple vs. complex) on three variables, a-c: (a) articulation rate (normal rate vs. up-tempo rate) (b) mouth opening at word initiation (large/open vowel words vs. small/closed vowel words) and (c) word length (2 syllable vs. 4-5 syllable words). The assessment, including sufficient pause time for the child, can be completed within one hour.

Study burden and risks

The nature and duration of the hearing test and speech tasks are comparable to tasks children are used to do in speech therapy treatment. The assessments are not invasive, not cognitively difficult and not social-emotional burdensome. Therefore, the risks of this study are negligible and the burden will be minimal.

An individual*s results of the speech tasks may contribute to his/her diagnosis of stuttering and may add to a tailormade treatment advice.

The research is regarded as group-related since it was aimed to ascertain the speech motror skills of children who stutter, children who recovered from stuttering, compared to children who do not stutter.

Contacts

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5 - Developing an innovative, objective, child-friendly, clinical measurement to ass ... 7-05-2025

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age Children (2-11 years)

Inclusion criteria

Eligible participants are children:

- aged 3;6-5;6 years or aged 7;6-10;0 years

- who stutter with a stuttering severity rating of at least a 2 (mild

stuttering) on an 8-point scale judged by the parents and by the therapist

A group of recovered 7;6-10;0-year old children will be included as well.

Recovered participants can be included when:

- stuttering was diagnosed by a speech pathologist and has been present for at least 6 months.

- stuttering is absent for at least 18 months at time of inclusion

A group of control children can be included:

- aged 3;6-5;6 years or aged 7;6-10;0 years

- who do not stutter and have never stuttered.

Exclusion criteria

Exclusion criteria are:

- a diagnosis of an emotional, behavioral, learning or neurological disorder

- a lack of proficiency in Dutch for children.

- a hearing disorder with insufficient access to spoken language, judged by audiologist

Study design

Design

Study type:	Observational non invasive
Intervention model:	Other
Allocation:	Non-randomized controlled trial
Masking:	Open (masking not used)
Control:	Active
Primary purpose:	Basic science

Recruitment

NL	
Recruitment status:	Recruiting
Start date (anticipated):	01-02-2024
Enrollment:	110
Туре:	Actual

Ethics review

Approved WMO	
Date:	26-10-2023
Application type:	First submission
Review commission:	METC Erasmus MC, Universitair Medisch Centrum Rotterdam (Rotterdam)
Approved WMO	
Date:	21-12-2023
Application type:	Amendment
Review commission:	METC Erasmus MC, Universitair Medisch Centrum Rotterdam (Rotterdam)

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register CCMO **ID** NL83494.078.23